FY 2014 VEHICLE TECHNOLOGIES PROGRAM WIDE FUNDING OPPORTUNITY ANNOUNCEMENT

Funding Opportunity Announcement (FOA) Number: DE-FOA-0000991
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FOA Issue Date:	1/22/2014
Amendment 000001	1/24/2014
Amendment 000002	2/12/2014
Amendment 000003	2/26/2014
Amendment 000004	3/14/2014
Amendment 000005	3/18/2014
First Informational Webinar	2/5/2014
Submission Deadline for Concept Papers:	2/19/2014 8:00 PM EST
Deadline for FOA Questions	3/25/2014 8:00 PM EST
Submission Deadline for Full Applications:	4/1/2014 8:00 PM EST
Submission Deadline for Replies to Reviewer Comments:	5/29/2014 8:00 PM EST
Expected Date for EERE Selection Notifications:	7/31/2014
Expected Second Informational Webinar	8/4/2014
Expected Timeframe for Award Negotiations	August 2014

- Applicants must submit a Concept Paper by the due date listed above to be eligible to submit a Full Application.

- To apply to this FOA, Applicants must register with and submit application materials through EERE Exchange at https://eere-Exchange.energy.gov, EERE's online application portal. Frequently asked questions for this FOA and the EERE Application process can be found at https://eere-exchange.energy.gov/FAQ.aspx.

- Applicants must designate primary and backup points-of-contact in EERE Exchange with whom EERE will communicate to conduct award negotiations. If an application is selected for award negotiations, it is not a commitment to issue an award. It is imperative that the Applicant/Selectee be responsive during award negotiations and meet negotiation deadlines. Failure to do so may result in cancelation of further award negotiations and rescission of the Selection.

AMENDMENTS

All changes to the Funding Opportunity Announcement as a result of this amendment are highlighted in the body of the FOA.

Amendment No.	Date	Description of Amendments
000001	1/24/2014	The purpose of this amendment is to add a new Area of Interest (AOI). AOI 13 is now Dual-Fuel/Bi-Fuel Class 8 Vehicle Technologies and Early Market Commercialization Opportunities is now AOI 14. The amount of Federal funds available and other various information has been updated as a result of this change. Additionally, language was added to AOI 3 to ensure that work performed under that AOI is coordinated with other DOE funded battery research to avoid duplication of efforts and increase the likelihood of success. Please review the yellow highlighted text throughout the document for all changes associated with Amendment 000001.
000002	2/4/2014	The purpose of this amendment is to add a new required submission document (SF-424A Budget Summary) to the application submission requirements. In addition, the processing temperature for AOI 1 has been clarified in a footnote and the cell capacity requirements in the deliverables for AOI 3 have been modified. As reflected in Section IV.C.1 regarding concept paper requirements. The applicant must include the Area Of Interest to which they are submitting the concept paper as part of the information contained in the concept paper. The email address utilized for question submissions has also been corrected. Please review the blue highlighted text throughout the document for all changes associated with Amendment 000002.
000003	2/26/2014	The purpose of this amendment is to clarify under Area of Interest (AOI) 2 that fabrication and testing of the completed assembly shall be limited to 25% of the total project cost and to add a new non-responsive criteria under AOI 2. Additionally, this amendment provides clarification on the eligibility of TARDEC and NETL as defined in Section III-Eligibility, Part A-Eligible Applicants.
000004	03/14/2014	The purpose of this amendment is to define the meaning of "confirmed vehicles" under AOI 4 and to add table notes to the Brake Thermal Efficiency table under Area of Interest (AOI) 12.
000005	03/18/2014	The purpose of this amendment is to correct the footnotes in the Vehicle-Level Efficiency Goals table under Area of Interest (AOI) 12.

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 Concept Paper and 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 Concept Paper and 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.**

- **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**
  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:

  DE-FOA0000991@NETL.DOE.GOV

  The deadline for submission of FOA related questions will be March 25, 2014 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 at http://eere.energy.gov/financing/Exchange. **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 try to respond to questions within 5 business days, unless a similar question and answer have already been posted on the website.

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EXECUTIVE SUMMARY

Means of Submission	Concept Papers, Full Applications, and Replies to Reviewer Comments must be submitted through EERE Exchange at https://eere-Exchange.energy.gov, EERE's online application portal. EERE will not review or consider applications submitted through other means. The Users' Guide for Applying to the Department of Energy EERE Funding Opportunity Announcements is found at https://eere-Exchange.energy.gov/Manuals.aspx.
Total Federal Amount to be Awarded	$51,400,000
Average Award Amount	EERE anticipates making awards that range from $500,000 to $10,000,000.
Types of Funding Agreements	Cooperative Agreements, Grants, Technology Investment Agreements, Work Authorizations, and Interagency Agreements
Period of Performance	24 to 60 months
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. See Section III. A.
Eligible Applicants	Individuals, Domestic Entities, Foreign Entities, Incorporated Consortia, Unincorporated Consortia, subject to the definitions in Section III.A.
Cost Share Requirement	Refer to the cost share 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 unique, scientifically distinct 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.
Application Forms	Required forms and templates for Full Applications are available on EERE Exchange at https://eere-Exchange.energy.gov.
FOA Summary	The Department Of Energy (DOE), Office of Energy Efficiency and Renewable Energy (EERE) intends to issue, on behalf of the Vehicle Technology Office (VTO), a Funding Opportunity Announcement (FOA) entitled "FY 2014 Vehicle Technologies Program Wide Funding Opportunity Announcement. The Vehicle Technologies Office supports a broad research, development, and deployment technology portfolio focused on reducing the cost and improving the performance of a mix of near- and long-term vehicle

	technologies including advanced batteries, power electronics and electric motors, lightweight and propulsion materials, advanced combustion engines, advanced fuels and lubricants, and other enabling technologies. Specifically, activities are aimed at meeting the goals and objectives of the President's Electric Vehicle (EV) Everywhere Grand Challenge as well as improvements in other vehicle technologies such as powertrains, fuel, tires, and auxiliary systems. Collectively, the Vehicle Technologies Program Activities focus on achieving the following goals: • Save 1.4 million barrels per day of highway petroleum use by 2020 (compared to the Energy Information Agency (EIA) Annual Energy Outlook (AEO) 2012-projected baseline in 2020 of 11.2 million barrels per day); and • Develop cost-effective technologies to improve new vehicle fuel efficiency and achieve or exceed corporate average fuel economy (CAFE) standards of 144 gCO2/mi (61.6 miles per gallon (mpg)) for cars and 203 gCO2/mi (43.7 mpg) for light trucks by 2025 (54.5 mpg light duty average). Investment in advanced vehicle technologies, like vehicle electrification, lightweighting, and combustion engines will yield benefits to conventional vehicles, as well as yielding the technologies necessary for alternative fuel vehicles with sufficiently long ranges, sufficiently low costs, and broad consumer appeal to result in significant market penetration potential. This FOA contains a total of 14 Areas of Interest in the general areas of advanced light-weighting; 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.

I. FUNDING OPPORTUNITY DESCRIPTION

A. DESCRIPTION/BACKGROUND

The Vehicle Technologies Office (VTO) supports a broad technology portfolio aimed at developing and deploying cutting-edge advanced highway transportation technologies that reduce petroleum consumption and greenhouse gas emissions, while meeting or exceeding vehicle performance and cost expectations. Research, development, and deployment efforts are focused on reducing the cost and improving the performance of a mix of near- and long-term vehicle technologies including advanced batteries, power electronics and electric motors, lightweight and propulsion materials, advanced combustion engines, advanced fuels and lubricants, and other enabling technologies.

Specifically, activities are aimed at meeting the goals and objectives of the President's EV Everywhere Grand Challenge as well as improvements in other vehicle technologies such as powertrains, fuel, tires, and auxiliary systems. The EV Everywhere Grand Challenge seeks to make the United States the first country to produce a wide array of plug-in electric vehicle (PEV) models (PEVs, including plug-in hybrids and all-electric vehicles) that are as affordable and convenient as the gasoline powered vehicles we drive today by 2022. The EV Everywhere Blueprint outlines the goals and describes the research, development, and deployment needed to meet the overall EV Everywhere goal as well as other aggressive, technology-specific goals. The technical targets for the DOE PEV program fall into four areas: battery R&D; electric drive system R&D; vehicle lightweighting; and advanced climate control technologies. Some specific goals include:

- Cutting battery costs from their current $500/kWh to $125/kWh
- Eliminating almost 30% of vehicle weight through lightweighting
- Reducing the cost of electric drive systems from $30/kW to $8/kW

Collectively, the Vehicle Technologies Program Activities focus on achieving the following goals:

- Save 1.4 million barrels per day of highway petroleum use by 2020 (compared to the Energy Information Agency (EIA) Annual Energy Outlook (AEO) 2012-projected baseline in 2020 of 11.2 million barrels per day); and
- Develop cost-effective technologies to improve new vehicle fuel efficiency and achieve or exceed corporate average fuel economy (CAFE) standards of 144 gCO2/mi (61.6 miles per gallon (mpg)) for cars and 203 gCO2/mi (43.7 mpg) for light trucks by 2025 (54.5 mpg light duty average).

VTO funds advanced technology research and development (R&D) needed to achieve these goals. Analysis shows that VTO's combined portfolio of technologies could reduce petroleum consumption by nearly 20% from projected 2030 levels in the AEO.

Investment in advanced vehicle technologies, like vehicle electrification, lightweighting, and combustion engines will yield benefits to conventional vehicles, as well as yielding the

technologies necessary for alternative fuel vehicles with sufficiently long ranges, sufficiently low costs, and broad consumer appeal to result in significant market penetration potential. This FOA contains a total of 14 Areas of Interest (AOIs) and focuses on advanced light-weighting; 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. Except for AOIs 4 and 14, technologies that apply exclusively for use in off-road (rail, marine, construction, small engines) or motorcycle applications will be considered non-responsive to this announcement and will not be forwarded for comprehensive review.

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. Topic Areas/Technical Areas of Interest

*One or more projects awarded may be managed collaboratively with U.S. Army Tank Automotive Research Development and Engineering Center (TARDEC)

AOI Number	Title
Critical Technologies to meet the EV Everywhere Grand Challenge	
1	Development of Low-cost, High Strength Automotive Aluminum Sheet
2	Integrated Computation Materials Engineering (ICME) Development of Carbon Fiber Composites for Lightweight Vehicles
3*	Beyond Lithium Ion Technologies
4*	Commercialization of Power Electronics for Electric Traction Drives Using Wide Band Gap (WBG) Semiconductors
5*	Tire Efficiency
6*	Multi-Speed Gearbox for Commercial Delivery Medium Duty Plug-In Electric Drive Vehicles
7*	Advanced Climate Control Auxiliary Load Reduction
Technology Development to Reduce Petroleum Consumption Through Fuel Efficiency Improvements in passenger and commercial vehicles	
8	Development of High Performance Low Temperature Catalysts for Exhaust Aftertreatment
9	Dual-Fuel Technologies
10	Fuel Property Impacts on Combustion
11*	Powertrain Friction and Wear Reduction
12	Advanced Technology Powertrains For Light-Duty Vehicles Phase 2 (ATP-2)
13	Dual-Fuel/Bi-Fuel Class 8 Vehicle Technologies
Early Market Commercialization	
14*	Early Market Commercialization Opportunities

CRITICAL TECHNOLOGIES TO MEET THE EV EVERYWHERE GRAND CHALLENGE

AREA OF INTEREST 1: Development of Low-Cost, High-Strength Automotive Aluminum Sheet

The objective of this Area of Interest (AOI) is to address two major technical gaps in the performance of automotive aluminum alloys:

1. Low strength among cost competitive automotive sheet alloys such as 5xxx and 6xxx series
2. High cost of high-strength aluminum alloys such as high performance 6xxx and 7xxx series

Aluminum alloy development has historically included significant participation from the aerospace industry. While aerospace alloys such as most 7xxx series alloys exhibit exceptional strength, the alloy and processing costs are not suitable for the automotive industry. Aluminum sheet alloys from 5xxx and 6xxx series are finding increased use in vehicle structures; however the maximum available strength from these alloys limits their applications on the vehicle. Vehicle components requiring ultra-high strength such as the B-pillar or rocker/sill must often use high strength steel which limits total vehicle weight reduction. Further, when high strength steel must be used to meet the strength requirements for a particular component, adjacent components are often made of steel as well to avoid a need for dissimilar-metal joining. Introducing a high-strength, low cost aluminum alloy would have the dual benefit of reducing weight in crash-critical structures while also enabling further aluminum implementation and attending weight reduction.

This AOI seeks applications to support high-strength aluminum alloy and process development meeting the following requirements:

- Ultimate Tensile Strength in a finished, stamped component of greater than 600 MPa with greater than 8% elongation to failure;
- Processing temperature of no greater than 225 °C[1]; and
- Cost of a finished, stamped component of no greater than $2 per pound of weight saved when compared to a comparable, baseline part.

[1] **The maximum processing temperature of 225 °C refers to the forming temperature. Pre-and post-stamping heat treatment can be done at any temperature**

Project scope related activities supported by this AOI will emphasize a combination of alloy development and process development to achieve these requirements. Applicants do not need to focus on a particular alloy series (e.g. 6xxx, 7xxx, or other) or processing route; however, applicants must indicate alloy and processing families for development and demonstration during the project. Alloy and process development shall produce a substantive change from existing technology and applications are encouraged to describe how the proposed alloy/process contributes to a combined improvement in properties and reduction in cost when compared to conventional alloys. Proposed work shall include final demonstration of alloy/process properties by producing a statistically meaningful quantity of samples where the work piece size is greater than 6" x 6".

Project teams shall include at least one automotive Original Equipment Manufacturer (OEM), Tier 1 automotive supplier, or major aluminum producer for identification of processing requirements and cost targets. Project teams are encouraged to include participation by at least 2 engineering students (undergraduate or graduate) as interns working on the project at an industry partner's site for at least 3 months per student.

AOI 1 Non-responsive Application Criteria:

Applications submitted under AOI 1 will be considered non-responsive to this AOI if they fail to meet any of the general compliance criteria established in Section I (C), Section III (C) and if they:

- Propose for development of materials having less than 75% aluminum;
- Do not include an automotive OEM, Tier 1 supplier, or major aluminum producer for identifying operational processing parameters and cost targets for the alloy;
- Do not meet the following alloy and process development requirements:
    - Ultimate Tensile Strength in a finished, stamped component of greater than 600 MPa with greater than 8% elongation to failure;
    - Processing temperature of no greater than 225 °C[1]; and
    - Cost of a finished, stamped component of no greater than $2 per pound of weight saved when compared to a comparable, baseline part.

AOI 1 Specific Deliverables:

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

AREA OF INTEREST 2: Integrated Computational Materials Engineering (ICME) Development of Carbon Fiber Composites for Lightweight Vehicles

The objective of this AOI is to simultaneously develop structural carbon fiber technology to support immediate weight reduction in Light Duty vehicles while also advancing Integrated Computational Materials Engineering (ICME) techniques to support a reduced development-to-

deployment lead time in all lightweight materials systems. For the purposes of this AOI, a carbon fiber composite is defined as a composite that combines carbon fiber with polymer resin. The fibers can be continuous or discontinuous and the resin can be either a thermoplastic or thermoset polymer.

Baseline Assembly:

Applications within this AOI shall focus on a "foundational engineering problem" (FEP)[2] approach to using ICME techniques for the cost-effective reduction of vehicle weight through the development and application of carbon fiber composites. Applications shall use an integrated approach to design, develop, and optimize an assembly consisting of what would have been at least four (4) Light Duty Vehicle components made from traditional metals. The proposed design utilizing carbon fiber composite may contain a fewer number of components due to parts integration. These components shall be constitutive components of either the body or chassis system, consistent with the weight reduction and cost savings targets identified in Table 1. With the exception of fasteners and adhesives (no more than 5% of baseline system weight), all components shall be constructed of carbon fiber composites. The proposed assembly shall significantly contribute to the structural performance of the vehicle in driving and crash conditions; projects. **Applications that focus solely on single components or non-structural systems (such as brakes or interiors) shall be considered non-responsive.**

Table 1: Carbon Fiber Composite Targets

Vehicle System	System Definition	Weight Reduction Target[2]	Cost per Pound of Weight Saved ($/lb saved)[3]	Additional Requirements
Body	Body-in-White, Closures, Windows, Fenders, & Bumpers	≥35%	≤$4.32/lb	Replacement Technology must achieve Function and Packaging Requirements of Technology to be Replaced
Chassis	Suspension, Steering, Wheels, & Underbody Structural Components	≥25%	≤$4.27/lb	

[2] Integrated Computational Materials Engineering: A Transformational Discipline for Improved Competitiveness and National Security, National Academies Press: Washington, DC, 2008.

[3] When compared to a 2006 or Later Production Light Duty Vehicle Technologies.

Applications shall provide the strategy for light-weighting the assembly while maintaining baseline performance requirements. This shall include the following:

- The weight reduction objective for the development assembly in pounds and percent;
- Assembly performance requirements and characteristics (stiffness/deflection, crashworthiness, etc.) necessary for implementation into a production passenger vehicle;
- Assembly performance characteristics that are to be optimized and predicted during the project. At a minimum, these must include the assembly performance requirements and characteristics (stiffness/deflection, dynamic performance, energy absorption/crashworthiness, and failure etc.) necessary for implementation into a production passenger vehicle.

Modeling Requirements:

The ICME approach supported in this AOI shall utilize an integrated collection of as many models as necessary to simulate the required constitutive and assembly behavior. These shall contain robust, accurate and reliable constitutive models for each constituent material as well as the composite assembly under expected service conditions including high-strain rates utilizing physics based models. Models will also include ICME methodologies to simulate the manufacturing process (including variability from both process and material) including the evolution of thermo-chemical-mechanical material properties of complex systems as well as defects such as voids.

A major challenge of the approach is moving from deterministic models with homogenized properties towards more realistic approaches to uncertainty and probabilistic consideration. The approach taken should address an approach to uncertainty and probabilistic consideration. Computational tools shall include the development, verification and validation of cost-effective and novel computational algorithms for very large systems; model-reduction techniques for modular and simplified analyses. Full systems analysis shall provide the capabilities to perform cost-effective & reliable predictions of a full nonlinear response of a complex system. Nonlinear response should include severe loading conditions, including dynamic crush and damage. These analyses should enable full-system testing-reduction for non-regulatory and non-compliance tests.

- Applications shall provide a complete strategy for the ICME approach. The Strategy shall address key challenges in ICME and must include the following elements:
    - Single length/timescale models; multi-scale models/coupled models; and multi-physics models that integrate structure/property/process relationships;

  - Tool Maturity Level[4];
  - Integration of the tools; and need for improved quantitative modeling tools;
  - Integration strategy for the models;
  - Elements should address the lack of acceptable linkage software and tools;
  - Identifies required level of verification and validation;
  - Identifies minimum number of experiments needed to validate models;
  - Integration of the impact of fiber architecture, design, and conditions of processing for predictive capabilities not only for structure/property relationships but also for process/property relationships;
  - Addresses a quantitative assessment of propagation of uncertainty for each of the models used and also for the integration of the suite of models.
- The suite of models to be integrated shall address not only structure/property predictions but also process/property predictions. These requirements are detailed under Integration Approach/Plan, below. The suite of models must include all of the required aspects:
  - Variability from both process and material;
  - Defects and voids;
  - Development, verification and validation of cost-effective and novel computational algorithms for very large systems;
  - Model-reduction techniques for modular and simplified analyses;
  - Enable full-system analysis of a full nonlinear response of a complex system.
- Applications shall provide sufficient justification for development of new models that do not exist but will fill needed gaps and are high priority for success of the project (**not to exceed 25% of the total budget provided in the budget detail**).
- Development of new and unique models is discouraged, however if no model exists to perform the simulation, or if the current model is deficient in some manner, the application must make a case for the need for this new model. The application shall provide a description of the desired attributes and precision, these desired attributes must be compared to those available in the current model. The application shall include references that cite these results and/or provide the data illustrating the current shortcoming. The application shall include a gap analysis for areas that are not easily predicted right now.

The integrated models shall at least be capable of the minimum modeling element accuracies identified in Table 2. A modeling approach for predicting joint/bond behavior is not required. However, applications shall include a plan to incorporate joint response into the final model. If needed, the joint response may be experimentally derived rather than predicted. The

[4] Table 4, page 29, **Verification and validation of ICME methods and models for aerospace applications** Bradford Cowles, Dan Backman, Rollie Dutton *Integrating Materials and Manufacturing Innovation* 2012, **1**:2 (11 June 2012) http://www.immijournal.com/content/supplementary/2193-9772-1-2-s2.pdf

application shall include a gap analysis for areas that are not easily predicted with current tools/models;

Table 2: Minimum Modeling Elements by Manufacturing Phase

Model	Manufacturing Phase	Modeled Elements	Percent Error (Compared to Experimental)
Constituent material (fiber/ interphase/ resin and assembly of such)		Robust, accurate and reliable constitutive models for each constituent material as well as the composite assembly under expected service conditions including high-strain rates utilizing physics based model	≤15%
Part Properties	During and After Molding	Microstructure morphology	N/A
		Optimized cycle time, and local thickness, fiber length and orientation of the final part	≤15%
Assembly Properties	After Joining/assembly	Load to failure, failure location, and failure mode, stiffness/deflection, dynamic performance, energy absorption/crashworthiness	≤15%

The system of models shall be integrated in such a manner that part and assembly properties (load to failure, failure location, failure mode, stiffness/deflection, dynamic performance, energy absorption/crashworthiness) may be predicted from the constituent properties (fiber/interphase/resin) and the process history. Tools and models developed under this AOI should be amenable to later validation of assembly-level properties to enable the required weight reduction and cost. Fabrication and testing of the completed assembly shall be limited to 25% of the total project cost. Applications shall describe the methodology that will be used to compare the cost of the developed end item with the baseline system identified along with any assumptions used in the analysis. The weight reduction cost will be compared to the targets identified in Table 2, and the cost report shall be provided to the DOE at the end of the project.

Integration Approach/Plan:

The application shall provide a plan for integration of ICME that contains[5] 1) the ability to link data from different sources and knowledge domains; 2) networking and collaborative development; and 3) optimization. The interrelationships between activities must be clearly defined and illustrated.

[5] *Integrated Computational Materials Engineering: A Transformational Discipline for Improved Competitiveness and National Security*, National Academies Press: Washington, DC, 2008.

The project plan shall contain the following requirements:

- Integration strategies for the models address all required aspects including:
  - Integration techniques for multi-scale modeling;
  - Integration of different types of models;
  - The ability to link data from different sources and knowledge domains;
  - Networking and collaborative development;
  - Optimization.
- The plan shall describe HOW the plan ensures the completeness of the suite of models to be integrated to address: not only structure property predictions but also structure processing predictions contains all required aspects including:
  - Variability from both process and material;
  - Defects and voids;
  - Development, verification and validation of cost-effective and novel computational algorithms for very large systems;
  - Model-reduction techniques for modular and simplified analyses;
  - Enabling full systems analysis providing the capabilities to perform cost-effective and reliable predictions of a full nonlinear response of a complex system under "severe" loadings including dynamic crush & damage and enable full-system testing-reduction for non-regulatory and non-compliance tests.

Team Requirements:

Applicants shall include at least one automotive OEM or Tier 1 automotive supplier whose responsibilities include, as a minimum, system definition and defining requirements for model performance. Applicants shall include an integrated team of academic institutions and/or research organizations such as National Laboratories. In order to address the various model types with sufficient expertise, teams must include organizations whose expertise in modeling and simulation is suited to the needs of the stated system. Teams shall include at least one material supplier with expertise in the production of structural polymer composites. Teams shall include at least one material supplier with expertise in the production of structural polymer composites.

In order to fully evaluate the project resources, it is essential that applicants provide budgetary detail by task and performing entity.

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, see http://www.nist.gov/mml/materials-data.cfm for more information. In addition, dissemination of results via publication in peer-reviewed journals will be encouraged.

The completed models shall be delivered to the DOE along with a software description document and a user's manual at the end of the project. The software description document will include a high level description of the integrated models along with a description of the input variables, output variables, state variables, and relational databases implemented within the final software deliverable. The user's manual shall provide an overall description of the user implementation approach for the software.

Recipients shall make the data available to other researchers in the automotive materials community and the general public. Models and related code shall be made available to other researchers and the general public unless the models and code contain sensitive information or the implementation is made commercially available.

Project Developmental Phases:

Projects should consist of two (2) sequential phases with a go/no go decision point at the completion of Phase 1. The proposed project shall consist of the following phases:
Phase 1 – Model Development and Model-Level Validation: This Phase is dedicated to model development. Existing computational models will be improved, tested, and validated to provide the necessary output and level of detail. Phase 1 shall include experimental and/or characterization work as necessary for model input and validation of individual models.

At the end of Phase 1 the following requirements shall be met:

- Each of the proposed models is demonstrated as capable of producing the required outputs. Where applicable, outputs from models are used as inputs to other models to demonstrate the potential for integration;
- Each of the proposed models is validated against experimental results. If experimental results were used to provide input parameters for a model, then different experimental results must be used for validation. Validation requires that model results are within 15% of experimental results for all relevant outputs; and
- Recipients will make non-protected data and code available to other researchers in the automotive materials community and the general public. This will include:
    - Any experimental measurements of materials properties and sample characteristics;
    - Models and related code, unless the models and code contain protected information or the implementation is made commercially available.

Phase 2 – Integration and Design: This Phase of the project is focused on integration of the proposed models, ICME-based design, and prediction of system-level performance (system = body-in-white or chassis). All models that are compatible with commercial software (e.g. thermodynamic, finite element, etc.) must be implemented such that they can be run by an industry partner who is a user of the particular software package.

The project team shall also develop a cost analysis for the proposed system which can be used to calculate the anticipated cost per pound of weight savings in an automotive production environment and at automotive production volumes.

At the end of Phase 2 the following criteria shall be met:

- Successful integration of the various models. This will be demonstrated by the ability to integrate models from different length scales, process history and local structure models, and local structure and local properties models to predict final properties of a manufactured component. The system-level performance requirements are simulated and reported for comparison with experimental results;
- Installed system cost is predicted using the cost analysis;
- Solution design is generated using ICME techniques with material, geometry, processing, and assembly specified. The design achieves at least 35% (body) or 25% (chassis) reduction in weight compared to the agreed-upon baseline;
- Predicted installed cost of the design is less than $4.32 (body) or $4.27 (chassis) per pound of weight saved; and
- Recipients will make non-protected data and code available to other researchers in the automotive materials community and the general public.
- Tool Maturity Level is defined and compared between the start and the completion of the project to quantify how efforts in this project matured the models.
- A quantitative assessment of propagation of uncertainty is provided for each of the models used and also for the integration of the suite of models.

AOI 2 Non-responsive Application Criteria:

Applications submitted under AOI 2 will be considered non-responsive to this AOI if they fail to meet any of the general compliance criteria established in Section I (C), Section III (C) and if they:

- Include vehicle light-weighting designs incorporating materials other than carbon fiber composites (excluding fasteners and adhesives);
- Include weight reduction strategies which are not consistent with the requirements of Table 2 above;
- Include an approach that is focused on single components or non-structural systems (such as suspension, braking, or interiors);
- Include systems other than Light Duty on-road vehicles.

- Do not include a Tier 1 automotive supplier or OEM as a partner for system definition, requirements, and performance validation and a supplier who manufactures structural carbon fiber composites for the automotive market.
- Do not identify the types of models currently available and those to be developed and integrated during the project.
- Do not include the following types of models for integration: single length/timescale models; multi-scale models/coupled models; and multi-physics models that integrate structure/property/process relationships.
- Do not include a plan to achieve the modeling accuracies identified in Table 2, above, "Minimum Modeling Elements by Manufacturing Phase"
- Do not include the planned approach for integration of the models and that don't address planned integration techniques such as multi-scale modeling, integration of different types of models, and plans to link data from multiple sources.
    - Do not include a plan to address the following key challenges in ICME: Identify required level of verification and validation;
    - Identify minimum number of experiments needed to validate models[i]; and
    - Integrate the impact of fiber architecture, design, and conditions of processing for predictive capabilities not only for structure/property relationships but also for process/property relationships.
- Do not optimize function in design of the subsystem (of either the body-in-white or chassis) used for validation of the models. Specifically applications that utilize a materials substitution approach;
- Do not provide a plan to disseminate results through infrastructure identified by NIST.
- Do not include at least one material supplier with expertise in the production of structural polymer composites.

AOI 2 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 2:

Phase 1 Topical Report

- Model Development and Model-level Validation – This topical report is a comprehensive report on Phase 1 activities, and shall include experimental and computational data, comparison, and discussion. This report will contain a description of the current state of the art with respect to ICME of carbon fiber composites as well as how the work funded under this topic advanced the state of the art. The description shall be as quantitative as possible.

FEP Models

- The completed models shall be delivered to the DOE along with a software description document and a user's manual. The software description document shall include a high level description integrated models along with a description of input variables, output

variables, state variables, and relational databases implemented within the final software deliverable. The user's manual shall provide an overall description of the user implementation approach for the software.

Phase 1 Data and Model Dissemination Data, models, and code shall be made available to the general public through infrastructure and methods identified by NIST. This shall include:

- Any experimental measurements of materials properties and sample characteristics;
- Models and related code, unless the models and code contain protected information or the implementation is made commercially available.

Phase 2 Topical Report

- Integration and Design - This report is a comprehensive report on Phase 2 activities. It shall include:
    - A design for the FEP solution which is based on modeling results. The design must include details on the material, geometry, processing, and assembly of the FEP solution.
    - System-level performance requirements of the FEP solution design are simulated and reported for crashworthiness, stiffness, durability, and other relevant assembly-level simulations.
    - A table demonstrating that integrated model results are within 15% of coupon-level experimental results for all relevant outputs.
    - Design light-weighting and cost analysis, and their comparison to FOA targets.
    - Discussion and documentation of the models (documentation) and data (simulated and experimentally derived) developed in Phase 1, and its availability to the automotive materials community and the general public.
    - Requirements and performance validation.

Phase 2 Data and Model Dissemination Data, models, and code shall be made available to the general public through infrastructure and methods identified by NIST. This shall include:

- Any experimental measurements of materials properties and sample characteristics;
- Models and related code, unless the models and code contain sensitive information, or the implementation is made commercially available.

AREA OF INTEREST 3: Beyond Lithium Ion Technologies

One or more projects selected under this AOI may be collaboratively funded and managed by the U.S. Department of Energy and the U.S. Army. The Energy Storage R&D activity within VTO includes research and development on advanced batteries in support of the *EV Everywhere Grand Challenge*, whose target is to make plug-in electric vehicles (PEVs) cost-competitive with current gasoline-powered vehicles within the next 10 years, www.vehicles.energy.gov/electric_vehicles/10_year_goal.html. Its emphasis is on developing and improving the next generation of energy storage technologies, since they represent the most critical component needed to enable widespread commercialization of PEVs. The technical performance requirements for such batteries are available from the U.S. DRIVE Roadmap website, www1.eere.energy.gov/vehiclesandfuels/about/partnerships/roadmaps-other_docs.html, a subset of which is listed in Table 3.

Table 3: Summary PEV End of Life Cell Level Performance Goals.

Energy Storage Performance Requirements		EV
Characteristics	**Unit**	
Specific Discharge Pulse Power	W/kg	700
Discharge Pulse Power Density	W/l	1,500
Specific Regen Pulse Power	W/kg	300
Recharge Rate	kW	1.4
Specific Energy	Wh/kg	350
Energy Density	Wh/l	750
Calendar Life	Year	15
Cycle Life	Cycles	1,000
Operating Temperature Range	°C	-30 to +52

Purpose and Tasks

The purpose of this AOI is to solicit applications to perform focused fundamental R&D on issues impeding the commercialization of beyond lithium ion technologies – for example, referring to batteries that at the anode do not involve an intercalation host for lithium ions and are coupled at the cathode with a low cost and high capacity electrode material. Such couples offer the promise of significantly reduced cost and improved energy density compared to current lithium ion batteries. However, such technologies face significant hurdles in reaching practically acceptable thresholds in such areas as cycle life and other performance measures.

Applications shall:

- Identify the cell chemistry — including anode & cathode materials, electrolyte/separator composition, and cell composition/construction— that will be used to demonstrate success.
- Demonstrate an understanding of all major issues impeding the proposed chemistry, and clearly identify the particular barriers that are to be the target of the research effort.
- Identify the synthesis, testing, modeling and diagnostics activities to be performed to understand the causes of the issues being addressed, and identify methods and technologies that will be used to mitigate those issues.
- Implement the mitigation methods and technologies, and test their effectiveness in half/full cells of sizes greater than 10mAh.
- Support performance claims with data to the greatest extent possible, including those for electrode capacity, half-cell capacity and cycling, and if possible, including full cell data.

Some sample topics of interest include, but are not limited to:

- Lithium metal protection;
- Improved lithium-ion conductors for solid-state and/or liquid cells;
- Determination through modeling the optimum of Li_2S solubility and identification of electrolytes that satisfy this requirement;
- Developing electrolytes that enable solubility of insoluble products, decrease solubility of highly soluble species, and/or prevent dendrite formation;
- Developing tools to investigate speciation and reaction kinetics in the sulfur electrode with the aim of controlling the spatial and temporal distribution of solid and liquid species;
- Ensuring adequate ionic and electronic conduction in solid-state cathodes; and
- Addressing poor reversibility and large voltage hysteresis of the air electrode.

Projects selected under this FOA will be integrated into the Batteries for Advanced Transportation Technologies (BATT) Program which is coordinated by Lawrence Berkeley National Laboratory (LBNL). The goal of this participation is to avoid duplication of efforts and to increase the likelihood of project success. Attendance and presentations at BATT quarterly review meetings by the project Principal Investigator (PI) or designated representative is required. Awardees will be expected to work closely with the LBNL BATT Program Technical Director in addition to the DOE BATT Program Manager. This will include negotiation of the Project milestones as required. Additional information regarding the Program may be found at http://batt.lbl.gov/.

AOI 3 Nonresponsive Application Criteria:
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 Section I (C) and Section III (C).

AOI 3 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 3:

- Attendance and presentations at quarterly review meetings by the project Principal Investigator (PI).
- Preparation of presentations, either poster or oral, at the DOE Energy Storage Annual Merit Review.
- Submission of 10 baseline cells (minimum capacity: 4mAh) for government testing and evaluation. The baseline cells should be representative of the proposed chemistry.
- Submission of 12 improved cells (minimum capacity: 4mAh) for government testing and evaluation.

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 submitted to, the DOE (Vehicle Technologies Program) and end item manufacturer.

AREA OF INTEREST 4: Commercialization of Vehicle Power Electronics Using Wide Bandgap (WBG) Semiconductors

One or more projects selected under this AOI may be collaboratively funded and managed by the U.S. Department of Energy and the U.S. Army. Wide bandgap (WBG) semiconductors such as silicon carbide (SiC) and gallium nitride (GaN) offer opportunities to significantly advance the performance and reduce the cost of vehicle power electronics with improved properties compared to current silicon (Si) semiconductors. This includes higher junction temperature capabilities, faster switching frequencies, higher voltages, and lower power losses. At the vehicle level, this results in a reduced thermal burden on the cooling system; simplification of the cooling system hardware; and reduced volume and lower weight for the motor inverter, power converter and associated cooling components. However, barriers to the adoption of these devices in vehicle applications persist, and can include their cost premium, long term reliability concerns, and component packaging and integration concerns such as gate drives, thermal management, and lower system inductance.

The development of less-expensive, more-efficient, smaller, and lighter power electronics and electric machines for electric traction, power generation, and accessory drive systems is necessary to reduce the cost and improve the performance of electric drive vehicles. WBG power semiconductor switches represent a potential pathway to achieving DOE targets for improved, low-cost power electronics, but the barriers to market adoption must be addressed.

The goal of this topic is to accelerate market introduction of vehicle electric drive systems utilizing WBG semiconductors with emphasis on market introduction of the proposed component(s) and vehicles. Applications to this area of interest shall identify the relevance of the proposed approach and technology to the vehicle market as a whole and to vehicle electrification. Additional information on VTO's initiative to develop and commercialize the next generation of technologies in support of the EV Everywhere Grand Challenge can be found in the EV Everywhere Blueprint (http://www1.eere.energy.gov/vehiclesandfuels/electric_vehicles/10_year_goal.html)

Applications shall organize tasks and schedule into two Phases. Phase 1 for technology design and development should include, at a minimum: defining specifications; establishing a commercially existing silicon-based approach; delivering bench test results; and presenting a commercialization plan that includes a confirmed vehicle[6]WBG based application from a vehicle OEM. Phase 2 integration and vehicle validation should include, at a minimum, a full test plan that demonstrates WBG based component performance in the intended or representative vehicle application.

[6] A confirmed vehicle application must include at least either a commitment from a vehicle OEM for a specific vehicle application, or detailed explanation of a vehicle where technology proposed will demonstrate: 1) the value proposition of WBG semiconductors; 2) improvements over state of the art technologies and Si devices; 3) demonstration platform to confirm performance; and, 4) defined commercialization path and plan.

Each phase shall be at least 12 months but no more than 24 months in length. The total project should not exceed 36 months in duration.

Applications to this area of interest shall address the barriers to WBG utilization. Proposed R&D should clearly identify the paths that enable market introduction of WBG power semiconductor switches for any vehicle type (including on-road or off-road vehicles) in a power electronics component such as, but not limited to inverters, converters, and/or chargers with a continuous power rating of at least 2 kW from a 100 V or greater source. Market introduction of components using these WBG switches will demonstrate their inherent benefits, and provide needed application-level performance, reliability, and cost data. Furthermore, market introduction should lead to higher production volumes and lower device costs for subsequent vehicle applications.

To address the current barriers to the adoption of WBG devices, applications shall detail how they will leverage WBG benefits and properties to reduce system size, complexity, and/or cost compared to a specific commercially existing silicon-based approach. This comparison is defined as establishing a value proposition for using WBG semiconductor switches.

Applications shall:

- Define specifications for at least one vehicle component using WBG power semiconductor switches that meet the identified electric traction drive system targets. Also include specifications for a specific commercially available silicon-based approach. This could include, but is not limited to, inverters, converters, and/or chargers that have a power rating of at least 2 kW from a 100 V or greater source.
- Address challenges to using WBG switches in the specified component(s), and detail any necessary R&D, testing, or analysis needed to ensure successful commercialization. These steps shall include a detailed cost analysis with a comparison to a specific, commercially existing silicon-based approach to define the value proposition of using WBG switches in this application.
- Show a strong, clear path to market vehicle application(s), including projected sales volume and concurrent quantity and type of WBG switches sold. Include supporting details such as anticipated market position, strategy, and timeline.
- Describe project performers and team and how their capabilities shall support the ultimate market entry and success of the specified component(s). Applications are strongly encouraged to show a vertically-integrated supply chain and product development team that includes, at a minimum, a U.S.-based device manufacturer and vehicle OEM.

AOI 4 Nonresponsive Application Criteria:

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 Section I (C) and Section III (C).

AOI 4 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 4:

Phase 1 Deliverables:

- Detailed specifications for WBG power semiconductor switch requirements and performance in this application, and application-specific component performance requirements. WBG devices can be existing, prototype, or new devices, but regardless requirements should include considerations for meeting or demonstrating vehicle application qualifications.
- Detailed plans and specifications for integration of WBG devices into the proposed electric traction drive vehicle component and approach. Clearly define what is required to enable successful implementation of the WBG devices (packaging, interfaces/interconnects, heat removal, etc.) and the trade-offs identified in the design approach.
- Comparison to a specific, commercially existing silicon-based approach that shows the cost benefit or explains the overall value proposition of using WBG devices in the proposed component.
- Hardware test results confirming that component application specifications are met.
- Detailed commercialization plan including expected vehicle sales and market strategy.
- Confirmed vehicle application from a vehicle OEM to proceed into second phase of award.

Phase 2 Deliverables:

- Develop test plan to demonstrate and confirm component performance.
- Demonstrate component performance in the intended vehicle application, or representative vehicle application, and provide data to show:
  - Component performance requirements and targets are met;
  - Vehicle performance, requirements, and overall value proposition for WBG application are successfully met.

AREA OF INTEREST 5: Tire Efficiency

One or more projects selected under this AOI may be collaboratively funded and managed by the U.S. Department of Energy and the U.S. Army. The goal of this topic is to develop technologies that enable reduction of fuel consumption of legacy fleet of passenger cars and commercial vehicles through tire technology development. Successful projects in this area will target improved materials, tread designs, weight reduction, pressure maintenance technologies, and other approaches that improve tire efficiency and will culminate in vehicle demonstrations of fuel consumption reduction by at least 4% compared to the state-of-the-art, while maintaining traction and wear characteristics of the tire.
Tire technology can contribute to improving the efficiency of both passenger cars and commercial vehicles. This contribution is amplified by the fact that the life cycle of a tire is much shorter than the life cycle of a full vehicle. Therefore, new tire technology has an ability to quickly penetrate a large percentage of the vehicle fleet, leading to a more significant impact on national fuel use.

The technical metric most commonly associated with effect of tires on fuel consumption is rolling resistance. All means of reducing rolling resistance will be considered, including but not limited to innovative tire materials, tire design and construction, tread configuration, and proper tire pressure maintenance. Applications must include a discussion of the process to be used to identify the state of the art of tire technology with respect to tire rolling resistance. Rolling resistance cannot be improved in isolation from other tire design goals, especially wear and traction. Therefore, any proposed rolling resistance reduction projects should not have a significant negative effect on other tire parameters. All proposed technologies must also satisfy relevant federal regulations related to tires and be able to meet applicable federal tests. A proposed technology should maintain an advantage over baseline tires throughout the expected life of improved and baseline tires. Additionally, it is preferred that a proposed technology is able to survive the retread process.

Applications shall demonstrate that the applicant:

- Is proposing a technology that has a high chance to meet the goal of reducing fleet fuel consumption by at least four percent, to be demonstrated by vehicle testing at the end of the project;
- Has demonstrated capability to develop tire technologies of similar complexity;
- Has demonstrated capability to commercialize tire technologies of similar complexity;
- Is prepared to commercialize the tire technologies developed in this project, as demonstrated in part by the amount of proposed cost share.

Applications may focus only on passenger car or light truck tires or only on commercial vehicle tires, but it is preferred that the proposed technology be either directly applicable to all vehicles, or easily scalable up or down. It is also preferred that the technology is directly applicable or easily adaptable to off-highway and military vehicle tires. Likewise, a proposal may focus only on OEM tires or only on replacement tires, but it is preferred that the proposed technology is applicable to both OEM and replacement tires.

AOI 5 Nonresponsive Application Criteria:

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 Section I (C) and Section III (C).

AOI 5 Specific Deliverables:

In addition to the deliverables required in the Federal Assistance Reporting Requirements Checklist, the recipient will be required to provide twelve (12) tires incorporating the developed technology and twelve (12) tires for use as a baseline for evaluating the developed technology for testing by TARDEC or another Federal laboratory.

Validation testing will be conducted on the tires 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.

AREA OF INTEREST 6: Multi-Speed Gearbox for Commercial Delivery Medium Duty Plug-In Electric Drive Vehicles

One or more projects selected under this AOI may be collaboratively funded and managed by the U.S. Department of Energy and the U.S. Army. The objective of this AOI is to develop and demonstrate an advanced multi-speed gearbox that replaces a single speed gearbox in a baseline Commercial Delivery Medium Duty Plug-in Electric Drive Vehicle (MD PEDV), demonstrate improved drivability and fuel efficiency, and improve the market penetration of the MD PEDV. The proposed project shall modify the proposed baseline vehicle by replacing the single speed gearbox with an advanced multi-speed gearbox and demonstrate improved drivability and fuel efficiency of the MD PEDV. The baseline vehicle should be designed for the Commercial Delivery market and have a single speed transmission. Other Medium and Heavy Duty market applications will be considered if the market application can provide an equivalent or greater reduction in petroleum consumption. Table 4 provides characteristics of a typical medium duty PEDV available in the market today.

Table 4 Characteristics of Baseline Medium Duty PEDV[7]

Drag , Mass, and Accessory Load Parameters	Traction Motor	Energy Storage	DC-DC Converter	Transmission	Differential & Wheels	Top Speed	Fuel Efficiency
Drag coefficient 0.5, Area = 5.33 m2. Weight=10000 kg., Accessory Load = .2 KW	Permanent Magnet, 134 KW peak, 95 KW continuous power	360 V, 80KWhr	95% efficiency	Single Speed 2.0 ratio, 93.4% efficient	3.4 ratio, 97% efficient	50 mph	37 MPGdge on UDDS, 50 MPGdge on CILCC

Baseline EDV top speed is approximately 50mph and has limited acceleration at speeds above 30 mph. The medium duty PEDV resulting from this project should have a top speed of at least 65 mph and be capable of strong acceleration at speeds above 35 mph and on highway entry ramps. In addition to high performance capabilities, the use of the proposed multi-speed advanced gearbox should result in higher overall vehicle efficiencies and the ability to utilize a down-sized traction battery while meeting range and other performance requirements.

Project Development Phases:

The project shall be planned in two phases. Applicants shall design and develop and laboratory test a prototype gearbox during Phase 1 and integrate the prototype into the MD PEV and perform integration/verification testing during Phase 2.

[7] Source Oak Ridge National Laboratory Commercial Delivery MD PEDV Model, October 2013.

In Phase 1 of the proposed project, applicants shall develop and validate a design and develop a multi-speed gearbox for Medium Duty PEDVs designed to satisfy the following requirements:

- Increase energy/fuel efficiency of the baseline vehicle by at least 5% by gearbox rapid response to vehicle control system shift commands. The gearbox implements commands to alter the gear ratio to allow the traction motor to deliver requested power while maximizing operations in its most efficient operating regions. The gearbox shall have minimal loss of torque during gear ratio transitions.
- Improve drivability of Commercial Delivery PEDVs by providing increased acceleration at speeds above 30 mph and increase the top speed of the vehicle to at least 65 mph. Provide low gear ratios sufficient to quickly accelerate from a stop and climb grades at speeds below 30mph.
- Optimized weight to minimize impact on fuel efficiency.
- Low cost when produced in volumes of 1,000 or more.
- Provide quick transitions of gear ratios that optimize the conversion of bi-directional power (to the wheels during acceleration or constant speed driving, and from the wheels during regenerative decelerations or braking).
- Provide a control system with the gearbox to enable the modified baseline vehicle to realize fuel efficiency gains via gear ratios optimized to the vehicle and customized to driver specified delivery route drive cycles. The developer should include this development work in their application and it should be done in conjunction with the vehicle manufacturer during the integration phase.

In Phase 2 of the proposed project, applicants shall;

- Further development and integration the system into a vehicle
- Perform validation testing in a vehicle.
    - The number of vehicles and scope of testing should be sufficient to validate the technology and enable commercialization of the technology.
    - The validation work shall address any deficiencies identified during the testing.

Selected applicants shall complete all project phases within approximately 3 years of award. Phase 1 should be planned for approximately 2 years and phase 2 for approximately 1 year. Selected applicants shall manufacture the gearbox in the US within 5 years of the successful completion of the project.

It is highly encouraged that the proposing applicant team includes an advanced transmission 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 committing to teaming arrangements shall be included in the application.

Additional Application Requirements:
In addition to the information provided in the narrative above specific to this AOI, applications shall address the following:

The projects shall include two phases of work:

1. Phase I - Technology Design and Development - Phase I shall include the system design and development with a laboratory demonstration of the technology.
2. 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 number of vehicles and scope of testing should be sufficient to validate the technology and enable commercialization of the technology. 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 capable of starting commercial production within five (5) years of project completion. Projects with a firm commitment to commercialization within five (5) years of successful project completion are highly encouraged.

The application shall address project scope, organization, and teaming to perform all of the following:

- System requirements analysis, concept development, and component interface specification;
- Design, build, and validate components in laboratory setting. The components shall be tested and performance validated by DOE;
- 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; and
- Operational testing & validation of vehicle integrated technology. The technology will be demonstrated to validate performance claims in real-world Commercial Delivery conditions. Test data will be periodically provided to a DOE Laboratory.

AOI 6 Nonresponsive Application 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 Section I (C) and Section III (C).

AOI 6 Specific Deliverables:
Aside from the deliverables required in the Federal Assistance Reporting Requirements Checklist, there are no special deliverables for AOI 6.

AREA OF INTEREST 7: Advanced Climate Control Auxiliary Load Reduction

One or more projects selected under this AOI may be collaboratively funded and managed by the U.S. Department of Energy and the U.S. Army. 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 (e.g., glazing, and shading), surface paints, thermal mass reduction (e.g. seating & dash), thermal mass management, ventilation, and advanced insulation.

Advanced HVAC Technologies
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, thermo-electric devices, phase change materials, and zonal ventilation. Development is highly encouraged to efficiently harvest the waste heat from power electronics, battery pack, and auxiliary loads for the express purpose of reducing the impact of HVAC and auxiliary loads on vehicle range.

Cabin Preconditioning

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. Characteristics of commercially viable solutions include the potential for 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.,Federal Motor Vehicle Safety Standards (FMVSS) 103). Proposed approaches must be implementable without imposing major changes to charging infrastructure or standards.

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 shall be included in the application.

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.

The projects shall include two (2) phases of work:

1. Phase I - Technology Design and Development - Phase I shall include the system design and development with a laboratory demonstration of the technology.

2. 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. 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 five years of project conclusion. EERE highly encourages projects with a firm commitment to commercialization within five years of successful project completion.

The application shall address project scope, organization, and teaming to perform all of the following:

- System requirements analysis, concept development, and component interface specification;
- Design, build, and validate components in laboratory setting. The components shall be tested and performance validated by DOE;
- 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; and
- Operational testing & validation of vehicle integrated technology. The technology will be demonstrated to validate performance claims in real-world climatic conditions.

AOI 7 Non-responsive Application Criteria:

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 Section I (C), Section III (C) and if they:

- Contain strategies that do not include the separate two phases of work as identified above;
- Contain strategies that are not compliant with Federal Motor Vehicle Safety Standards (FMVSS);
- Include solutions that have significant potential to negatively impact the environment in terms of Greenhouse gas (GHG) emissions;
- Do not address at least one of the specific technical strategies:
    - Energy Load Reduction and Energy Management:
    - Advanced HVAC Technologies
    - Cabin Preconditioning

AOI 7 Specific Deliverables:

Aside from the deliverables required in the Federal Assistance Reporting Requirements Checklist, there are no special deliverables for AOI 7.

TECHNOLOGY DEVELOPMENT TO REDUCE PETROLEUM CONSUMPTION THROUGH FUEL EFFICIENCY IMPROVEMENTS IN PASSENGER AND COMMERCIAL VEHICLES

AREA OF INTEREST 8: Development of High Performance Low Temperature Catalysts for Exhaust Aftertreatment

The objective of this Area of Interest is to accelerate the development and deployment of new catalyst aftertreatment systems based on the most promising developments in basic catalyst research. These new exhaust aftertreatment technologies and catalysts must have light off temperatures of 150°C and conversion efficiencies near 90%, to fully meet topic objectives. Key emissions of interest in order of importance are Oxides of Nitrogen (NOx)(#1), non-methane organic gasses and Hydrocarbons (NMOG & HC)(#2), and particulate matter (PM)(#3). Successful projects will benefit society by accelerating the deployment of vehicles with increased engine efficiency and reduced petroleum consumption.

New fuel economy and greenhouse gas emission standards are challenging automotive manufacturers to produce more fuel efficient engines, but in many cases, the fuel efficiency improvements result in lower exhaust temperatures where conventional aftertreatment systems are not suitable. Thus, catalysts that are active at lower exhaust temperatures are needed to enable future U.S. EPA emission compliant aftertreatment systems. On November 29-30, 2012, a workshop was conducted to address "The 150°C Challenge" (http://www.pnnl.gov/main/publications/external/technical_Reports/PNNL-22815.pdf), and provided a high-level roadmap for the discovery and development of catalytic materials and systems capable of functioning at 150°C.

Applicants under this Area of Interest will develop catalyst and prototype aftertreatment systems which are operational and meet U.S. EPA emissions requirements with low temperature (<150°C) exhaust. Applicant teams shall include a Tier 1 automotive supplier or OEM as a partner for identifying operational parameters, cost targets, prototype design, demonstration, and validation.

Applications shall address all of the following aspects:

- Catalyst development and performance demonstration;
- Prototype aftertreatment system development, demonstration and evaluation;
- Evaluation of existing Computational Models;
- Cost Model of catalyst system.

Catalyst Development and Performance Demonstration:
Applications shall provide details on the proposed catalyst properties, applications, and temperature behavior. A baseline catalyst will be established using state of the art OEM or Tier 1 supplier catalysts, and the new catalyst will be compared to the baseline. The technology descriptions should include process-structure/thermal cycling/ catalyst deactivation mechanism simulations and modeling techniques to predict life cycle performance.

Evaluation of Existing Computational Models:
Applications shall include evaluation of existing computational methods as applied to catalyst materials, and how the proposed catalyst will be modeled with those techniques. Proposed catalysts shall be modeled using existing techniques and modeling results compared with experimentally characterization and performance results.

Prototype Aftertreatment System Development, Demonstration and Evaluation:
A prototype demonstration assembly shall be developed to emulate expected exhaust gas compositions and temperatures as identified by OEM or Tier 1 supplier and the workshop report (http://www.pnnl.gov/main/publications/external/technical_Reports/PNNL-22815.pdf).. The assembly should be capable of simulating performance challenges such as thermal cycling, startups, cool-down, chemical poisoning, catalyst aging and deactivation, and other anticipated technical challenges.

Cost Model:
A cost model shall be developed for a scaled prototype assembly which would operate in an on-road vehicle with low-temperature exhaust (<150°C). Applicants should show how the proposed assembly will meet industry cost targets at expected production levels.

AOI 8 Non-responsive 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 Section I (C), Section III (C) and if they:

- Do not include a Tier 1 automotive supplier or OEM as a partner for identifying operational parameters, cost targets, prototype design, demonstration, and validation.
- Do not address all four (4) technical areas of the scope will be considered non responsive. These four areas are:
    1) Catalyst development and performance demonstration;
    2) Evaluation of existing Computational Models for catalyst composition and performance;
    3) Prototype aftertreatment system development, demonstration and evaluation;
    4) Cost model.

AOI 8 Specific Deliverables:

Aside from the deliverables required in the Federal Assistance Reporting Requirements Checklist, there are no special deliverables for AOI 8.

AREA OF INTEREST 9: Dual-Fuel Technologies

The objective of this AOI is to develop and demonstrate dual-fuel technologies that will achieve at least a 50% reduction in petroleum usage through a combination of petroleum displacement and improved efficiency. Improved efficiency is enabled through improved performance of advanced spark-ignition and/or compression-ignition combustion engines for light, medium, or heavy-duty vehicle applications. Proposed concepts must include demonstration of the technology up through at least single-cylinder engine testing.

Dual-fuel concepts are sought for on-road light-, medium- and heavy-duty passenger car applications that (i) increase engine efficiency by exploiting the fuel properties, (ii) have the capability and suitability for retrofit into the existing fleet and/or incorporation into current production models, (iii) displace/reduce petroleum usage by at least 50%, (iv) enable use of existing emissions controls in standard configurations and capacities, (v) meet all emissions and onboard diagnostic requirements, and (vi) where the engine can switch between operation on 100% gasoline or diesel fuel, 100% other fuel, and a combination of both without having to refuel. Applications shall demonstrate that the proposed concept improves the thermal efficiency of the engine beyond the baseline fuel (gasoline or diesel) through a combined use of both fuels. The application shall demonstrate that the cost of retrofitting or additional production costs must be recoverable by fuel savings within 36 months of typical vehicle operation.

AOI 9 Non-responsive 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 Section I (C), Section III (C) and if they fail to meet the following requirements:

- Proposed concepts must not be aimed at platform integration or implementation of commercially available bi-fuel systems, or applications that substantially resemble commercially available systems.
- Proposed concepts must use only commercially available and widely applied emission control devices and not depend on the use of of non-standard emissions control devices or increased capacity of standard devices;
- Proposed concepts must meet all emissions and onboard diagnostic requirements;
- Proposed concepts must be able to switch between operation on 100% gasoline or diesel, 100% other fuel, and a combination of both without having to refuel;
- Proposed technologies must be able to be retrofitted into existing on-road light-duty vehicles or incorporated into current production models and demonstrate at least a 50% petroleum reduction/displacement;
- Cost of retrofitting or additional production costs must be shown to be recoverable by fuel savings within 36 months of typical vehicle operation.
- Proposed concepts must improve the thermal efficiency of the engine beyond the baseline fuel (gasoline or diesel) through a combined use of both fuels.

AOI 9 Specific Deliverables:

Aside from the deliverables required in the Federal Assistance Reporting Requirements Checklist, there are no special deliverables for AOI 9.

AREA OF INTEREST 10: Fuel Property Impacts on Combustion

The objective of this AOI is to develop advanced fuel concepts that will achieve at least a 25% reduction in petroleum usage through enabling optimal performance of advanced spark-ignition and/or compression-ignition combustion engines for light-, medium-, and heavy-duty vehicle applications. Proposed concepts must include demonstration of the technology up through at least single-cylinder engine testing.

Fuel properties, such as octane and cetane, have been widely discussed in recent years as potential design variables for future mainstream vehicles. Applications are sought for innovative and cost-effective approaches to exploiting fuel properties to enable or enhance efficient combustion in reciprocating internal combustion engines.

Proposed work should be for fuel-focused research for the facilitation or enhancement of advanced combustion regime engine operation – i.e., ultra-clean and highly-efficient, liquid-fueled combustion engines. Such concepts: may incorporate novel thermodynamic cycles, but should not simply involve a recycling of existing concepts (e.g., Miller Cycle); should have extremely low engine-out NOx and PM as a target; and should have efficiency at least as high as state-of-the-art direct injection diesel engines (i.e., approximately 45% peak thermal efficiency for light duty and greater-than 50% peak thermal efficiency for heavy duty). Additionally, applications must demonstrate that the proposed concept/technology meets the following criteria:

- Required unconventional fuel or fuel components must be able to be cost-effectively produced at greater than 10,000 gallons per year in the next 5 years;
- Proposed concepts must use only commerically available and widely applied emission control devices and not depend on the use of non-standard emissions control devices or increased capacity of standard devices;
- Proposed concepts must meet all emissions and onboard diagnostic requirements;
- Proposed technologies must be able to be retrofitted into existing on-road vehicles or incorporated into current production models and demonstrate at least a 25% reduction in petroleum consumed;
- The cost of retrofitting or additional production costs must be shown to be recoverable by fuel savings within 36 months of typical vehicle operation.

AOI 10 Non-responsive Application Criteria:

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 Section I (C), Section III (C) and the following AOI specific criteria:

- Proposed concepts must use only commerically available and widely applied emission control devices and not depend on the use of non-standard emissions control devices or increased capacity of standard devices;
- Proposed concepts must meet all emissions and onboard diagnostic requirements;
- Proposed technologies must be able to be retrofitted into existing on-road vehicles or incorporated into current production models and demonstrate at least a 25% reduction in petroleum consumed;
- The cost of retrofitting or additional production costs must be shown to be recoverable by fuel savings within 36 months of typical vehicle operation.

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: Powertrain Friction and Wear Reduction

One or more projects selected under this AOI may be collaboratively funded and managed by the U.S. Department of Energy and the U.S. Army. Parasitic losses within vehicle engines and drivetrains are responsible for approximately two million barrels of oil consumption per day in the US. These losses are caused by friction between components, movement of components through fluids, and movement of fluids through components. Engine component sources of friction include accessories, piston skirts, valve-trains, and bearings & seals. Drivetrain component sources of friction include the transmission, bearings, seals, and differential.

This AOI is composed of two separate subtopics. Single applications under this AOI are to be submitted to address only one of the subtopics**. Single applications that address both topic areas will not be accepted.**

Subtopic 11A: Technology Development to Improve Fuel Efficiency Through Friction Reduction

The objective of Subtopic 11A is to develop and demonstrate friction and wear reduction technologies for light-, medium-, or heavy-duty vehicles that improve fuel efficiency of legacy vehicles by at least 2%, and/or improve fuel efficiency of future vehicles by at least 4% (improvement based on comparative results from engine dynamometer, chassis dynamometer testing, or test track, e.g., SAE J1321) without adverse impacts on vehicle performance or durability.

Applications under this subtopic for low-friction technology development must include demonstration of the proposed technology up through at least bench-scale testing with justification of the full engine or vehicle fuel economy improvement. More robust evaluation up to full engine and/or full vehicle tests is desirable but not required. Applications under this subtopic for low-friction technology development must include one (1) or more of technology development pathways:

- Lubricants – low-viscosity fluids and low-friction additives;
- Component Materials and Coatings – materials and coatings that exhibit low asperity friction behavior, or enable reduced surface area for friction;
- Component Designs – engineered surface textures/finishes, ring tension, shapes that enhance hydrodynamic fluid response.

Applications shall not include:

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

- 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;
- Formulations that are not compatible with existing emissions control systems;
- Formulations exclusively for automatic transmissions;
- Projects focused solely on demonstration of a technology;
- Projects focused mainly on production methods for lubricants;
- Projects focused on idle reduction and aerodynamic drag reduction.

Subtopic 11A Additional Application Requirements:

In addition to the information provided in the narrative above specific to this subtopic, all applications submitted under Subtopic 11A must specifically address ALL of the following:

- Any formulations used must be for a lubricant application that can be easily replaced in the legacy fleet. Engine lubricants, manual transmission lubricants, and axle/gear lubricants are acceptable applications. Automatic transmission lubricants and/or any lubricant in a sealed bearing are not acceptable applications.
- Any comparison lubricants used should include 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 and 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. Base oil and partially formulated applications are acceptable as compliments, not replacements for fully formulated applications.
- Friction reduction analysis should include expected improvements to fuel economy with a breakdown for boundary, mixed and hydrodynamic friction.
- Proposed concepts must include demonstration of the technology up through at least bench-scale testing with justification of the full engine or vehicle fuel economy improvement. More robust evaluation up to full engine and/or full vehicle tests is desirable but not required.

Subtopic 11A Nonresponsive Application Criteria:

Applications submitted under AOI 11A, will be considered non-responsive to this FOA if they fail to meet any of the general compliance criteria established in Section I (C), Section III (C) and if they include:

- Formulations that aren't expected to show a fuel efficiency improvement within 4000 miles or 50 hours of engine operation;
- Formulations exclusively for use in off-road (rail, marine, construction, small engines) or motorcycle applications;
- Formulations exclusively for alternative fuel applications;

- Formulations that are not compatible with existing emissions control systems;
- Formulations exclusively for automatic transmissions;
- Projects focused solely on demonstration of a technology;
- Projects focused mainly on production methods for lubricants;
- Projects focused on idle reduction and aerodynamic drag reduction; and
- Single applications that address both topic areas.

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

Subtopic 11B: Identification and Quantification of Friction Losses along with Methods to Measure and Predict Fuel Economy Gains in Full Engine and/or Vehicles.
The objective of this Subtopic 11B is to develop empirical characterizations of friction and wear mechanisms in internal combustion engines and methods to predict the impact of such mechanisms on full-engine or full-vehicle fuel economy. This is to include technologies that can reliably use a defined set of protocols and experimental results from lower-cost bench top friction and wear devices and reliability predict the friction and wear performance of actual powertrain and drivetrain components and lubricants under actual operating conditions. Successful projects in this topic will be able to develop accurate and reliable correlations between friction and wear performance data (and mechanisms) obtained from a select set of bench top tests and performance in actual vehicles. Such a correlation will provide the ability to evaluate advanced technologies to reduce parasitic losses in vehicles in terms of their performance and mechanisms more quickly and more economically than full engine or vehicle tests.

Applications under this subtopic for friction/wear characterization and measurement must include work to quantify actual friction losses and improvements not just computer modeled losses and improvements. Applications under this subtopic must include two (2) or more of following regimes:

- Boundary lubrication typical of the engine valve train or drivetrain gears;
- Hydrodynamic lubrication typical of engine bearings;
- Mixed lubrication regimes typical of the engine power cylinder.

Applications must not include:

- Technology that is proprietary or requires a license to operate;
- Technology that is not stand-alone or requires proprietary equipment as a compliment to give full results; and
- Items that are hazardous and require special precautions for operation, e.g., radioactive materials are used as a tracer element.

Subtopic 11B Additional Application Requirements:

In addition to the information provided in the narrative above specific to this subtopic, all applications submitted under Subtopic AOI 11B must specifically address ALL of the following:

- All applications shall include work to quantify actual friction losses and improvements not just computer modeled losses and improvements.
- Any formulations used shall be for a lubricant application that can be easily replaced in the legacy fleet. Engine lubricants, manual transmission lubricants, and axle/gear lubricants are acceptable applications. Automatic transmission lubricants and/or any lubricant in a sealed bearing are not acceptable applications.
- Any comparison lubricants used shall include 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 and 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. Base oil and partially formulated applications are acceptable as compliments, not replacements for fully formulated applications.
- Friction reduction analysis should include expected improvements to fuel economy with a breakdown for boundary, mixed and hydrodynamic friction.

AOI 11B Non-responsive Applications Criteria:

Applications submitted under AOI 11B, will be considered non-responsive to this FOA if they fail to meet any of the general compliance criteria established in Section I (C), Section III (C) and if they include:

- Technology that is proprietary or requires a license to operate;
- Technology that is not stand-alone or requires proprietary equipment as a compliment to give full results
- Items that are hazardous and require special precautions for operation, e.g., radioactive materials are used as a tracer element; and
- Single applications that address both topic areas.

AOI 11B Specific Deliverables:

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

AREA OF INTEREST 12: Advanced Technology Powertrains For Light-Duty Vehicles Phase 2 (ATP-2)

The objective of this AOI is to accelerate the development of cost-competitive engine and powertrain systems for light-duty vehicles that attain breakthrough thermal efficiencies while meeting future emissions standards. **Vehicle-level goals are to improve fuel economy by 35% for gasoline and by 50% for diesel, compared to a baseline 2009 gasoline vehicle.** Development of the engine and powertrain system shall also include friction reduction, emission control, fuels, materials, electrification, and reduced ancillary load requirements. The engine system can be designed to accommodate a hybrid system, Continuously Variable Transmission (CVT) or other advanced transmissions. The projects will be structured with well-defined phase gates and associated technical milestones.

Over the three (3)-to-five (5) year period of this activity, the selected participants will develop, test and eventually demonstrate these advanced technologies and the associated efficiency gains on a powertrain dynamometer and finally on a full-scale vehicle. Emissions will be measured to show compliance. Technologies that are compatible with or can support future fuels and are adaptable to bio-fuels with relatively minor modifications will be taken into consideration during the comprehensive merit evaluation process. Achievement of the stated fuel economy goals may require improvements to the entire powertrain system although engine system efficiency improvements must play a significant role in this effort. **The engine system may be designed to accommodate a hybrid system, CVT or other advanced transmission, however, the development of these technologies *will not* be cooperatively funded by the DOE. For an engine used in a hybrid vehicle application, the stated fuel economy improvements shall result from improvements only to the engine system efficiency when compared to the base-line hybrid vehicle. Funding for hybrid system development *shall not* be considered for this area of interest.** In order to bring the best possible resources to bear on this problem, appropriate teaming arrangements among suppliers, national labs, universities, energy companies, and vehicle OEMs are encouraged.

Applications shall include the following requirements:

- Combustion related research, development, and demonstration activities;
- Both engine-level and vehicle-level demonstrations;
- Include, as prime or partner, a vehicle, engine, or component OEM, where OEM is defined as having built and sold commercially at least 500 vehicles, engines, or components of a single type or function in the 12 months prior to this solicitation's closing date;
- Must propose only gasoline or gasoline blends up to E15, diesel or biodiesels up to B10.

Vehicle-Level Efficiency Goals:

The following table summarizes the project goals at the vehicle level:

Demonstration Type	Efficiency	Emissions	Conditions	DOE Cooperatively Funded R&D
Modeling and/or Analysis	≥ 35% Fuel Economy Improvement - Gasoline Engine[8] ≥ 50% Fuel Economy Improvement - Diesel Engine[8]	EPA Tier 3	**Type:** On Road representative **Profile:** City Federal Test Procedure (FTP) and Highway fuel economy cycles (unadjusted, weighted 55% and 45% to give a "combined" fuel economy number) Test cycles and measurement procedures per CFR 40, Part 600	Engine and Ancillary Systems[9]
Full Scale Vehicle	≥ 35% Fuel Economy Improvement - Gasoline Engine[8] ≥ 50% Fuel Economy Improvement - Diesel Engine[8]	EPA Tier 3	**Type:** On Road **Profile:** City FTP and Highway fuel economy cycles (unadjusted, weighted 55% and 45% to give a "combined" fuel economy number) Test cycles and measurement procedures per CFR 40, Part 600, US06 cycle	Engine and Ancillary Systems[9]

Engine-Level Efficiency Goals:

In addition to the demonstration of vehicle-level goals, attainment of specific engine-level efficiencies shall also be demonstrated. The engine shall be tested before vehicle integration to support analysis that vehicle fuel economy improvements can be achieved. Successful results on this engine-level analysis shall be a necessary prerequisite for the project to advance to the vehicle integration phase.

[8] Improvement is based on comparison to a baseline state-of-the-art port fuel-injected gasoline vehicle maintaining comparable vehicle performance

[9] Includes improvements to in-cylinder combustion, waste heat recovery, friction reduction, emission control, fuels, materials, electrification and reducing ancillary load requirements

The engine efficiency test points shall include the following required speed and load conditions:

- 2-bar Brake Mean Effective Pressure (BMEP) and 2000 rpm,
- 20% of peak load and 2000 rpm,
- Peak engine efficiency point.

The following table illustrates the modeled efficiency improvements required for several engine technologies to meet the stated fuel economy goals:

		2010 Baselines				2020 Stretch Goals		
Technology Pathway	Fuel	Peak Efficiency[1]	Efficiency[1] at 2 bar BMEP and 2000 rpm	Efficiency[1] at 20% of the Peak Load at 2000 rpm	Peak Load[2] at 2000 rpm	Peak Efficiency[3]	Efficiency[3] at 2 bar BMEP and 2000 rpm	Efficiency[3] at 20% of the Peak Load at 2000 rpm
Hybrid Application	Gasoline	38	25	24	9.3	46	30	29
Naturally Aspirated	Gasoline	36	24	24	10.9	43	29	29
Downsized Boosted	Gasoline[4]	36	22	29	19.0	43	26	35
	Diesel	42	26	30	22.0	50	31	36

[1] Entries in percent Brake Thermal Efficiency (BTE)
[2] Entries in bars of Brake Mean Effective Pressure (BMEP)
[3] Entries in percent BTE that are equal to 1.2 times the corresponding baseline BTE
[4] Downsized Boosted engine used premium grade fuel and direct injection

Aftertreatment Requirements:

In order to successfully introduce a more efficient powertrain into the US vehicle marketplace, the engine technology must be coupled with an aftertreatment system that will meet proposed EPA Tier 3 Motor Vehicle Emission and Fuel Standards utilizing fuels that will be in effect at the point of introduction. The most stringent emissions requirements include NMOG + NOx levels not to exceed 30mg/mi, CO less than 2.1 g/mi, and particulate matter under 3mg/mi. For the purpose of this solicitation, applications must include an aftertreatment approach that will satisfy Tier 3 emission standards and can be demonstrated by the end of the project timeline. On-Board Diagnostic (OBD) controls are normally an integral component of an aftertreatment system. However, for the purposes of this development effort, the OBD requirement will be limited to a description of a viable OBD methodology to be reported at the conclusion of the project. However, an estimate of the cost of a proposed and demonstrated powertrain approach beyond the cost of baseline reference vehicle must include engine, aftertreatment, and OBD components. The baseline engine should be model year 2009 multi-valve, port-fuel injected, equipped with variable valve timing, operating stoichiometric on regular fuel with a 3-way catalyst. The additional cost, demonstrated by the end of the project, must be justified along with a clear path or strategy to achieve the cost target incorporated into the proposal.

The following table summarizes the project deliverables for a proposed aftertreatment system:

AFTERTREATMENT REQUIREMENTS	**Performance Goals**	
Emissions Test Cycle	FTP or Equivalent	US06 or Equivalent
"Tailpipe" Emissions	EPA Tier 3	EPA Tier 3
Proposed Durability Testing Methodology	150K Mile Equivalent	150K Mile Equivalent
ON-BOARD DIAGNOSTICS (OBD) METRICS		
Proposed Component Methodology	2.5 X standard	
Proposed System Methodology	2.5 X standard	
Proposed Durability Testing Methodology	150K Mile Equivalent	
COST METRICS		
Cost relative to a Model Year 2010 PFI vehicle	Estimation of cost differential	

AOI 12 Non-responsive 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 Section I (C), Section III (C) and if they:

- Do not include Combustion related research, development, and demonstration activities;
- Do not include both engine-level and vehicle-level demonstrations;
- Do not have, as prime or partner, a vehicle, engine, or component OEM, where OEM is defined as having built and sold commercially at least 500 vehicles, engines, or components of a single type or function in the 12 months prior to this solicitation's closing date;
- Include approaches which do not meet the minimum vehicle efficiency goals;
- Propose fuels other than gasoline or gasoline blends up to E15, diesel or biodiesels up to B10.

AOI 12 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 12:

- Powertrain and vehicle test results confirming that project requirements are met.

AREA OF INTEREST 13: Dual-Fuel/Bi-Fuel Class 8 Vehicle Technologies

The objective of this AOI is to develop and demonstrate the most promising heavy-duty, truck technologies with a particular interest in Class 8 long-haul trucks utilizing dual fuels or alternative fuels to the point of suitability for commercial introduction. The technologies must achieve at least a 50% reduction in petroleum usage. Proposed concepts must include demonstration of the technology up through an on-road demonstration and a feasible market introduction plan that would enable the technology to be introduced within three years.

Dual-fuel and bi-fuel concepts are sought for heavy-duty,l vehicle technologies that (i) have the capability and suitability for retrofit into the existing fleet and/or incorporation into current production models, (ii) displace/reduce petroleum usage by at least 50%, (iii) enable use of existing emissions controls in standard configurations and capacities, (iv) meet all emissions and onboard diagnostic requirements. The application must include a plausible business plan that will allow recovery of costs through fuel savings over a reasonable period for the vocation (i.e., Class 8, long haul applications).

Proposed concepts must use commercially available and widely applied emission control devices and not depend on the use of non-standard emissions control devices or increased capacity of standard devices. Proposed concepts must not be aimed at platform integration of or implementation of commercially available bi-fuel systems, or for use in applications that substantially resemble commercially available systems;

AOI 13 Non-responsive Application Criteria:
Applications submitted under AOI 13 will be considered non-responsive to this FOA if they fail to meet any of the general compliance criteria established in Section I (C), Section III (C) and if they:

- Propose concepts aimed at platform integration of or implementation of commercially available bi-fuel systems,
- Propose concepts that substantially resemble commercially available systems;
- Propose concepts that do not use commercially available and widely applied emission control devices and depend on the use of non-standard emissions control devices or increased capacity of standard devices.
- Propose concepts aimed at technologies other than heavy duty vehicles.

AOI 13 Specific Deliverables:
Aside from the deliverables required in the Federal Assistance Reporting Requirements Checklist, there are no special deliverables for AOI 13.

EARLY MARKET COMMERCIALIZATION

AREA OF INTEREST 14: Early Market Commercialization Opportunities

One or more projects selected under this AOI may be collaboratively funded and managed by the U.S. Department of Energy and the U.S. Army. The objective of this AOI is to support the development, demonstration and commercialization of new or improved vehicle systems which increase the overall energy efficiency of vehicles, target reductions in petroleum consumption, and which can be developed for near-term market deployment/commercialization opportunities.

The overall energy efficiency of vehicles depends on the efficiency of all vehicle systems which consume, store, or transfer energy from one form to another. A vehicle's propulsion system efficiency directly affects the overall efficiency of a vehicle. An improved powertrain, for example, would consume less fuel for the same vehicle distance traveled or for the same work performed. Designs of many other non-powertrain vehicle systems also affect overall vehicle efficiency, either directly or indirectly.

Any new or significantly improved vehicle system or technology (including, but not limited to propulsion system architectures and subsystems) applied to at least a single vehicle type (including highway rated, non-highway and off-highway vehicles such as construction, agriculture, or military vehicles) is a candidate for this topic if it is expected to increase the overall energy efficiency and/or decrease the petroleum consumption of host vehicles. The host vehicle is the vehicle in which the technology is to be incorporated. Proposed new technologies may be newly developed technologies, new combinations of existing off-the-shelf technologies, or any combination.

Standard laboratory test cycles and measurement techniques will be the basis for evaluating the energy efficiency improvement due to the newly developed technology for this topic, where appropriate. Otherwise, estimates will be made using a combination of standard test cycle test results and/or good engineering judgment related to the improved efficiency, projected duty cycles, and their nationwide applicability and impact. Vehicles employing the new technologies must continue to meet or exceed all applicable safety, emission, and other existing vehicle requirements/standards.

Applications shall include:

- A plan for market entry of an innovative technology, or innovative combination of technologies into a market segment;
- A detailed analysis of the expected speed of adoption and time to market per vehicle type;

- Include a detailed analysis of the expected manufacturing cost and complexity per vehicle type;
- A detailed analysis of the expected energy saving potential per vehicle type;
- An analysis of host vehicles which demonstrates compliance with emissions, safety, or other existing vehicle requirements;
- Detailed plans for the development and demonstration of the efficient vehicle system(s) on at least a single vehicle type;
- Explain how widely the technology can ultimately apply across the domestic vehicle fleet segment(s) (all applicable vehicle types); and
- Explain how the technology can migrate to other vehicle types to achieve maximum benefit

AOI 14 Non-responsive Application Criteria:

Applications submitted under AOI 14 will be considered non-responsive to this FOA if they fail to meet any of the general compliance criteria established in Section I (C), Section III (C) and if they:

- Result in noncompliance of host vehicles with respect to emissions, safety, or other existing vehicle requirements;
- Do not represent market entry of an innovative technology, or innovative combination of technologies into a market segment;
- Do not include an analysis of the expected speed of adoption and time to market per vehicle type;
- Do not include an analysis of the expected manufacturing cost and complexity per vehicle type; and
- Do not include an analysis of the expected energy saving potential per vehicle type.

AOI 14 Specific Deliverables:

Aside from the deliverables required in the Federal Assistance Reporting Requirements Checklist, there are no special deliverables for AOI 14.

C. APPLICATIONS SPECIFICALLY NOT OF INTEREST

The following types of applications will be deemed nonresponsive and will not be reviewed or considered (See Section III.C and IV.D of the FOA for further details

Non-Responsive criteria applicable to ALL Areas of Interest.

- Applicant fails to address the compliance criteria outlined in Section III (C)
- The Full Application fails to comply with the content and form requirements in Section IV.D of the FOA; and
- The Applicant fails to successfully upload all required documents and clicked the "Submit" button in EERE Exchange by the deadline stated in the FOA.

Non-Responsive specific to each Areas of Interest.

Applications that fall outside the technical parameters specified in Section I.B of the FOA, including the 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:
  - Propose development of materials having less than 75% aluminum;
  - Do not include an automotive OEM, Tier 1 supplier, or major aluminum producer for identifying operational processing parameters and cost targets for the alloy;
  - Do not meet the following alloy and process development requirements;
    - Ultimate Tensile Strength in a finished, stamped component of greater than 600 MPa with greater than 8% elongation to failure;
    - Processing temperature of no greater than 225 °C; and
    - Cost of a finished, stamped component of no greater than $2 per pound of weight saved when compared to a comparable, baseline part.

- **AOI 2** - Applications submitted under AOI 2 will be considered nonresponsive if they:
  - Include vehicle light-weighting designs incorporating materials other than carbon fiber composites (excluding fasteners and adhesives);
  - Include weight reduction strategies which are not consistent with the requirements of Table 2 above;
  - Include an approach that is focused on single components or non-structural systems (such as suspension, braking, or interiors);
  - Include systems other than Light Duty on-road vehicles.
  - Do not include a Tier 1 automotive supplier or OEM as a partner for system definition, requirements, and performance validation and a supplier who manufactures structural carbon fiber composites for the automotive market.
  - Do not identify the types of models currently available and those to be developed and integrated during the project.
  - Do not include the following types of models for integration: single length/timescale models; multi-scale models/coupled models; and multi-physics

models that integrate structure/property/process relationships.
- Do not include a plan to achieve the modeling accuracies identified in Table 2, above, "Minimum Modeling Elements by Manufacturing Phase"
- Do not include the planned approach for integration of the models and that don't address planned integration techniques such as multi-scale modeling, integration of different types of models, and plans to link data from multiple sources.
- Do not include a plan to address the following key challenges in ICME:
    - Identify required level of verification and validation;
    - Identify minimum number of experiments needed to validate models[10]; and
    - Integrate the impact of fiber architecture, design, and conditions of processing for predictive capabilities not only for structure/property relationships but also for process/property relationships.
- Do not optimize function in design of the subsystem (of either the body-in-white or chassis) used for validation of the models. Specifically applications that utilize a materials substitution approach;
- Do not provide a plan to disseminate results through infrastructure identified by NIST.
- Do not include at least one material supplier with expertise in the production of structural polymer composites.

- **AOI 3** - There are no additional nonresponsive criteria for AOI 3.
- **AOI 4** - There are no additional nonresponsive criteria for AOI 4.
- **AOI 5** - There are no additional nonresponsive criteria for AOI 5.
- **AOI 6** - There are no additional nonresponsive criteria for AOI 6.

- **AOI 7** - Applications submitted under AOI 7 will be considered non-responsive to this FOA if they:
    - Contain strategies that do not include the separate two phases of work as identified above;
    - Contain strategies that are not compliant with Federal Motor Vehicle Safety Standards (FMVSS);
    - Include solutions that have significant potential to negatively impact the environment in terms of Greenhouse gas (GHG) emissions;
    - Do not address at least one of the specific technical strategies:
        - Energy Load Reduction and Energy Management:
        - Advanced HVAC Technologies
        - Cabin Preconditioning

[10] Jitesh H. Panchal, Surya R. Kalidindi, David L. McDowell, Computer-Aided Design 45 (2013) 4–25

- **AOI 8 -** Applications submitted under AOI 8 will be considered non-responsive to this FOA if they:
    - Do not include a Tier 1 automotive supplier or OEM as a partner for identifying operational parameters, cost targets, prototype design, demonstration, and validation.
    - Do not address all four (4) technical areas of the scope will be considered non responsive. These four areas are:
        - Catalyst development and performance demonstration;
        - Evaluation of existing Computational Models for catalyst composition and performance;
        - Prototype aftertreatment system development, demonstration and evaluation;
        - Cost model.

- **AOI 9** - Applications submitted under AOI 9 will be considered non-responsive to this FOA if they:
    - Propose concepts that are aimed at platform integration or implementation of commercially available bi-fuel systems, or applications that substantially resemble commercially available systems.
    - Propose concepts that do not use commercially available and widely applied emission control devices and are dependent on the use of of non-standard emissions control devices or increased capacity of standard devices;
    - Propose concepts that do not meet all emissions and onboard diagnostic requirements;
    - Propose concepts that are not able to switch between operation on 100% gasoline or diesel, 100% other fuel, and a combination of both without having to refuel;
    - Propose technologies that are not able to be retrofitted into existing on-road light-duty vehicles or incorporated into current production models and demonstrate at least a 50% petroleum reduction/displacement;
    - Do not show the cost of retrofitting or additional production costs to be recoverable by fuel savings within 36 months of typical vehicle operation.
    - Propose concepts that do not improve the thermal efficiency of the engine beyond the baseline fuel (gasoline or diesel) through a combined use of both fuels.

- **AOI 10** - Applications submitted under AOI 10 will be considered non-responsive to this FOA if they:
    - Propose concepts that do not use commerically available and widely applied emission control devices;
    - Propose concepts that depend on the use of non-standard emissions control devices or increased capacity of standard devices;
    - Propose concepts that do not meet all emissions and onboard diagnostic requirements;
    - Propose technologies that can not be retrofitted into existing on-road vehicles or incorporated into current production models and demonstrate at least a 25% reduction in petroleum consumed;
    - Do not show the cost of retrofitting or additional production costs to be recoverable by fuel savings within 36 months of typical vehicle operation.

- **AOI 11 (Subtopic A)** - Applications submitted under AOI 11 for lubricant development (subtopic A) shall be considered nonresponsive to this FOA if they include:
    - Formulations that aren't expected to show a fuel efficiency improvement within 4000 miles or 50 hours of engine operation;
    - Formulations exclusively for use in off-road (rail, marine, construction, small engines) or motorcycle applications;
    - Formulations exclusively for alternative fuel applications;
    -
    - Formulations that are not compatible with existing emissions control systems;
    - Formulations exclusively for automatic transmissions;
    - Projects focused solely on demonstration of a technology;
    - Projects focused mainly on production methods for lubricants;
    - Projects focused on idle reduction and aerodynamic drag reduction; and
    - Single applications that address both topic areas.

- **AOI 11 (Subtopic B)** - Applications submitted under AOI 11 for lubricant development (subtopic B) shall be considered nonresponsive to this FOA if they include:
    - Technology that is proprietary or requires a license to operate;
    - Technology that is not stand-alone or requires proprietary equipment as a compliment to give full results; and/or
    - Items that are hazardous and require special precautions for operation, e.g., radioactive materials are used as a tracer element; and
    - Single applications that address both topic areas.

- **AOI 12** - Applications submitted under AOI 12 will be considered non-responsive to this FOA if they:
  - Do not include Combustion related research, development, and demonstration activities;
  - Do not include both engine-level and vehicle-level demonstrations;
  - Do not have, as prime or partner, a vehicle, engine, or component OEM, where OEM is defined as having built and sold commercially at least 500 vehicles, engines, or components of a single type or function in the 12 months prior to this solicitation's closing date;
  - Include approaches which do not meet the minimum vehicle efficiency goals;
  - Propose fuels other than gasoline or gasoline blends up to E15, diesel or biodiesels up to B10.

- **AOI 13** - Applications submitted under AOI 13 will be considered nonresponsive if they:
  - Propose concepts aimed at platform integration of or implementation of commercially available bi-fuel systems;
  - Propose concepts that substantially resemble commercially available systems;
  - Propose concepts that do not use commercially available and widely applied emission control devices and depend on the use of non-standard emissions control devices or increased capacity of standard devices.
  - Propose concepts aimed at technologies other than heavy duty vehicles.

- **AOI 14** - Applications submitted under AOI 14 will be considered nonresponsive if they:
  - Result in noncompliance of host vehicles with respect to emissions, safety, or other existing vehicle requirements;
  - Do not represent market entry of an innovative technology, or innovative combination of technologies into a market segment;
  - Do not include an analysis of the expected speed of adoption and time to market per vehicle type;
  - Do not include an analysis of the expected manufacturing cost and complexity per vehicle type; and
  - Do not include an analysis of the expected energy saving potential per vehicle type.

II. AWARD INFORMATION

A. AWARD OVERVIEW

1. ESTIMATED FUNDING

EERE expects to make approximately $51.4 million of Federal funding available for new awards under this FOA subject to the availability of appropriated funds.

Certain AOIs may result in projects that may be funded and managed collaboratively with TARDEC. A separate agreement with DoD will not be required for those AOIs.

EERE anticipates making approximately 20-40 awards under this FOA.

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:

*One or more projects awarded may be managed collaboratively with U.S. Army Tank Automotive Research Development and Engineering Center (TARDEC)

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
Critical Technologies to Meet the EV Everywhere Grand Challenge					
1	Development of Low-cost, High Strength Automotive Aluminum Sheet	$2.5M	$2.5M	$2.5M	$2.5M
2	Integrated Computation Materials Engineering (ICME) Development of Carbon Fiber Composites for Lightweight Vehicles	$6M	$6M	$6M	$6M
3*	Beyond Lithium Ion Technologies	$2M	$0.5M	$1.25M	$8M
4*	Commercialization of Power Electronics for Electric Traction Drives Using Wide Band Gap (WBG) Semiconductors	$2M	$1M	$1.5M	$3M
5*	Tire Efficiency	$1M	$0.5M	$0.9M	$1.9M
6*	Multi-Speed Gearbox for Commercial Delivery	$3M	$1M	$2M	$3M

	Medium Duty Plug-In Electric Drive Vehicles				
7*	Advanced Climate Control Auxiliary Load Reduction	$3M	$1M	$2M	$5M
Technology Development to Reduce Petroleum Consumption Through Fuel Efficiency Improvements in Passenger and Commercial Vehicles					
8	Development of High Performance Low Temperature Catalysts for Exhaust Aftertreatment	$2M	$0.5M	$1.5M	$3M
9	Dual-Fuel Technologies	$1M	$0.5M	$0.75M	$1M
10	Fuel Property Impacts on Combustion	$1M	$0.5M	$0.75M	$1M
11*	Powertrain Friction and Wear Reduction	$2M	$1M	$1M	$2M
12	Advanced Technology Powertrains For Light-Duty Vehicles Phase 2 (ATP-2)	$10M	$5M	$7.5M	$10M
13	Dual-Fuel/Bi-Fuel Class 8 Vehicle Technologies	$2M	$1M	$1M	$2M
Early Market Commercialization					
14*	Early Market Commercialization Opportunities	$3M	$1M	$1.5M	$3M

EERE may establish more than one budget period for each award and fund only the initial budget period(s). Funding for all budget periods, including the initial budget period, is not guaranteed. 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 DOE.

2. Period of Performance

EERE anticipates making awards that will have durations up to sixty (60) months in length. Project continuation will be contingent upon satisfactory performance and go/no-go decision review. At the go/no-go decision points, EERE will evaluate project performance, project schedule adherence, meeting milestone objectives, compliance with reporting requirements, and overall contribution to the program goals and objectives. As a result of this evaluation, EERE will make a determination to continue the project, re-direct the project, or discontinue funding the project. Only those projects demonstrating a high probability of successfully meeting the program targets will be continued. The table below describes the anticipated number of awards and performance period for each AOI.

*One or more projects awarded may be managed collaboratively with U.S. Army Tank Automotive Research Development and Engineering Center (TARDEC)

Area of Interest Number	Area of Interest	Anticipated Number of Awards	Period of Performance
Critical Technologies to Meet the EV Everywhere Grand Challenge			
1	Development of Low-cost, High Strength Automotive Aluminum Sheet	1	Up To 4 Years
2	Integrated Computation Materials Engineering (ICME) Development of Carbon Fiber Composites for Lightweight Vehicles	1	Up To 4 Years
3*	Beyond Lithium Ion Technologies	4-8	Up To 3 Years
4*	Commercialization of Power Electronics for Electric Traction Drives Using Wide Band Gap (WBG) Semiconductors	1-2	Up To 3 Years
5*	Tire Efficiency	1-2	Up To 3 Years
6*	Multi-Speed Gearbox for Commercial Delivery Medium Duty Plug-In Electric Drive Vehicles	1-2	Up To 3 Years
7*	Advanced Climate Control Auxiliary Load Reduction	1-2	Up To 3 Years
Technology Development to Reduce Petroleum Consumption Through Fuel Efficiency Improvements in Passenger and Commercial Vehicles			
8	Development of High Performance Low Temperature Catalysts for Exhaust Aftertreatment	1-2	Up To 5 Years
9	Dual-Fuel Technologies	1-2	Up To 3 Years
10	Fuel Property Impacts on Combustion	1-2	Up To 3 Years
11*	Powertrain Friction and Wear Reduction	1-2	Up To 3 Years
12	Advanced Technology Powertrains For Light-Duty Vehicles Phase 2 (ATP-2)	1-2	Up To 5 Years
13	Dual-Fuel/Bi-Fuel Class 8 Vehicle Technologies	1-2	Up to 2 Years
Early Market Commercialization			
14*	Early Market Commercialization Opportunities	1-2	Up To 3 Years

3. NEW APPLICATIONS ONLY

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

B. EERE FUNDING AGREEMENTS

Through Cooperative Agreements and other similar agreements, EERE provides financial and other support to projects that have the potential to realize the FOA objectives. EERE does not use such agreements to acquire property or services for the direct benefit or use of the United States Government. **It is EERE's intent to award cooperative agreements under this FOA as applicable.**

1. COOPERATIVE AGREEMENTS

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

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

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

2. FUNDING AGREEMENTS WITH FFRDCS, GOGOS, FEDERAL AGENCIES AND FEDERAL INSTRUMENTALITIES

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

3. GRANTS

Although EERE has the authority to provide financial support to Prime Recipients through Grants, EERE generally does not fund projects through Grants. EERE may fund a limited number of projects through Grants, as appropriate.

4. TECHNOLOGY INVESTMENT AGREEMENTS

In rare cases, and if determined appropriate, EERE will consider awarding a Technology Investment Agreement (TIA) to a non-FFRDC applicant. TIAs, governed by 10 CFR Part 603, are assistance instruments used to increase the involvement of commercial entities in the

Department's research, development, and demonstration programs. A TIA may be either a type of cooperative agreement or an assistance transaction other than a cooperative agreement, depending on the intellectual property provisions. In both cases, TIAs are not necessarily subject to all of the requirements of 10 CFR Part 600.

In a TIA, EERE may modify the standard Government terms and conditions, including but not limited to:

- Intellectual Property Provisions: EERE may negotiate special arrangements with Recipients to avoid the encumbrance of existing intellectual property rights or to facilitate the commercial deployment of inventions conceived or first actually reduced to practice under the EERE funding agreement.
- Accounting Provisions: EERE may authorize the use of generally accepted accounting principles (GAAP) where Recipients do not have accounting systems that comply with Government recordkeeping and reporting requirements.

EERE will be more amenable to awarding a TIA in support of an application from a consortium or a team arrangement that includes cost sharing with the private sector. Such a consortium or teaming arrangement could include a DOE/NNSA FFRDC, other Federal agency, or other Federal agency FFRDC. If the DOE/NNSA FFRDC is a part of the consortium or teaming arrangement, the value of, and funding for the DOE/NNSA FFRDC portion of the work will be authorized and funded under the DOE field work authorization system and performed under the laboratory's Management and Operating contract. Funding for another Federal agency or its FFRDC would be through an interagency agreement under the Economy Act or other statutory authority. Other appropriate contractual accommodations, such as those involving intellectual property, may be made through a "funds in" agreement to facilitate the FFRDCs participation in the consortium or teaming arrangement. If a TIA is awarded, certain types of information described in 10 CFR 603.420(b) are exempt from disclosure under the Freedom of Information Act for five years after DOE receives the information.

An applicant may request a TIA if it believes that using a TIA could benefit the RD&D objectives of the program (see section 603.225) and can document these benefits. If an applicant is seeking to negotiate a Technology Investment Agreement, the applicant must include an explicit request in its Full Application. After an applicant is selected for award, the Contracting Officer will determine if awarding a TIA would benefit the RD&D objectives of the program in ways that likely would not happen if another type of assistance agreement (e.g., cooperative agreement subject to the requirements of 10 CFR Part 600). The Contracting Officer will use the criteria in 10 CFR 603, Subpart B, to make this determination.

III. ELIGIBILITY INFORMATION

A. ELIGIBLE APPLICANTS

1. PERFORMANCE OF WORK IN THE UNITED STATES

EERE requires all work (100% of all direct labor, including contract/subrecipient labor) under EERE financial assistance agreements to be performed in the United States. This requirement does not apply to the purchase of supplies and equipment; however, the Prime Recipient should make every effort to purchase domestically produced supplies and equipment. If a recipient fails to comply with the Performance of Work in the United States requirement, the EERE Contracting Officer may deny reimbursement for the work conducted outside the United States and such costs may not be recognized as allowable cost share.

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

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

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

2. INDIVIDUALS

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

3. DOMESTIC ENTITIES

For-profit entities, educational institutions, and nonprofits[11] 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 Sub-recipient.

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

The National Energy Technology Laboratory (NETL) and U.S. Army Tank Automotive Research Development and Engineering Center (TARDEC) are ineligible to participate as a prime applicant or as a team member/sub-recipient on another entities application because of each entities' role in developing the requirements for this announcement.

DOE/NNSA Federally Funded Research and Development Centers (FFRDCs) and DOE Government-Owned, Government-Operated laboratories (GOGOs) are eligible to apply for funding as a Prime Recipient or Sub-recipient according to the table below:

*One or more projects awarded may be managed collaboratively with U.S. Army Tank Automotive Research Development and Engineering Center (TARDEC)

Area of Interest Number	Area of Interest	DOE/NNSA Federally Funded Research and Development Centers (FFRDCs) and DOE Government-Owned, Government-Operated laboratories (GOGOs) are eligible to apply as a Prime Recipient	DOE/NNSA Federally Funded Research and Development Centers (FFRDCs) and DOE Government-Owned, Government-Operated laboratories (GOGOs) are eligible to apply as a Sub Recipient
Critical Technologies to Meet the EV Everywhere Grand Challenge			
1	Development of Low-cost, High Strength Automotive Aluminum Sheet	Yes	Yes
2	Integrated Computation Materials Engineering (ICME) Development of Carbon Fiber Composites for Lightweight Vehicles	Yes	Yes
3*	Beyond Lithium Ion Technologies	Yes	Yes
4*	Commercialization of Power Electronics for Electric Traction Drives Using Wide Band Gap (WBG)	Yes	Yes

[11] 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.

	Semiconductors		
5*	Tire Efficiency	Yes	Yes
6*	Multi-Speed Gearbox for Commercial Delivery Medium Duty Plug-In Electric Drive Vehicles	Yes	Yes
7*	Advanced Climate Control Auxiliary Load Reduction	Yes	Yes
Technology Development to Reduce Petroleum Consumption Through Fuel Efficiency Improvements in Passenger and Commercial Vehicles			
8	Development of High Performance Low Temperature Catalysts for Exhaust Aftertreatment	Yes	Yes
9	Dual-Fuel Technologies	Yes	Yes
10	Fuel Property Impacts on Combustion	Yes	Yes
11*	Powertrain Friction and Wear Reduction	Yes	Yes
12	Advanced Technology Powertrains For Light-Duty Vehicles Phase 2 (ATP-2)	No	Yes
13	Dual-Fuel/Bi-Fuel Class 8 Vehicle Technologies	Yes	Yes
Early Market Commercialization			
14*	Early Market Commercialization Opportunities	Yes	Yes

Non-DOE/NNSA FFRDCs and non-DOE GOGOs are eligible to apply for funding as a Prime Recipient or Sub-recipient.

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

4. FOREIGN ENTITIES

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

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

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

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

In the waiver request, the Applicant must demonstrate to the satisfaction of EERE that it would further the purposes of this FOA and is otherwise in the interests of EERE to have a foreign entity serve as the Prime Recipient. The Contracting Officer may require additional information before considering the waiver request. Save the waiver request(s) in a single PDF file using the following convention for the title: "ControlNumber_LeadOrganization_Waiver".

A foreign entity may receive funding as a Sub-recipient.

5. INCORPORATED CONSORTIA

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

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

6. UNINCORPORATED CONSORTIA

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

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

- Management structure;
- Method of making payments to consortium members;
- Means of ensuring and overseeing members' efforts on the project;
- Provisions for members' cost sharing contributions; and

- Provisions for ownership and rights in intellectual property developed previously or under the agreement.

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.

For all prime applicants who are a Federal Laboratory, FFRDC, or Educational Institution submitting to AOI 3, "Beyond Lithium Ion Technologies," a cost share waiver was obtained and applies when the applicant is selected for award as the prime applicant. When the prime applicant receives a cost share waiver, any project partners other than National Laboratories, FFRDCs, and Universities shall provide at least 20 percent cost share based on the total value of the work they will contribute.

Under AOI 3, 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.

There is no cost share waiver applicable to any other area of interest. The minimum cost share required for each AOI for different types of Applicants is as follows:

*One or more projects awarded may be managed collaboratively with U.S. Army Tank Automotive Research Development and Engineering Center (TARDEC)

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
Critical Technologies to Meet the EV Everywhere Grand Challenge			
1	Development of Low-cost, High Strength Automotive Aluminum Sheet	50%	50%
2	Integrated Computation Materials Engineering (ICME) Development of Carbon Fiber Composites for Lightweight Vehicles	30%	30%
3*	Beyond Lithium Ion Technologies	20%	0%
4*	Commercialization of Power	50%	50%

	Electronics for Electric Traction Drives Using Wide Band Gap (WBG) Semiconductors		
5*	Tire Efficiency	20%	20%
6*	Multi-Speed Gearbox for Commercial Delivery Medium Duty Plug-In Electric Drive Vehicles	20%	20%
7*	Advanced Climate Control Auxiliary Load Reduction	20%	20%
Technology Development to Reduce Petroleum Consumption Through Fuel Efficiency Improvements in Passenger and Commercial Vehicles			
8	Development of High Performance Low Temperature Catalysts for Exhaust Aftertreatment	20%	20%
9	Dual-Fuel Technologies	20%	20%
10	Fuel Property Impacts on Combustion	20%	20%
11*	Powertrain Friction and Wear Reduction	20%	20%
12	Advanced Technology Powertrains For Light-Duty Vehicles Phase 2 (ATP-2)	60%	60%
13	Dual-Fuel/Bi-Fuel Class 8 Vehicle Technologies	50%	50%
Early Market Commercialization			
14*	Early Market Commercialization Opportunities	50%	50%

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

1. LEGAL RESPONSIBILITY

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

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

2. COST SHARE ALLOCATION

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

3. COST SHARE TYPES AND ALLOWABILITY

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

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

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

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

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

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

Cost share contributions must be specified in the project budget, verifiable from the Prime Recipient's records, and necessary and reasonable for proper and efficient accomplishment of the project. As all sources of cost share are considered part of total project cost, the cost share dollars will be scrutinized under the same Federal regulations as Federal dollars to the project.

Every cost share contribution must be reviewed and approved in advance by the Contracting Officer and incorporated into the project budget before the expenditures are incurred.

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

4. COST SHARE CONTRIBUTIONS BY FFRDCS AND GOGOS

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

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.

6. COST SHARE PAYMENT

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

EERE requires Prime Recipients to contribute the cost share amount incrementally over the life of the award. Specifically, the Prime Recipient's cost share for each billing period must always reflect the overall cost share ratio negotiated by the parties (i.e., the total amount of cost sharing on each invoice when considered cumulatively with previous invoices must reflect, at a minimum, the cost sharing percentage negotiated).

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

C. COMPLIANCE CRITERIA

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

1. COMPLIANCE CRITERIA

i. Concept Papers

Concept Papers are deemed compliant if:

- The Applicant successfully uploaded all required documents and clicked the "Submit" button in EERE Exchange by the deadline stated in this FOA.

ii. Full Applications

Full Applications are deemed compliant if:

- The Applicant submitted a compliant and responsive Concept Paper;
- The Full Application complies with the content and form requirements in Section IV.D of the FOA;
- The Full Application complies with the AOI specific responsiveness criteria set forth in Section I.C; and
- The Applicant successfully uploaded all required documents and clicked the "Submit" button in EERE Exchange by the deadline stated in the FOA.

iii. Replies to Reviewer Comments

Replies to Reviewer Comments are deemed compliant if:

- The Reply to Reviewer Comments complies with the content and form requirements in Section IV.F of the FOA; and
- The Applicant successfully uploaded all required documents to EERE Exchange by the deadline stated in the FOA.

D. RESPONSIVENESS CRITERIA

EERE performs a preliminary technical review of Full Applications. Any "Applications Specifically Not of Interest," as described in Section I.C and additionally criteria outlined in Section III (C), and Section IV (D) of the FOA, are deemed nonresponsive and are not reviewed or considered for a technical merit review of the full application..

E. OTHER ELIGIBILITY REQUIREMENTS

1. REQUIREMENTS FOR DOE/NNSA FEDERALLY FUNDED RESEARCH AND DEVELOPMENT CENTERS (FFRDC) LISTED AS THE APPLICANT

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

The following wording is acceptable for the authorization:

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

2. REQUIREMENTS FOR DOE/NNSA AND NON-DOE/NNSA FEDERALLY FUNDED RESEARCH AND DEVELOPMENT CENTERS INCLUDED AS A SUB-RECIPIENT

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

i. Authorization for non-DOE/NNSA FFRDCs

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

ii. Authorization for DOE/NNSA FFRDCs

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

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

iii. Value/Funding

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

iv. Cost Share

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

v. Responsibility

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

F. LIMITATION ON NUMBER OF CONCEPT PAPERS AND FULL APPLICATIONS ELIGIBLE FOR REVIEW

Applicants may submit more than one Concept Paper and Full Application to this FOA, provided that each Concept Paper and Full Application describes a unique, scientifically distinct 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.

G. 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.

IV. APPLICATION AND SUBMISSION INFORMATION

A. APPLICATION PROCESS

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

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

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

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

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

B. Application Forms

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

Note: The maximum file size that can be uploaded to the EERE Exchange website is 10MB. Files in excess of 10MB cannot be uploaded, and hence cannot be submitted for review. If a file exceeds 10MB but is still within the maximum page limit specified in the FOA it must be broken into parts and denoted to that effect. For example:
ControlNumber_LeadOrganization_Project_Part_1
ControlNumber_LeadOrganization_Project_Part_2, etc.

C. Content and Form of the Concept Paper

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

Each Concept Paper must be limited to a single concept or technology. Unrelated concepts and technologies should not be consolidated into a single Concept Paper.

1. CONCEPT PAPER CONTENT REQUIREMENTS

The Concept Paper must conform to the following content requirements:

SECTION	PAGE LIMIT	DESCRIPTION
Technology Description	2 pages maximum	Applicants are required to describe succinctly: • Must include the Area of Interest to which the organization is submitting the concept paper • The proposed technology, including its basic operating principles and how it is unique and innovative; • The proposed technology's target level of performance (Applicants should provide technical data or other support to show how the proposed target could be met); • The current state-of-the-art in the relevant field and application, including key shortcomings, limitations, and challenges; • How the proposed technology will overcome the shortcomings, limitations, and challenges in the relevant field and application; • The potential impact that the proposed project would have on the relevant field and application; • The key technical risks/issues associated with the proposed technology development plan; and • The impact that EERE funding would have on the proposed project.
Addendum	1 pages maximum	Applicants may provide graphs, charts, or other data to supplement their Technology Description. Applicants are required to describe succinctly the qualifications, experience, and capabilities of the proposed Project Team, including: • Whether the Principal Investigator (PI) and Project Team have the skill and expertise needed to successfully execute the project plan; • Whether the Applicant has prior experience which demonstrates an ability to perform tasks of similar risk and complexity; • Whether the Applicant has worked together with its teaming partners on prior projects or programs; and • Whether the Applicant has adequate access to equipment and facilities necessary to accomplish the effort and/or clearly explain how it intends to obtain access to the necessary equipment and facilities.

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

EERE makes an independent assessment of each Concept Paper based on the criteria in Section V.A.1 of the FOA. EERE will encourage a subset of Applicants to submit Full Applications. Other

Applicants will be discouraged from submitting a Full Application. An applicant who receives a "discouraged" notification may still submit a Full Application. EERE will review all compliant and responsive Full Applications. However, by discouraging the submission of a Full Application, EERE intends to convey its lack of programmatic interest in the proposed project in an effort to save the Applicant the time and expense of preparing an application that is unlikely to be selected for award negotiations.

In order to provide Applicants with feedback on their Concept Papers, EERE will include general comments provided from independent reviewers on an Applicant's Concept Paper in the encourage/discourage notification sent to Applicants at the close of that phase.

D. CONTENT AND FORM OF THE FULL APPLICATION

Applicants must submit a Full Application by the specified due date to be considered for funding under this FOA. Applicants must complete the following application forms found on the EERE Exchange website at https://eere-Exchange.energy.gov/, in accordance with the instructions.

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

All Full Application documents must be marked with the Control Number issued to the Applicant.

"Applicants will receive a control number upon submission of their Concept Paper, and should include that control number in the file name of their Full Application submission (i.e., *Control number_Applicant Name_Full Application*)."

1. FULL APPLICATION CONTENT REQUIREMENTS

Each Full Application should be limited to a single concept or technology. Unrelated concepts and technologies should not be consolidated in a single Full Application.
Full Applications must conform to the following requirements:

SUBMISSION	COMPONENTS	FILE NAME (IF NECESSARY)
Full Application (PDF, unless stated otherwise)	Technical Volume (See Chart in Section IV.D.2)	ControlNumber_LeadOrganization_ TechnicalVolume
	SF-424 (no page limit)	ControlNumber_LeadOrganization_ App424
	Budget Justification (EERE 159) (no page limit, Microsoft Excel format. Applicants must use the template available in EERE Exchange)	ControlNumber_LeadOrganization_ Budget_Justification

	Summary for Public Release (1 page max)	ControlNumber_LeadOrganization_ Summary
	Summary Slide (1 page limit, Microsoft PowerPoint format)	ControlNumber_LeadOrganization_ Slide
	Sub-award Budget Justification (EERE 159);	ControlNumber_LeadOrganization_ Sub-awardee_Budget_Justification
	Budget for Federally Funded Research and Development Center Contractor File, (if applicable)	ControlNumber_LeadOrganization_ FWP
	Authorization from cognizant Contracting Officer for FFRDC, if applicable	ControlNumber_LeadOrganization_ FFRDCAuth
	SF-LLL Disclosure of Lobbying Activities	ControlNumber_LeadOrganization_ SF-LLL
	Foreign Entity and Performance of Work in the United States waiver requests (if applicable)	ControlNumber_LeadOrganization_ Waiver
	U.S. Manufacturing Plans	ControlNumber_LeadOrganization_ USMP
	Environmental Questionnaire NETL Form 451_1-1-3	Control Number_LeadOrganization_EQ
	Letters of Commitment	ControlNumber_LeadOrganization_ LOC
	SF-424A Budget Summary	ControlNumber_LeadOrganization_ SF424A

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

ControlNumber_LeadOrganization_Project_Part_1
ControlNumber_LeadOrganization_Project_Part_2, etc.

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

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

2. TECHNICAL VOLUME

The Technical Volume must be submitted in Adobe PDF format. The Technical Volume must conform to the following content and form requirements, including maximum page lengths. If Applicants exceed the maximum page lengths indicated below, EERE will review only the authorized number of pages and disregard any additional pages. This volume must address the Merit Review Criteria as discussed in Section V.A.2 of the FOA. Save the Technical Volume in a single PDF file using the following convention for the title: "ControlNumber_LeadOrganization_TechnicalVolume".

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

The Technical Volume to the Full Application may not be more than thirty-five (35) pages, including the cover page, table of contents, and all citations, charts, graphs, maps, photos, or other graphics, and must include all of the information in the table below. The applicant should consider the weighting of each of the evaluation criteria (see Section V.A.2 of the FOA) when preparing the Technical Volume.

SECTION/PAGE LIMIT	DESCRIPTION
Cover Page	The cover page should include the project title, the specific FOA AOI being addressed, both the technical and business points of contact, names of all team member organizations, and any statements regarding confidentiality.
Project Overview (This section should constitute approximately 10% of the Technical Volume)	The Project Overview should contain the following information: • Background: The Applicant should discuss the background of their organization, including the history, successes, and current research and development status (i.e., the technical baseline) relevant to the technical topic being addressed in the Full Application. • Project Goal: The Applicant should explicitly identify the targeted improvements to the baseline technology and the critical success factors in achieving that goal. • DOE Impact: The Applicant should discuss the impact that DOE funding would have on the proposed project. Applicants should specifically explain how DOE funding, relative to prior, current, or anticipated funding from other public and private sources, is necessary to achieve the project objectives.
Technical Description, Innovation, and Impact (This section should constitute approximately 25% of the Technical Volume)	The Technical Description should contain the following information: • Relevance and Outcomes: The Applicant should provide a detailed description of the technology, including the scientific and other principles and objectives that will be pursued during the project. This section should describe the relevance of the proposed project to the goals and objectives of the FOA, including the potential to meet specific DOE technical targets or other relevant performance targets. The Applicant should clearly specify the expected outcomes of the project. • Feasibility: The Applicant should demonstrate the technical feasibility of the proposed technology and capability of achieving the anticipated performance targets, including a description of previous work done and prior results. • Innovation and Impacts: The Applicant should describe the current state of the art in the applicable field, the specific innovation of the proposed technology, the advantages of proposed technology over current and emerging technologies,

	and the overall impact on advancing the state of the art/technical baseline if the project is successful.
Workplan (This section should constitute approximately 50% of the Technical Volume)	The Workplan should contain the following information: • Project Objectives: The Applicant should provide a clear and concise (high-level) statement of the goals and objectives of the project as well as the expected outcomes. • Technical Scope Summary: The Applicant should provide a summary description of the overall work scope and approach to achieve the objective(s). The overall work scope is to be divided by performance periods that are separated by discrete, approximately annual decision points (see below for more information on go/no-go decision points). The applicant should describe the specific expected end result of each performance period. • Work Breakdown Structure (WBS) and Task Descriptions: The Workplan should fully describe the work to be accomplished and how the applicant will achieve the milestones, will accomplish the final project goal(s), and will produce all deliverables. The Workplan is to be structured with a hierarchy of performance period (approximately annual), task and subtasks, which is typical of a standard work breakdown structure (WBS) for any project. The Workplan shall contain a concise detailed description of the specific activities to be conducted over the life of the project. "Detailed" is defined as a full explanation and disclosure of the project being proposed (i.e., a statement such as "we will then complete a proprietary process" is unacceptable). It is the Applicant's responsibility to prepare an adequately detailed task plan to describe the proposed project and the plan for addressing the objectives of this FOA. To this end each task and subtask is to have a unique number and title and an indication of the duration of the task or subtask in months. Each task and subtask is to have a task summary that describes the objectives, what work is to be accomplished, and relationship to project deliverables or expected results. Appropriate milestones should be incorporated into the task and subtask structure. Each task and subtask is to have a technical details section, as appropriate, to discuss how the work will be done, anticipated problems or uncertainties, and any further clarification, such as why a specific approach is being taken. An example Work Breakdown Structure is provided below. • Milestones: The Applicant should provide appropriate milestones throughout the project to demonstrate success, where success is defined as technical achievement rather than simply completing a task. To ensure that milestones are relevant, Applicants should follow the SMART rule of thumb, which is that all milestones should be **S**pecific, **M**easurable, **A**chievable, **R**elevant, and **T**imely. Unless otherwise specified in

	the FOA, the minimum requirement is that each project must have at least one milestone per quarter for the duration of the project (depending on the project, more milestones may be necessary to comprehensively demonstrate progress). The Applicant should also provide the means by which the milestone will be verified. In addition to describing milestones in the Workplan text and including them in the schedule, the Applicant is required to complete the Milestone Summary Table shown below. • Go/No-Go Decision Points: The Applicant should provide project-wide go/no-go decision points at appropriate points in the Workplan. A go/no-go decision point is a risk management tool and a project management best practice to ensure that, for the current phase or period of performance, technical success is definitively achieved and potential for success in future phases or periods of performance is evaluated, prior to actually beginning the execution of future phases. Unless otherwise specified in the FOA, the minimum requirement is that each project must have at least one project-wide go/no-go decision point for each year (12-month period) of the project. The Applicant should also provide the specific technical criteria to be used to make the go/no-go decision. In addition to describing the go/no-go decision points in the Workplan text and including them in the schedule, the Applicant is required to complete the Milestone Summary Table shown below, which must include go/no-go decision points and their method of verification. • Project Schedule (Gantt Chart or similar): The Applicant should provide a detailed schedule for the entire project, including task and subtask durations, milestones, and go/no-go decision points. • Project Management: The Applicant should discuss the team's proposed management plan, including the following: o The overall approach to and organization for managing the work o The roles of each Project Team member o Any critical handoffs/interdependencies among Project Team members o The technical and management aspects of the management plan, including systems and practices, such as financial and project management practices o The approach to project risk management o A description of how project changes will be handled o If applicable, the approach to Quality Assurance/Control o How communications will be maintained among Project Team members • Market Transformation/Commercialization Plan: The Applicant should provide a market transformation/commercialization plan, including the following: o Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including a mitigation plan o Identification of a product development and/or service plan, commercialization timeline, financing, product

		marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, U.S. manufacturing plan etc., and product distribution.

Example Milestone Summary Table and Work Breakdown Structure are provided on following two pages, after which the Technical Volume requirements will continue.

Milestone Summary Table							
Recipient Name:							
Project Title:							
Task Number	Task Title or Subtask Title (If Applicable)	Milestone Type (Milestone or Go/No-Go Decision Point)	Milestone Number* (Go/No-Go Decision Point Number)	Milestone Description (Go/No-Go Decision Criteria)	Milestone Verification Process (What, How, Who, Where)	Anticipated Date (Months from Start of the Project)	Anticipated Quarter (Quarters from Start of the Project)

*Milestone numbering convention should align with Task and Subtask numbers, as appropriate. For example, M1.1, M3.2, etc.

Note 1: It is required that each project have at least one milestone per quarter for the entire project duration. it is not necessary that each task have one milestone per quarter.

Note 2: It is required that each project have at least one project-wide go/no-go decision point each year. If a decision point is not specific to a particular task, then you may leave the task information blank for those decision points.

Note 3: All milestones should follow the SMART rule of thumb: Specific, Measureable, Achievable, Relevant, and Timely

Example Work Breakdown Structure

Technical Summary: Provide a high-level overview of the final result of this project. Explain the final objective, outcome, milestone and/or deliverable that are to be produced and the rationale for why the applicant has organized the tasks in the way they have.

Technical Details (Optional): Describe the relevant management, engineering, design, process, scientific or other principles and aspects of the project that warrant discussion.

Task 1: Distinctive Title, Date range of the task in months (M1-M4)

Task Summary: Task summaries shall explicitly describe what work is to be accomplished, identify the project objectives/outcomes being addresses and provide a concise statement of the objectives of that task. In addition, the description should indicate the project deliverables that this task will help achieve (D1, D2, D5 etc. note that deliverables may be applicable to multiple or all tasks.]

Task Details: Within this section, the barriers and risks should be identified, as well as the approaches for overcoming those barriers and risks. Where appropriate, multiple pathways early in the effort can be outlined for risk reduction.

Milestone 1.1 (if applicable)
Milestone 1.2 (if applicable)
Etc.

Subtask 1.1: Date range (M1-M2)

Subtask Summary: Describe the specific and detailed work efforts that go into achieving the higher-level tasks.

Subtask Details: Describe the evaluation techniques that will be used and the expected result that will be generated from the effort.

Milestone 1.1.1 (if applicable)
Milestone 1.1.2 (if applicable)
Etc.

Subtask 1.2:

(Continue until all Task 1 subtasks are listed)

Task 2: (continue in the format above until all tasks and subtasks are listed)

Subtask 2.1: Description and Discussion

Subtask 2.2: Description and Discussion

Technical Qualifications and Resources (Approximately 15% of the Technical Volume)	The Technical Qualifications and Resources should contain the following information: • Describe the Project Team's unique qualifications and expertise, including those of key sub-recipients • Describe the Project Team's existing equipment and facilities that will facilitate the successful completion of the proposed project; include a justification of any new equipment or facilities requested as part of the project • This section should also include relevant, previous work efforts, demonstrated innovations, and how these enable the Applicant to achieve the project objectives. • Describe the time commitment of the key team members to support the project. • Attach one-page resumes for key participating team members as an appendix. Resumes do not count towards the page limit. Multi-page resumes are not allowed. • Describe the technical services to be provided by DOE/NNSA FFRDCs and GOGOs, if applicable. • Attach any letters of support from partners/end users as an appendix (1 page maximum per letter). Letters of support do not count towards the page limit. • For multi-organizational or multi-investigator projects, describe succinctly: o The roles and the work to be performed by each PI and Key Participant; o Business agreements between the Applicant and each PI and Key Participant; o How the various efforts will be integrated and managed; o Process for making decisions on scientific/technical direction; o Publication arrangements; o Intellectual Property issues; and o Communication plans

3. 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 project year, first phase or other subset of the project period. Save the SF-424 in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_App424".

4. BUDGET JUSTIFICATION WORKBOOK (EERE 159)

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

5. 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 identified the name of the applicant, the project director/principal investigator(s), the project title, the objectives of the project, a description of the project, including methods to be employed, the potential impact of the project (i.e., benefits, outcomes), and major participants (for collaborative projects). This document must not include any proprietary or sensitive business information as the Department may make it available to the public after selections are made. The project summary must not exceed 1 page when printed using standard 8.5 x 11 paper with 1" margins (top, bottom, left, and right) with font not smaller than 11 point. Save the Summary for Public Release in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Summary".

6. 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. Save the Summary Slide in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Slide".

The Summary Slide template requires the following information:

- A technology Summary;
- A description of the technology's impact;
- Proposed project goals;
- Any key graphics (illustrations, charts and/or tables);
- The project's key idea/takeaway;

- Project title, Prime Recipient, Principal Investigator, and Key Participant information; and
- Requested EERE funds and proposed applicant cost share.

7. SUB-AWARD BUDGET JUSTIFICATION (EERE159)

Applicants must provide a separate budget justification, EEERE 159 (i.e., budget justification for each budget year and a cumulative budget) for each sub-awardee that is expected to perform work estimated to be more than $100,000 of the total work effort (whichever is less). The budget justification must include the same justification information described in the "Budget Justification" section, above. Save each sub-award budget justification in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Subawardee_Budget_Justification".

8. BUDGET FOR DOE/NNSA FFRDC (IF APPLICABLE)

If a DOE/NNSA FFRDC contractor is to perform a portion of the work, the Applicant must provide a DOE Field Work Proposal (FWP) in accordance with the requirements in DOE Order 412.1, Work Authorization System. DOE Order 412.1 and DOE O 412.1 (Field Work Proposal form) area available at the following link, under "DOE Budget Forms": https://www.directives.doe.gov/directives/current-directives/412.1-BOrder-1/view. Save the FWP in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_FWP".

9. AUTHORIZATION FOR NON-DOE/NNSA OR DOE/NNSA FFRDCS

The Federal agency is sponsoring the FFRDC contractor must authorize in writing the use of the FFRDC contractor on the proposed project and this authorization must be submitted with the application. The use of a FFRDC contractor must be consistent with the contractor's authority under its award. Save the Authorization in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_FFRDCAuth".

10. SF-LLL: DISCLOSURE OF LOBBYING ACTIVITIES

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

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

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

Save the SF-LLL in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_SF-LLL".

11. WAIVER REQUESTS: FOREIGN ENTITIES AND PERFORMANCE OF WORK IN THE UNITED STATES

i. Foreign Entity Participation:

As set forth in Section III.A.4, all Prime Recipients receiving funding under this FOA must be incorporated (or otherwise formed) under the laws of a State or territory of the United States. To request a waiver of this requirement, the Applicant must submit an explicit waiver request in the Full Application. Waiver information is provided in Section III.A.4 of the FOA.

ii. Performance of Work in the United States

All work under EERE funding agreements must be performed in the United States. This requirement does not apply to the purchase of supplies and equipment, so a waiver is not required for foreign purchases of these items. However, the Prime Recipient should make every effort to purchase supplies and equipment within the United States. Section III.A.1 lists the necessary information that must be included in a request to waive this requirement.

Save the Waiver in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Waiver".

12. U.S. MANUFACTURING COMMITMENTS

U.S. Manufacturing Plans

As part of the application, Applicants are required to submit a U.S. Manufacturing Plan. The U.S. Manufacturing Plan represents the applicant's measurable commitment to support U.S. manufacturing of the results from its award.

The nature and specificity of the applicants' U.S. Manufacturing Plans are expected to vary based on the FOA. A higher level of specificity is expected in U.S. Manufacturing Plans for technologies at higher technology readiness levels due to the greater certainty surrounding the commercialization of these awards. U.S. Manufacturing Plans submitted in response to FOAs targeting technologies at high technology readiness levels or demonstration activities should include specific commitments to manufacturing in the U.S. For example, a U.S. Manufacturing Plan may commit to manufacturing products that embody or are made through the use of IP developed under the award in the U.S. or making investments in U.S. facilities to support product manufacture. U.S. Manufacturing Plans submitted in response to FOAs directed at technologies at lower technology readiness levels may have fewer specific manufacturing details and may focus more on licensing and other strategies to promote U.S. manufacturing.

The weight given to the U.S. Manufacturing Plans during the review and selection process varies based on the particular FOA. Applicants should review Section V.A.2 of this FOA to determine the weight given to the U.S. Manufacturing Plans under this FOA.

When an applicant is selected for an award, the U.S. Manufacturing Plan submitted by the applicant becomes part of the terms and conditions of the award. The applicant/awardee may request a waiver or modification of the U.S. Manufacturing Plan from DOE upon a showing that the original U.S. Manufacturing Plan is no longer economically feasible.

Save the U.S. Manufacturing Plan in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_USMP".

13. Environmental Questionnaire

You must complete the Environmental Questionnaire found at
http://www.netl.doe.gov/business/forms/451_1-1-3.pdf

Save the Environmental Questionnaire in a single PDF file using the following convention for the title "Control Number_LeadOrganization_EQ."

14. 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.

Save the Letters of Commitment in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_LOC".

15. SF-424A BUDGET SUMMARY

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/.

Save the SF-424A in a single PDF file using the following convention for the title "SF-424A ControlNumber_LeadOrganization_SF424A".

E. POST-AWARD INFORMATION REQUESTS

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

- Indirect cost information
- Other budget information
- Commitment Letters from Third Parties Contributing to Cost Share, if applicable
- Name and phone number of the Designated Responsible Employee for comply with national policies prohibiting discrimination (See 10 CFR 1040.5)
- Representation of Limited Rights Data and Restricted Software, if applicable
- Any necessary documentation or information needed to issue the award

F. CONTENT AND FORM OF REPLIES TO REVIEWER COMMENTS

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

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

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

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

G. SUBMISSION DATES AND TIMES

Concept Papers, Full Applications, and Replies to Reviewer Comments must be submitted no later than 8:00 p.m. EST on the dates provided on the cover page of this FOA.

H. INTERGOVERNMENTAL REVIEW

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

I. FUNDING RESTRICTIONS

1. ALLOWABLE COSTS

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

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

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

2. PRE-AWARD COSTS

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

must obtain the prior approval of the Contracting Office for any pre-award costs that are for periods greater than this 90 day calendar period.

i. Pre-Award Costs Related to National Environmental Policy Act (NEPA) Requirements

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

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

3. CONSTRUCTION

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

4. FOREIGN TRAVEL

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

5. EQUIPMENT AND SUPPLIES

To the greatest extent practicable, all equipment and products purchased with funds made available under this award should be made or manufactured in the United States. This requirement does not apply to used or leased equipment.

Property disposition will be required at the end of a project if the property is no longer used by the Prime Recipient for the objectives of the project, and the fair market value of property exceeds $5,000. The rules for property disposition are set forth in the following sections of 10 CFR Part 600:

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

6. LOBBYING

Recipients and Sub-recipients 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 Sub-recipients 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.

V. APPLICATION REVIEW INFORMATION

A. TECHNICAL REVIEW CRITERIA

1. CONCEPT PAPERS

Concept Papers are evaluated based on the following criteria:

Criterion 1: Impact of the Proposed Technology Relative to State of the Art (50%)
This criterion involves consideration of the following factors:

- Method used to identify current state of the art technology
- If technical success is achieved, the proposed idea would significantly improve technical and economic performance relative to the state of the art.

Criterion 2: Overall Scientific and Technical Merit (50%)
This criterion involves consideration of the following factors:

- The proposed technology is unique and innovative; and
- The proposed approach is without major technical flaws.

2. FULL APPLICATIONS

Applications will be evaluated against the merit review criteria outlined for each individual AOI as shown below.

Area of Interest 1: Development of Low-Cost, High Strength Aluminum Alloy Sheet

Criterion 1: Technical Merit, Innovation, and Impact **Weight: 50%**
Technical Merit and Innovation

- Extent to which the proposed material and processing is innovative and has the potential to advance the state of the art towards the stated properties;
- Degree to which the current state of the technology and the proposed advancement are clearly described;
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state of the art to the proposed advancement; and
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and revolutionary, including relevant data, calculations, and discussion of prior work in the literature with analysis that supports the viability of the proposed work.

Impact of Technology Advancement

- Degree to which the project supports the topic area objectives and target specifications and metrics; and
- Clarity of the description of how the proposed properties and processing would support weight reduction in high-volume vehicles.

Criterion 2: Project Research and Market Transformation/Commercialization Plan

Weight: 30%

Research Approach and Workplan

- Degree to which the approach and critical path have been clearly described and thoughtfully considered; and
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed Workplan will succeed in meeting the project goals.
- Identification of Technical Risks; and
- Depth and comprehensiveness of the key technical risk areas involved in the proposed work and the quality of the mitigation strategies to address them.

Baseline, Metrics, and Deliverables

- The level of clarity in the definition of the baseline, metrics, and milestones; and
- The extent to which the described metrics, milestones, and deliverables result in a material with properties and processing requirements suitable for high-volume automotive production.

Market Transformation Plan/Commercialization Plan

- Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including mitigation plan; and
- Comprehensiveness of market transformation/commercialization plan including product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, U.S. manufacturing plan etc., and product distribution.

Criterion 3: Team and Resources **Weight: 20%**

- The capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a good chance of success. Qualifications, relevant expertise, and time commitment of the individuals on the team;
- The sufficiency of the proposed facilities to support the work;
- Degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further development and commercial deployment of the proposed technologies; and

- Level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan.

Area of Interest 2: Integrated Computational Materials Engineering (ICME) Development of Carbon Fiber Composites for Lightweight Vehicles

Criterion 1: Technical Merit **Weight: 50%**

- The extent to which the application plans to advance the state of the art for ICME tools for carbon fiber composites compared to the baseline current capabilities
- The extent to which the application describes the current state of the art and how the proposed plan will provide additional enabling capabilities
- The completeness of the strategy to address key challenges in ICME as described in the body of the topic
- The extent to which the suite of models to be integrated addresses not only structure/property predictions but also structure/processing predictions, including all of the required aspects as described in the body of the topic; and
- The technical soundness of the proposed cost modeling techniques and the ability of the solution to meet the stated cost targets.

Criterion 2: Project Approach **Weight: 30%**

- The extent to which the approach adequately addresses integration of different types and size scales of models as well as integration of the modeling and experimental tasks.
- The extent to which the interrelationship between activities/tasks are clearly defined and illustrated
- The extent to which the quality of the plan for integration strategies for the models address all required aspects as described in the body of this topic
- The extent to which the application describes how the project will ensure completeness of the integrated suite of models. This includes structure property predictions and structure processing predictions as well as the required model elements described in the body of this topic; and
- Relative to a clearly defined experimental baseline, the strength and reasonableness of quantifiable metrics, milestones, and mid-point deliverables defined in the application.
- The extent to which the application provides sufficient justification for development of new models as described in the body of the topic.

Criterion 3: Team and Resources **Weight: 20%**

- The degree of involvement of an automotive OEM or Tier 1 supplier for system definition and defining requirements for model performance;
- The qualifications of the proposed team researchers and previous success in development of ICME tools for composites, as evidenced by publications, patents, or other documentation;
- The extent to which the team is integrated on a technical basis; and

- The extent to which the project structure will allow for effective management of resources to meet scope, cost, and schedule requirements

Area of Interest 3: Beyond Lithium Ion Technologies

Criterion 1: Technical Merit, Innovation, and Impact **Weight: 50%**

Technical Merit and Innovation

- Extent to which the proposed technology or process is innovative and has the potential to advance the state of the art;
- Degree to which the current state of the technology and the proposed advancement are clearly described;
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state of the art to the proposed advancement; and
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and revolutionary, including relevant data, calculations, and discussion of prior work in the literature with analysis that supports the viability of the proposed work.

Impact of Technology Advancement

- The degree to which the project supports the topic area objectives and target specifications and metrics; and the potential impact of the project on advancing the state of the art.

Criterion 2: Project Research and Market Transformation/Commercialization Plan

Weight: 30%

Research Approach and Workplan

- Degree to which the approach and critical path have been clearly described and thoughtfully considered; and
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed Workplan will succeed in meeting the project goals.

Identification of Technical Risks

- Depth and comprehensiveness of the key technical risk areas involved in the proposed work, and the quality of the mitigation strategies to address them.

Baseline, Metrics, and Deliverables

- The level of clarity in the definition of the baseline, metrics, and milestones; and
- The comprehensiveness of the quantifiable metrics, milestones, and mid-point deliverables defined in the application, such that meaningful interim progress will be made with respect to the experiemental baseline.

Market Transformation/Commercialization Plan

- Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including mitigation plan; and
- Comprehensiveness of market transformation/commercialization plan including product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, U.S. manufacturing plan etc., and product distribution.

Criterion 3: Team and Resources **Weight: 20%**

- The capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a good chance of success. Qualifications, relevant expertise, and time commitment of the individuals on the team;
- The sufficiency of the proposed facilities to support the work;
- Degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further development and commercial deployment of the proposed technologies; and
- Level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan;

Area of Interest 4: Commercialization of Vehicle Power Electronics Using Wide Bandgap (WBG) Semiconductors

Criterion 1: Technical Merit of Technology **Weight: 45%**

- Relevance to goals for development and commercialization of next generation power electronics technologies for vehicle electrification as identified in the EV Everywhere Blueprint.
- Demonstration of a profound understanding of the current approach and/or state-of-the-art for the use and integration of WBG devices in the inverter, converter, and/or battery charger proposed;
- Comprehensive technical description that includes as a minimum the analysis, technical assumptions, and design rationale for proposed WBG devices, other necessary components, and proposed inverter, converter and/or battery charger;
- Extent to which the cost analysis confirms overall cost reduction potential will be achieved relative to the identified commercially existing silicon-based approach; and
- Thoroughness of a test plan that address key operational and performance evaluations for the proposed project, including details such as proposed test matrices, data acquisition, and sampling and analysis protocols;

Criterion 2: Project Approach and Market Transformation/Commercialization Plan

Weight: 35%

- Adequacy, clarity, reasonableness, and thoroughness of the technical and project management approach to address project objectives, management details (resources, duration and sequencing of tasks, milestones, go/no-go decisions, success and failure metrics, coordination, etc.), key project barriers and proposed mitigations, and viability of the proposed WBG approach;
- Comprehensiveness of a market transformation/commercialization plan that includes:
    - The overall WBG value proposition and improved competitiveness achieved by using the proposed technologies and WBG devices;
    - Product development strategy describing the timeliness and economic viability of the proposed project and supply chain to supports vehicle electrification;
    - Commercialization timeline, financing considerations, product marketing strategy, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, U.S. manufacturing plan, and product distribution; and
    - Comprehensive description of market potential for proposed technologies and vehicles as well as future plans to expand beyond proposed vehicle and approach for commercialization of WBG semiconductors in vehicle applications.
- Demonstration of successful development and commercialization of similar, new technologies in vehicles.

Criterion 3: Applicant and Team Member Roles, Capabilities, and Facilities **Weight: 20%**

- Appropriateness and depth of qualifications and capabilities of the Principal Investigator (PI) and key personnel;
- Appropriateness of the team members, team, and the degree of their commitment to the project;
- Demonstrated knowledge with WBG semiconductors and/or electric drive technology;
- Demonstration of prior experience in conducting related research and development similar to the proposed technology commercialization;
- Appropriateness of the planned organizational structure alignment with required tasks and appropriateness of responsibilities among individuals and team members; and
- Availability and adequacy of proposed equipment, facilities, and other support necessary for the successful performance of the proposed work.

Area of Interest 5: Tire Efficiency

Criterion 1: Technical Merit, Innovation, and Impact **Weight: 50%**

Technical Merit and Innovation

- Extent to which the proposed technology or process is innovative and has the potential to advance the state of the art;
- Degree to which the current state of the technology and the proposed advancement are clearly described;
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state of the art to the proposed advancement; and
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and revolutionary, including relevant data, calculations, and discussion of prior work in the literature with analysis that supports the viability of the proposed work.

Impact of Technology Advancement

- The degree to which the project supports the topic area objectives and target specifications and metrics; and
- The potential impact of the project on advancing the state of the art.

Criterion 2: Project Research and Market Transformation/Commercialization Plan **Weight: 30%**

Research Approach and Workplan

- Degree to which the approach and critical path have been clearly described and thoughtfully considered; and
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed Workplan will succeed in meeting the project goals.

Identification of Technical Risks

- Depth and comprhensiveness of the key technical risk areas involved in the proposed work, and the quality of the mitigation strategies to address them.

Baseline, Metrics, and Deliverables

- The level of clarity in the definition of the baseline, metrics, and milestones; and
- The comprehensiveness of the quantifiable metrics, milestones, and mid-point deliverables defined in the application, such that meaningful interim progress will be made with respect to the experiemental baseline.

Market Transformation/Commercialization Plan

- Identification of target market, competitors, and distribution channels for proposed

technology along with known or perceived barriers to market penetration, including mitigation plan; and
- Comprehensiveness of market transformation/commercialization plan including to product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, U.S. manufacturing plan etc., and product distribution.

Criterion 3: Team and Resources **Weight: 20%**

- The capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a good chance of success. Qualifications, relevant expertise, and time commitment of the individuals on the team;
- The sufficiency of the facilities to support the work;
- Degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further development and commercial deployment of the proposed technologies; and
- Level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan.

Area of Interest 6: Multi-speed Gearbox

Criterion 1: Technical Merit, Innovation, and Impact **Weight: 50%**

- Extent to which the proposed technology or process is innovative and has the potential to advance the state of the art;
- Degree to which the current state of the technology and the proposed advancement are clearly described;
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state of the art to the proposed advancement; and
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and revolutionary, including relevant data, calculations, and discussion of prior work in the literature with analysis that supports the viability of the proposed work.

Criterion 2: Project Research and Market Transformation/Commercialization Plan

Weight: 30%

Impact of Technology Advancement

- The potential to improve overall vehicle efficiency.
- The degree to which the project supports the topic area objectives and target specifications and metrics; and
- The potential impact of the project on advancing the state of the art.

Research Approach and Workplan

- Degree to which the approach and critical path have been clearly described and thoughtfully considered; and
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed Workplan will succeed in meeting the project goals.

Identification of Technical Risks

- Depth and comprehensiveness of the key technical risk areas involved in the proposed work, and the quality of the mitigation strategies to address them.

Baseline, Metrics, and Deliverables

- The level of clarity in the definition of the baseline, metrics, and milestones; and
- The comprehensiveness of the quantifiable metrics, milestones, and mid-point deliverables defined in the application, such that meaningful interim progress will be made with respect to the experiemental baseline

Market Transformation/Commercialization Plan

- Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including mitigation plan; and
- Comprehensiveness of market transformation/commercialization plan including product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, U.S. manufacturing plan etc., and product distribution.

Criterion 3: Team and Resources **Weight: 20%**

- The capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a good chance of success. Qualifications, relevant expertise, and time commitment of the individuals on the team;
- The sufficiency of the facilities to support the work;
- Degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further development and commercial deployment of the proposed technologies;
- Extent of involvement of an OEM and/or technology commercialization partner; and Level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan.

Area of Interest 7: Advanced Climate Control Auxiliary Load Reduction

Criterion 1: Technical Merit of Technology **Weight: 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 geographic climates/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 electric drive vehicles within the transportation sector.

Criterion 2: Project Approach **Weight: 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 from the project team and capability to commercialize the technology;
- Adequacy and appropriateness of the proposed plan for coordinating, directing, and performing the proposed work; and
- Adequacy, reasonableness and soundness of the proposed project management plan, including go/no-go decisions, interim milestones, and success/failure metrics: and

Criterion 3: Applicant and Team Member Roles, Capabilities, and Facilities Weight: 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; and
- Appropriateness of the planned organizational structure alignment with required tasks and appropriateness of responsibilities among individuals and team members

Area of Interest 8: Development Of High Performance Low Temperature Catalysts For Exhaust Aftertreatment

Criterion 1: Technical Merit Weight: 50%

- The technical soundness of the proposed development process and characterization techniques;
- The degree to which the current state of the technology and the proposed advancement are clearly described, including data on catalyst properties, performance, applications, and temperature limitations;
- The technical soundness of the proposed process-structure/thermal cycling/ catalyst deactivation mechanism simulations and modeling techniques to predict life cycle performance;
- The technical soundness of the proposed cost modeling techniques and the ability of the solution to meet industry cost targets;
- The extent to which the proposed prototype scale demonstration assembly accurately emulates the expected exhaust gas composition and temperature challenges of next generation high efficiency internal combustion engines; and

- The extent to which the prototype scale demonstration assembly captures expected performance challenges such as thermal cycling, startups, cool-down, chemical poisoning, catalyst aging and deactivation etc.

Criterion 2: Project Approach **Weight: 30%**

- The detail and technical credibility of the described technical barriers to low temperature catalysis and details of how the proposed approach for producing high performance low temperature aftertreatment catalysts will overcome these barriers;
- The extent to which the proposed solution can be modeled using computational methods;
- The level of clarity in the definition of the baseline, metrics, and milestones;
- The comprehensiveness of the quantifiable metrics, milestones, and mid-point deliverables defined in the application, such that meaningful interim progress will be made with respect to the experiemental baseline;
- The soundness of the approach to convert technologies developed into a commercial product resulting in effective technology transfer, market transformation/commercialization; and
- The technical soundness of the proposed technology transfer, market transformation/commercialization plan.

Criterion 3: Team and Resources **Weight: 20%**

- The qualifications of the proposed team researchers and previous success in the field as evidenced by publications, patents, or special awards;
- The extent of existing team production, research and development, materials characterization, and computational capabilities;
- The performance history of the proposed team, including a list of private and government funded work in the field of advanced catalysis and the status of technology transfer of those technologies; and
- The quality of the linkages between the proposed team and the OEM supply chain, as evidenced by letters of support, resource and financial commitment

Area of Interest 9: Dual-Fuel Technologies

Criterion 1: Technical Merit, Innovation, and Impact **Weight: 50%**

Technical Merit and Innovation

- Extent to which the proposed technology or process is innovative and has the potential to advance the state of the art;
- Degree to which the current state of the technology and the proposed advancement are clearly described;
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state of the art to the proposed advancement; and
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and revolutionary, including relevant data, calculations, and discussion of prior work in the literature with analysis that supports the viability of the proposed work.

Impact of Technology Advancement

- The degree to which the project supports the topic area objectives and target specifications and metrics; and
- The potential impact of the project on advancing the state of the art.

Criterion 2: Project Research and Market Transformation/Commercialization Plan

Weight: 30%

Research Approach and Workplan

- Degree to which the approach and critical path have been clearlydescribedandthoughtfully considered; and
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed Workplan will succeed in meeting the project goals.

Identification of Technical Risks

- Depth and comprehensiveness of the key technical risk areas involved in the proposed work, and the quality of the mitigation strategies to address them.

Baseline, Metrics, and Deliverables

- The level of clarity in the definition of the baseline, metrics, and milestones; and
- The comprehensiveness of the quantifiable metrics, milestones, and mid-point deliverables defined in the application, such that meaningful interim progress will be made with respect to the experiemental baseline.

Market Transformation/Commercialization Plan

- Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including mitigation plan; and
- Comprehensiveness of market transformation/commercialization plan including product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, U.S. manufacturing plan etc., and product distribution.

Criterion 3: Team and Resources **Weight: 20%**

- The capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a good chance of success. Qualifications, relevant expertise, and time commitment of the individuals on the team;
- The sufficiency of the proposed facilities to support the work;
- Degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further development and commercial deployment of the proposed technologies; and
  Level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan.

Area of Interest 10: Fuel Property Impacts on Combustion

Criterion 1: Technical Merit, Innovation, and Impact **Weight: 50%**

Technical Merit and Innovation

- Extent to which the proposed technology or process is innovative and has the potential to advance the state of the art;
- Degree to which the current state of the technology and the proposed advancement are clearly described;
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state of the art to the proposed advancement; and
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and revolutionary, including relevant data, calculations, and discussion of prior work in the literature with analysis that supports the viability of the proposed work.

Impact of Technology Advancement

- The degree to which the project supports the topic area objectives and target specifications and metrics; and
- The potential impact of the project on advancing the state of the art

Criterion 2: Project Research and Market Transformation/Commercialization Plan

Weight: 30%

Research Approach and Workplan

- Degree to which the approach and critical path have been clearly described and thoughtfully considered; and
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed Workplan will succeed in meeting the project goals.

Identification of Technical Risks

- Depth and comprehensiveness of the key technical risk areas involved in the proposed work, and the quality of the mitigation strategies to address them.

Baseline, Metrics, and Deliverables

- The level of clarity in the definition of the baseline, metrics, and milestones; and
- The comprehensiveness of the quantifiable metrics, milestones, and mid-point deliverables defined in the application, such that meaningful interim progress will be made with respect to the experiemental baseline.

Market Transformation/Commercialization Plan

- Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including mitigation plan; and
- Comprehensiveness of market transformation/commercialization plan including product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, U.S. manufacturing plan etc., and product distribution.

Criterion 3: Team and Resources **Weight: 20%**

- The capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a good chance of success. Qualifications, relevant expertise, and time commitment of the individuals on the team;
- The sufficiency of the proposed facilities to support the work;
- Degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further development and commercial deployment of the proposed technologies; and
- Level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan.

Area of Interest 11: Powertrain Friction and Wear Reduction

Criterion 1: Technical Merit, Innovation, and Impact **Weight: 50%**

Technical Merit and Innovation

- Extent to which the proposed technology or process is innovative and has the potential to advance the state of the art;
- Degree to which the current state of the technology and the proposed advancement are clearly described;
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state of the art to the proposed advancement; and
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and revolutionary, including relevant data, calculations, and discussion of prior work in the literature with analysis that supports the viability of the proposed work.

Impact of Technology Advancement

- The degree to which the project supports the topic area objectives and target specifications and metrics; and
- The potential impact of the project on advancing the state of the art.

Criterion 2: Project Research and Market Transformation/Commercialization Plan

Weight: 30%

Research Approach and Workplan

- Degree to which the approach and critical path have been clearly described and thoughtfully considered; and
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed Workplan will succeed in meeting the project goals.

Identification of Technical Risks

- Depth and comprehensiveness of the key technical risk areas involved in the proposed work, and the quality of the mitigation strategies to address them.

Baseline, Metrics, and Deliverables

- The level of clarity in the definition of the baseline, metrics, and milestones; and
- The comprehensiveness of the quantifiable metrics, milestones, and mid-point deliverables defined in the application, such that meaningful interim progress will be made with respect to the experiemental baseline.

Market Transformation/Commercialization Plan

- Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including mitigation plan; and
- Comprehensiveness of market transformation/commercialization plan including product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, U.S. manufacturing plan etc., and product distribution.

Criterion 3: Team and Resources **Weight: 20%**

- The capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a good chance of success. Qualifications, relevant expertise, and time commitment of the individuals on the team;
- The sufficiency of the proposed facilities to support the work;
- Degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further development and commercial deployment of the proposed technologies; and
- Level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan.

Area of Interest 12: Advanced Technology Powertrain 2 (ATP2)

Criterion 1: Technical Merit, Innovation, and Impact **Weight: 50%**

Technical Merit and Innovation

- Extent to which the proposed technology or process is innovative and has the potential to advance the state of the art;
- Degree to which the current state of the technology and the proposed advancement are clearly described;
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state of the art to the proposed advancement; and
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and revolutionary, including relevant data, calculations, and discussion of prior work in the literature with analysis that supports the viability of the proposed work.

Impact of Technology Advancement

- The degree to which the project supports the topic area objectives and target specifications and metrics; and
- The potential impact of the project on advancing the state of the art.

Criterion 2: Project Research and Market Transformation/Commercialization Plan **Weight: 30%**

Research Approach and Workplan

- Degree to which the approach and critical path have been clearly described and thoughtfully considered; and
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed Workplan will succeed in meeting the project goals.

Identification of Technical Risks

- Depth and comprehensiveness of the key technical risk areas involved in the proposed work, and the quality of the mitigation strategies to address them.

Baseline, Metrics, and Deliverables

- The level of clarity in the definition of the baseline, metrics, and milestones; and
- The comprehensiveness of the quantifiable metrics, milestones, and mid-point deliverables defined in the application, such that meaningful interim progress will be made with respect to the experiemental baseline.

Market Transformation/Commercialization Plan

- Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including mitigation plan; and
- Comprehensiveness of market transformation/commercialization plan including product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, U.S. manufacturing plan etc., and product distribution.

Criterion 3: Team and Resources **Weight: 20%**

- The capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a good chance of success. Qualifications, relevant expertise, and time commitment of the individuals on the team;
- The sufficiency of the proposed facilities to support the work;
- Degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further development and commercial deployment of the proposed technologies; and
  Level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan..

Area of Interest 13: Dual-Fuel/Bi-Fuel Class 8 Vehicle Technologies

Criterion 1: Technical Merit, Innovation, and Impact **Weight:50%**

Technical Merit and Innovation

- Extent to which the proposed technology or process is innovative and has the potential to advance the state of the art;
- Degree to which the current state of the technology and the proposed advancement are clearly described;
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state of the art to the proposed advancement; and
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and revolutionary, including relevant data, calculations, and discussion of prior work in the literature with analysis that supports the viability of the proposed work.

Impact of Technology Advancement

- The degree to which the project supports the topic area objectives and target specifications and metrics; and
- The potential impact of the project on advancing the state of the art.

Criterion 2: Project Research and Market Transformation/Commercialization Plan **Weight:30%**

Research Approach and Workplan

- Degree to which the approach and critical path have been clearly described and thoughtfully considered; and
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed Workplan will succeed in meeting the project goals.

Identification of Technical Risks

- Depth and comprehensiveness of the key technical risk areas involved in the proposed work, and the quality of the mitigation strategies to address them.

Baseline, Metrics, and Deliverables

- The level of clarity in the definition of the baseline, metrics, and milestones; and
- The comprehensiveness of the quantifiable metrics, milestones, and mid-point deliverables defined in the application, such that meaningful interim progress will be made with respect to the experiemental baseline.

Market Transformation/Commercialization Plan

- Identification of target market, competitors, and distribution channels for proposed

technology along with known or perceived barriers to market penetration, including mitigation plan; and

- Comprehensiveness of market transformation/commercialization plan including to product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, U.S. manufacturing plan etc., and product distribution.

Criterion 3: Team and Resources **Weight:20%**

- The capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a good chance of success. Qualifications, relevant expertise, and time commitment of the individuals on the team;
- The sufficiency of the proposed facilities to support the work;
- Degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further development and commercial deployment of the proposed technologies; and
- Level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan.

Area of Interest 14: Early Market Commercialization Opportunities

Criterion 1: Technical Merit and Innovation **Weight: 30%**

- Extent to which the proposed technology or process is innovative and has the potential to advance the state of the art;
- Degree to which the current state of the technology and the proposed advancement are clearly described;
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state of the art to the proposed advancement; and
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and revolutionary, including relevant data, calculations and discussion of prior work in the literature with analyses that support the viability of the proposed work.

Criterion 2: Potential for Early Market Development **Weight: 20%**

Extent to which the proposed technology represents the best combination of:

- Potential for Introduction in an early market opportunity;
- Vehicle efficiency improvement;
- Prospects to expand the technology into other vehicle segments.

Criterion 3: Project Research and Commercialization Plan **Weight: 30%**

Research Approach and Workplan

- Degree to which the approach and critical path have been clearly described and thoughtfully considered; and
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed Workplan will succeed in meeting the project goals.

Identification of Technical Risks

- Depth and comprehensiveness of the key technical risk areas involved in the proposed work and the quality of the mitigation strategies to address them.

Baseline, Metrics, and Deliverables

- The level of clarity in the definition of the baseline, metrics, and milestones; and
- Relative to a clearly defined experimental baseline, the strength of the quantifiable metrics, milestones, and a mid-point deliverables defined in the application, such that meaningful interim progress will be made.

Market Transformation /Commercialization Plan

- Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including mitigation plan; and
- Comprehensiveness of market transformation/commercialization plan including but not limited to product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, U.S. manufacturing plan etc., and product distribution.

Criterion 4: Team and Resources **Weight: 20%**

- The capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a good chance of success. Qualifications, relevant expertise, and time commitment of the individuals on the team;
- The sufficiency of the proposed facilities to support the work;
- Degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further development and commercial deployment of the proposed technologies; and
- Level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan.

3. *Criteria for Replies to Reviewer Comments*

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

B. Standards for Application Evaluation

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

C. Other Selection Factors

1. *Program Policy Factors*

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

- The degree to which the proposed project, including proposed cost shares, optimizes the use of available EERE funding to achieve programmatic objectives;
- The level of industry involvement and demonstrated ability to commercialize energy or related technologies;
- Technical, market, organizational, and environmental risks associated with the project;
- Whether the proposed project is likely to lead to increased employment and manufacturing in the United States;
- Whether the proposed project will accelerate transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty;
- The degree to which the proposed project directly addresses EERE's statutory mission and strategic goals.
- The degree to which projects collectively represent diverse types and sizes of applicant organizations, while not being detrimental to the overall objectives of the program.
- The degree to which projects represent a diversity of technology concepts and applications, as well as technical approaches, while not being detrimental to the overall objectives of the program.

D. MERIT REVIEW AND SELECTION PROCESS

1. OVERVIEW

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

2. PRE-SELECTION INTERVIEWS

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

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

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

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

3. PRE-SELECTION CLARIFICATION

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

not signify that the applicant has been selected for negotiation of award or that the applicant is among the top ranked applications.

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

4. SELECTION

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

VI. AWARD ADMINISTRATION INFORMATION

A. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES

EERE anticipates notifying applicants selected for negotiation of award in August 2014 and making awards by September 30, 2014.

B. AWARD NOTICES

1. REJECTED SUBMISSIONS

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

2. CONCEPT PAPER NOTIFICATIONS

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

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

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

3. Full Application Notifications

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

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

4. Successful Applicants

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

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

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

5. 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.

6. 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.

C. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS

1. REGISTRATION REQUIREMENTS

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

i. EERE Exchange

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

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

ii. DUNS Number

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

iii. System for Award Management

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

iv. Fedconnect

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

v. Grants.gov

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

vi. Electronic Authorization of Applications and Award Documents

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

2. AWARD ADMINISTRATIVE REQUIREMENTS

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

3. LIMITATIONS ON COMPENSATION COSTS

The annual compensation costs (total amount of wages, salary, bonuses and deferred compensation) for an individual allowable for an award under this FOA are capped at $250,000 (i.e. $250,000 is the maximum amount that EERE will reimburse a Recipient for any one individual's annual compensation and EERE will not recognize such costs above $250,000 as Recipient cost share).

This limitation does not restrict the Recipient or its sub-recipients from providing annual compensation to an individual that exceeds $250,000. However, any amount above $250,000 cannot be included in the total project costs (i.e., Federal share or recipient cost share).

4. SUB-AWARD AND EXECUTIVE REPORTING

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

5. NATIONAL POLICY REQUIREMENTS

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

6. *ENVIRONMENTAL REVIEW IN ACCORDANCE WITH NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)*

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

While NEPA compliance is a Federal agency responsibility and the ultimate decisions remain with the federal agency, all applicants will be required to assist in the timely and effective completion of the NEPA process in the manner most pertinent to their proposed project. The Environmental Questionnaire can be found at http://www.netl.doe.gov/business/forms/451_1-1-3.pdf

7. *APPLICANT REPRESENTATIONS AND CERTIFICATIONS*

i. Lobbying Restrictions

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

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

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

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

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

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

For purposes of these representations, the following definitions apply:

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

8. STATEMENT OF SUBSTANTIAL INVOLVEMENT

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

- EERE shares responsibility with the Prime Recipient for the management, control, direction, and performance of work under this award.
- EERE reviews in a timely manner project plans, including project management, testing and technology transfer plans, and recommending alternate approaches, if the plans do not address the critical programmatic issues.
- EERE participates in project management planning activities, including risk analysis, to ensure EERE Technology Office requirements or limitations are considered in performance of the work elements.
- EERE may intervene in the conduct or performance of work under this Award for programmatic reasons. Intervention includes the interruption or modification of the conduct or performance of project activities.
- EERE promotes and facilitates technology transfer activities, including disseminating Technology Office results through presentations and publications.
- EERE may redirect or discontinue funding projects that fail to fully and satisfactorily complete the work described in the Statement of Project Objectives as evaluated at the Go/No Go decision points.
- EERE participates in major project decision-making processes.

The aforementioned 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.

9. INTELLECTUAL PROPERTY MANAGEMENT PLAN

Within 30 days of selection, Applicants must submit an executed IP Management Plan between the members of the consortia or team.

The award will set forth the treatment of and obligations related to intellectual property rights between EERE and the individual members. The IP Management Plan should describe how the members will handle intellectual property rights and issues between themselves while ensuring compliance with Federal IP laws, regulations, and policies (see Sections VIII.L-VIII.O of this FOA for more details on applicable Federal IP laws and regulations).

The following is a non-exhaustive list of examples of items that the IP Management Plan may cover:

- The treatment of confidential information between members (e.g., the use of non-disclosure agreements);
- The treatment of background IP (e.g., any requirements for identifying it or making it available);
- The treatment of inventions made under the project (e.g., any requirements for disclosing to the other members, filing patent applications, paying for patent prosecution, and cross-licensing or other licensing arrangements between the members);
- The treatment of data produced, including software, under the project (e.g., any publication process or other dissemination strategies, copyrighting strategy or arrangement between members);
- Any technology transfer and commercialization requirements or arrangements between the members;
- The treatment of any intellectual property issues that may arise due to a change in membership of the consortia or team; and
- The handling of disputes related to intellectual property between the members.

10. SUBJECT INVENTION UTILIZATION REPORTING

To ensure that Prime Recipients and Sub-recipients holding title to subject inventions are taking the appropriate steps to commercialize subject inventions, EERE requires that each Recipient holding title to a subject invention submit annual reports for 10 years from the date the subject invention was disclosed to EERE on the utilization of the subject invention and efforts made by Recipient or their licensees or assignees to stimulate such utilization. The reports must include information regarding the status of development, date of first commercial sale or use, gross royalties received by the Prime Recipient, and such other data and information as EERE may specify.

11. Intellectual Property Provisions

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

12. Reporting

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

13. Foreign National Involvement

All applicants selected for an award resulting from this FOA may be required to comply with the requirements set forth in the department of energy (DOE) Order O 142.3a "unclassified foreign visits and assignments program" (https://www.directives.doe.gov/directives/current-directives/all-current-directives). This order establishes requirements for doe selected applicants, whose award may involve 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 who is affiliated with non-sensitive countries, countries identified by the doe as sensitive (reference http://info.publicintelligence.net/snl-sensitivecountries.pdf), or countries identified by the department of state as state sponsors of terrorism (http://www.state.gov/j/ct/list/c14151.htm) in the performance of an award, the selected applicant may be responsible for providing to the DOE representative specific information of the foreign nationals to ensure compliance with all of the requirements for access approval.

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.

14. Go/No-Go Review and Stage-Gate Review

Each project selected under this FOA will be subject to a period project evaluation referred to as a Go/No-Go or Stage Gate Review. Federal funding beyond the Go/No Go or Stage Gate decision point (continuation funding), is contingent, in part[12], on the outcome of the Go/No Go or Stage Gate Review.

As a result of the Go/No Go or Stage Gate Reviews, DOE may, at its discretion, authorize the following actions: (1) continue to fund the project, contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority; (2) recommend redirection of work under the project; (3) place a hold on federal funding for the project, pending further supporting data or funding; or (4) discontinue funding the project because of insufficient progress, change in strategic direction, or lack of funding.

- **Go/No-Go Decision Points**: Go/No-Go decision points are similar to project milestones, in that EERE staff will review the project based on pre-established metrics defined in the award negotiations process following selection.
- **Stage-Gate Reviews**: Stage-Gate reviews are very similar to Go/No-Go decision points, except that EERE will bring in third parties to assist with validation of project progress. These third parties are typically specialized subject matter experts that will allow EERE to evaluate crucial aspects of project performance with a greater degree of specificity and scrutiny.

[12] Continuation funding is contingent on (1) contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority; (2) meeting the objectives, milestones, deliverables, decision point criteria, and stage gates of Recipient's approved project and obtaining approval from EERE to continue work on the project; (3) submittal of required reports; and/or (4) compliance with the terms and conditions of the award.

VII. QUESTIONS/AGENCY CONTACTS

Upon the issuance of a FOA, EERE personnel are prohibited from communicating (in writing or otherwise) with Applicants regarding the FOA except through the established question and answer process as described below. Specifically, questions regarding the content of this FOA must be submitted to: DE-FOA0000991@netl.doe.gov not later than 5 business 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 FOA related questions will be March 25, 2014 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 5 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.

VIII. OTHER INFORMATION

A. FOA AMENDMENTS

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

B. INFORMATIONAL WEBINARS

EERE will conduct two informational webinars during the FOA process. The first will be held after the initial FOA release but before the due date for Concept Papers. The second will be held after selections have been made and will only be open to those applicants selected for negotiation for an award.

The purpose of the first webinar will be to give applicants a chance to ask questions about the FOA process generally. Attendance is not mandatory and will not positively or negatively impact the overall review of any Applicant submissions. As the webinar will be open to all Applicants who wish to participate, Applicants should refrain from asking questions or communicating information that would reveal confidential and/or proprietary information specific to their project.

The purpose of the second webinar will be to provide those applicants selected for negotiation the opportunity to ask questions about the negotiation process.

Specific dates for the webinars can be found on the cover page of the FOA.

C. GOVERNMENT RIGHT TO REJECT OR NEGOTIATE

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

D. COMMITMENT OF PUBLIC FUNDS

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

E. TREATMENT OF APPLICATION INFORMATION

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

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

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

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

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

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

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

Subject to the specific FOIA exemptions identified in 5 U.S.C. 552(b), all information submitted to EERE by a FOA applicant is subject to public release under the Freedom of Information Act, 5 U.S.C. §552, as amended by the OPEN Government Act of 2007, Pub. L. No. 110-175. It is the applicant's responsibility to review FOIA and its exemptions to understand (1) what information may be subject to public disclosure and (2) what information applicants submit to the Government that are protected by law. In some cases, DOE may be unable to make an independent determination regarding which information submitted by an applicant is releasable and which is protected by an exemption. In such cases, DOE will consult with the applicant, in accordance with 10 C.F.R. §1004.11, to solicit the applicant's views on how the information should be treated.

F. 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.

G. Notice Regarding Eligible/Ineligible Activities

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

H. Notice of Right to Conduct a Review of Financial Capability

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

I. 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.

J. REQUIREMENT FOR FULL AND COMPLETE DISCLOSURE

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

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

K. RETENTION OF SUBMISSIONS

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

L. TITLE TO SUBJECT INVENTIONS

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

- Domestic Small Businesses, Educational Institutions, and Nonprofits: Under the Bayh-Dole Act (35 U.S.C. § 200 et seq.), domestic small businesses, educational institutions, and nonprofits may elect to retain title to their subject inventions.

  All other parties: The Federal Non Nuclear Energy Act of 1974, 42. U.S.C. 5908, provides that the Government obtains title to new inventions unless a waiver is granted (see below).

- Class Waiver: Under 42 U.S.C. § 5908, title to subject inventions vests in the U.S. Government and large businesses and foreign entities do not have the automatic right to elect to retain title to subject inventions. **EERE has an approved "class patent waiver" under which large businesses and foreign entities that meet certain stated requirements may elect to retain title to their subject inventions**. Under this determination, it will not be necessary for that entity to apply for a patent waiver. Please see Appendix D for a copy of the class patent waiver terms.

- Advance and Identified Waivers: Applicants may request a patent waiver that will cover subject inventions that may be invented under the award, in advance of or within 30 days after the effective date of the award. Even if an advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver for identified inventions, i.e., individual subject inventions that are disclosed to EERE within the timeframes set forth in the award's intellectual property

terms and conditions. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784.

- Determination of Exceptional Circumstances (DEC): EERE is considering the use of a blanket Determination of Exceptional Circumstances which, if used, would warrant the modification of the standard patent rights clause for small businesses and non-profit awardees under Bayh-Dole to the extent necessary to implement and enforce the Applicant's U.S. Manufacturing Plan (see section IV.D.13 of the FOA). For example, the commitments and enforcement of a U.S. Manufacturing Plan may be tied to subject inventions. Any Bayh-Dole entity affected by this DEC has the right to appeal it

M. GOVERNMENT RIGHTS IN SUBJECT INVENTIONS

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

1. GOVERNMENT USE LICENSE

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

2. MARCH-IN RIGHTS

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

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

- The owner or licensee has not taken or is not expected to take effective steps to achieve practical application of the invention within a reasonable time;
- The owner or licensee has not taken action to alleviate health or safety needs in a reasonably satisfied manner;
- The owner has not met public use requirements specified by Federal statutes in a reasonably satisfied manner; or
- The U.S. Manufacturing requirement has not been met.

Any determination that march-in rights are warranted must follow a fact-finding process in which the recipient has certain rights to present evidence and witnesses, confront witnesses and appear with counsel and appeal any adverse decision. To date, DOE has never exercised its march-in rights to any subject inventions.

N. 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.

Special Protected Data:
Government rights in Technical Data Produced Under Awards: The U.S. Government normally retains unlimited rights in technical data produced under Government financial assistance awards, including the right to distribute to the public. However, pursuant to special statutory authority, certain categories of data generated, under EERE awards may be protected from public disclosure for up to five (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 (i.e., non-protected data) must be inserted into the data clause in the award. In addition, invention disclosures may be protected from public disclosure for a reasonable time in order to allow for filing a patent application. **EERE intends to offer five (5) years of data protection for certain categories of data generated under selected awards as outlined above under this FOA.**

O. COPYRIGHT

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

P. PROTECTED PERSONALLY IDENTIFIABLE INFORMATION

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

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

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

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

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

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

- Social Security Numbers in any form
- Place of Birth associated with an individual
- Date of Birth associated with an individual
- Mother's maiden name associated with an individual
- Biometric record associated with an individual
- Fingerprint
- Iris scan
- DNA
- Medical history information associated with an individual
- Medical conditions, including history of disease
- Metric information, e.g. weight, height, blood pressure
- Criminal history associated with an individual
- 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 Technology Office describing a speaker)
- Academic credentials
- Schools attended
- Major or area of study
- Personal information stored by individuals about themselves on their assigned workstation or laptop unless it contains a Social Security Number

Q. ANNUAL COMPLIANCE AUDITS

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

If an educational institution, non-profit organization, or state/local government is a Prime Recipient or Sub-recipient and has expended greater than $500K of Federal funds in a respective fiscal year, then an A-133 audit is required. For additional information, please refer to OMB Circular A-133 through the link below.
http://www.whitehouse.gov/sites/default/files/omb/assets/omb/circulars/a133/a133.pdf

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

APPENDIX A – DEFINITIONS

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

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

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

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

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

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

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

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

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

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

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

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

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

"**EERE Exchange**" is the Department of Energy, Energy Efficiency and Renewable Energy's web system for posting Federal FOAs and receiving applications.
EERE Exchange website

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

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

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

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

"**Grant**" means a Financial Assistance instrument used by EERE to transfer money or property when the principal purpose of the transaction is to accomplish a public purpose of support or

stimulation authorized by Federal statute, and no Substantial Involvement is anticipated between EERE and the Applicant during the performance of the contemplated activity.

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

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

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

"**Marketing Partner Identification Number (MPIN)**" is a very important password designated by your organization when registering in SAM. The E-Business Point of Contact will need the MPIN to assign privileges to the individual(s) authorized to perform SAM transactions on behalf of your organization. The MPIN must have 9 digits containing at least one alpha character (must be in capital letters) and one number (no spaces or special characters permitted).

"**Modification**" means a revision to a FOA.

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

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

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

"**Project Team**" means the team which consists of the Prime Recipient, Sub-recipients, and others performing or otherwise supporting work under an EERE funding agreement.

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

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

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

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

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

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

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

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

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

"**Tribal Energy Resource Development Organization or Group**" means an "organization" of two or more entities, at least one of which is an Indian Tribe (see "Indian Tribe" above) that has the written consent of the governing bodies of all Indian Tribes participating in the organization to apply for a grant or loan, or other assistance under 25 U.S.C. § 3503.

APPENDIX B – COST SHARE INFORMATION

Cost Sharing or Cost Matching

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

How Cost Sharing Is Calculated

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

- Formula: Federal share ($) divided by Federal share (%) = Total Project Cost
  Example: $1,000,000 divided by 80% = $1,250,000

- Formula: Total Project Cost ($) minus Federal share ($) = Non-federal share ($)
  Example: $1,250,000 minus $1,000,000 = $250,000

- Formula: Non-federal share ($) divided by Total Project Cost ($) = Non-federal share (%)
  Example: $250,000 divided by $1,250,000 = 20%

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

What Qualifies For Cost Sharing

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

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

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

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

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

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

DOE Financial Assistance Rules (10 CFR 600)

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

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

(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 cost principles in 48 CFR Part 31 in the Federal Acquisition Regulation, except that patent prosecution costs are not allowable unless specifically authorized in the award document. (v) Commercial Organizations. FAR Subpart 31.2—Contracts with Commercial Organizations

b. Other types of organizations. Allowability of costs incurred by other types of organizations that may be Sub-recipients 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.

APPENDIX C – SAMPLE COST SHARE CALCULATION FOR BLENDED COST SHARE PERCENTAGE

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

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

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

Each task must be calculated individually as follows:

Task 1
$1,000,000 divided by 80% = $1,250,000 (Task 1 Cost)
Task 1 Cost minus federal share = Non-federal share
$1,250,000 - $1,000,000 = $250,000 (Non-federal share)

Task 2
$500,000 divided 80% = $625,000 (Task 2 Cost)
Task 2 Cost minus federal share = Non-federal share
$625,000 - $500,000 = $125,000 (Non-federal share)

Task 3
$400,000 / 50% = $800,000 (Task 3 Cost)
Task 3 Cost minus federal share = Non-federal share
$800,000 - $400,000 = $400,000 (Non-federal share)

Task 4
Federal share = $100,000
Non-federal cost share is not mandated for outreach = $0 (Non-federal share)

The calculation may then be completed as follows:

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

Blended Cost Share %
Non-federal share ($775,000) divided by Total Project Cost ($2,775,000) = 27.9% (Non-federal)
Federal share ($2,000,000) divided by Total Project Cost ($2,775,000) = 72.1% (Federal)

APPENDIX D – PATENT RIGHTS - WAIVER AS MODIFIED BY 10 C.F.R. 784, DOE PATENT WAIVER REGULATIONS

(a) Definitions.
As used in this clause:

Background patent means a domestic patent covering an invention or discovery which is not a Subject Invention and which is owned or controlled by the Contractor at any time through the completion of this contract:

(i) Which the Contractor, but not the Government, has the right to license to others without obligation to pay royalties thereon, and

(ii) Infringement of which cannot reasonably be avoided upon the practice of any specific process, method, machine, manufacture or composition of matter (including relatively minor modifications thereof) which is a subject of the research, development, or demonstration work performed under this contract.

Contract means any contract, grant, agreement, understanding, or other arrangement, which includes research, development, or demonstration work, and includes any assignment or substitution of parties.

DOE patent waiver regulations means the Department of Energy patent waiver regulations at 10 CFR Part 784.

Invention as used in this clause, means any invention or discovery which is or may be patentable or otherwise protectable under Title 35 of the United States Code or any novel variety of plant that is or may be protectable under the Plant Variety Protection Act (7 U.S.C. 2321 et seq.).

Made when used in relation to any invention means the conception or first actual reduction to practice of such invention.

Nonprofit organization means a university or other institution of higher education or an organization of the type described in section 501(c)(3) of the Internal Revenue Code of 1954 (26 U.S.C. 501(c)) and exempt from taxation under section 501(a) of the Internal Revenue Code (26 U.S.C. 501(a)) or any nonprofit scientific or educational organization qualified under a state nonprofit organization statute.

Patent Counsel means the Department of Energy Patent Counsel assisting the procuring activity.

Practical application means to manufacture, in the case of a composition or product; to practice, in the case of a process or method; or to operate, in the case of a machine or system; and, in each case, under such conditions as to establish that the invention is being utilized and that its benefits are, to the extent permitted by law or Government regulations, available to the public on reasonable terms.

Secretary means the Secretary of Energy.

Small business firm means a small business concern as defined at Section 2 of the Pub. L. 85-536 (15 U.S.C. 632) and implementing regulations of the Administrator of the Small Business Administration. For the purpose of this clause, the size standards for small business concerns involved in Government procurement and subcontracting at 13 CFR 121.3-8 and 13 CFR 121.3-12, respectively, will be used.

Subject invention means any invention of the Contractor conceived or first actually reduced to practice in the course of or under this contract, provided that in the case of a variety of plant, the date of determination (as defined in section 41(d) of the Plant Variety Protection Act (7 U.S.C. 2401(d)) must also occur during the period of contract performance.

(b) Allocation of principal rights.

Whereas DOE has granted a waiver of rights to subject inventions to the Contractor, the Contractor may elect to retain the entire right, title, and interest throughout the world to each subject invention subject to the provisions of this clause and 35 U.S.C. ''202 and 203. With respect to any subject invention in which the Contractor elects to retain title, the Federal Government shall have a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States the subject invention throughout the world.

(c) Invention disclosure, election of title, and filing of patent applications by Contractor.

(1) The Contractor shall disclose each subject invention to the Patent Counsel within six months after conception or first actual reduction to practice, whichever occurs first in the course of or under this contract, but in any event, prior to any sale, public use, or public disclosure of such invention known to the Contractor. The disclosure to the Patent Counsel shall be in the form of a written report and shall identify the inventors and the contract under which the invention was made. It shall be sufficiently complete in technical detail to convey a clear understanding, to the extent known at the time of the disclosure, of the nature, purpose, operation, and physical, chemical, biological, or electrical characteristics of the invention. The disclosure shall also identify any publication, on sale, or public use of the invention and whether a manuscript describing the invention has been submitted for publication and, if so, whether it has been accepted for publication at the time of disclosure. In addition, after disclosure to the Patent Counsel, the Contractor shall promptly notify the Patent Counsel of the acceptance of any manuscript describing the invention for publication or of any on sale or public use planned by the Contractor.

(2) The Contractor shall elect in writing whether or not to retain title to any such invention by notifying the Patent Counsel at the time of disclosure or within 8 months of disclosure, as to those countries (including the United States) in which the Contractor will retain title; provided, that in any case where publication, on sale, or public use has initiated the 1-year statutory period wherein valid patent protection can still be obtained in the United States, the period of election of title may be shortened by the Agency to a date that is no more than 60 days prior to the end of the statutory period. The Contractor shall notify the Patent Counsel as to those countries (including the United States) in which the Contractor will retain title not later than 60 days prior to the end of the statutory period.

(3) The Contractor shall file its United States patent application on an elected invention within 1 year after election, but not later than at least 60 days prior to the end of any statutory period wherein valid patent protection can be obtained in the United States after a publication, on sale, or public use. The Contractor shall file patent applications in additional countries (including the European Patent Office and under the Patent Cooperation Treaty) within either 10 months of the corresponding initial patent application or 6 months from the date permission

is granted by the Commissioner of Patents and Trademarks to file foreign patent applications where foreign filing has been prohibited by a Secrecy Order.

(4) Requests for extension of the time for disclosure to the Patent Counsel, election, and filing may, at the discretion of DOE, be granted, and will normally be granted unless the Patent Counsel has reason to believe that a particular extension would prejudice the Government's interest.

(d) Conditions when the Government may obtain title notwithstanding an existing waiver.

The Contractor shall assign and hereby assigns to DOE, upon written request from DOE, title to any subject invention--

(1) If the Contractor elects not to retain title to a subject invention;

(2) If the Contractor fails to disclose or elect the subject invention within the times specified in paragraph (c) of this clause (provided that DOE may only request title within 60 days after learning of the Contractor's failure to report or elect within the specified times);

(3) In those countries in which the Contractor fails to file patent applications within the times specified in paragraph (c) of this clause; provided, however, that if the Contractor has filed a patent application in a country after the times specified in paragraph (c) of this clause, but prior to its receipt of the written request of DOE, the Contractor shall continue to retain title in that country;

(4) In any country in which the Contractor decides not to continue the prosecution of any application for, to pay the maintenance fees on, or defend in reexamination or opposition proceeding on, a patent on a subject invention;

(5) If the waiver authorizing the use of this clause is terminated as provided in paragraph (p) of this clause; or

(6) Upon breach of paragraph (h) or paragraph (t) of this clause.

(e) Minimum rights to Contractor when the Government retains title.

(1) The Contractor shall retain a nonexclusive, royalty-free license throughout the world in each subject invention to which the Government obtains title under paragraph (d) of this clause except if the Contractor fails to disclose the subject invention within the times specified in paragraph (c) of this clause or breaches paragraph (h) or (t). The Contractor's license extends to its domestic subsidiaries and affiliates, if any, within the corporate structure of which the Contractor is a part and includes the right to grant sublicenses of the same scope to the extent the Contractor was legally obligated to do so at the time the contract was awarded. The license is transferable only with the approval of DOE except when transferred to the successor of that part of the Contractor's business to which the invention pertains.

(2) The Contractor's domestic license may be revoked or modified by DOE to the extent necessary to achieve expeditious practical application of the subject invention pursuant to an application for an exclusive license submitted in accordance with applicable provisions in 37 CFR part 404 and DOE licensing regulations. This license shall not be revoked in that field of use or the geographical areas in which the Contractor has achieved practical application and continues to make the benefits of the invention reasonably accessible to the public. The license in any foreign country may be revoked or modified at the discretion of DOE to the extent the Contractor, its licensees, or its domestic subsidiaries or affiliates have failed to achieve practical application in that foreign country.

(3) Before revocation or modification of the license, DOE shall furnish the Contractor a written notice of its intention to revoke or modify the license, and the Contractor shall be allowed 30 days (or such other time as may be authorized by DOE for good cause shown by the Contractor) after the notice to show cause why the license should not be revoked or modified. The Contractor has the right to appeal, in accordance with applicable agency licensing regulations and 37 CFR part 404 concerning the licensing of Government-owned inventions, any decision concerning the revocation or modification of its license.

(f) Contractor action to protect the Government's interest.

(1) The Contractor agrees to execute or to have executed and promptly deliver to DOE all instruments necessary to:

(i) establish or confirm the rights the Government has throughout the world in those subject inventions to which the Contractor elects to retain title, and

(ii) convey title to DOE when requested under paragraphs (d) and (n)(2) of this clause, and to enable the Government to obtain patent protection throughout the world in that subject invention.

(2) The Contractor agrees to require, by written agreement, its employees, other than clerical and nontechnical employees, to disclose promptly in writing to personnel identified as responsible for the administration of patent matters and in a format suggested by the Contractor each subject invention made under contract in order that the Contractor can comply with the disclosure provisions of paragraph (c) of this clause, and to execute all papers necessary to file patent applications on subject inventions and to establish the Government's rights in the subject inventions. This disclosure format should require, as a minimum, the information required by paragraph (c)(1) of this clause. The Contractor shall instruct such employees through employee agreements or other suitable educational programs on the importance of reporting inventions in sufficient time to permit the filing of patent applications prior to U.S. or foreign statutory bars.

(3) The Contractor shall notify DOE of any decision not to continue the prosecution of a patent application, pay maintenance fees, or defend in a reexamination or opposition proceeding on a patent, in any country, not less than 30 days before the expiration of the response period required by the relevant patent office.

(4) The Contractor agrees to include, within the specification of any United States patent application and any patent issuing thereon covering a subject invention, the following statement: "This invention was made with Government support under (identify the contract) awarded by DOE. The Government has certain rights in this invention."

(5) The Contractor shall establish and maintain active and effective procedures to assure that subject inventions are promptly identified and disclosed to Contractor personnel responsible for patent matters within 6 months of conception and/or first actual reduction to practice, whichever occurs first in the course of or under this contract. These procedures shall include the maintenance of laboratory notebooks or equivalent records and other records as are reasonably necessary to document the conception and/or the first actual reduction to practice of subject inventions, and records that show that the procedures for identifying and disclosing the inventions are followed. Upon request, the Contractor shall furnish the Patent Counsel a description of such procedures for evaluation and for determination as to their effectiveness.

(6) The Contractor agrees, when licensing a subject invention, to arrange to avoid royalty charges on acquisitions involving Government funds, including funds derived through Military Assistance Program of the Government or otherwise derived through the Government; to refund any amounts received as royalty charges on the subject invention in acquisitions for, or on behalf of, the Government; and to provide for such refund in any instrument transferring rights in the invention to any party.

(7) The Contractor shall furnish the Patent Counsel the following:

(i) Interim reports every 12 months (or such longer period as may be specified by the Patent Counsel) from the date of the contract, listing subject inventions during that period and certifying that all subject inventions have been disclosed or that there are no such inventions.

(ii) A final report, within 3 months after completion of the contracted work, listing all subject inventions or certifying that there were no such inventions, and listing all subcontracts at any tier containing a patent rights clause or certifying that there were no such subcontracts.

(8) The Contractor shall promptly notify the Patent Counsel in writing upon the award of any subcontract at any tier containing a patent rights clause by identifying the subcontractor, the applicable patent rights clause, the work to be performed under the subcontract, and the

dates of award and estimated completion. Upon request of the Patent Counsel, the Contractor shall furnish a copy of such subcontract, and no more frequently than annually, a listing of the subcontracts that have been awarded.

(9) The Contractor shall provide, upon request, the filing date, serial number and title, a copy of the patent application (including an English-language version if filed in a language other than English), and patent number and issue date for any subject invention for which the Contractor has retained title.

(10) Upon request, the Contractor shall furnish the Government an irrevocable power to inspect and make copies of the patent application file.

(g) Subcontracts.

(1) Unless otherwise directed by the Contracting Officer, the Contractor shall include the clause at 48 CFR 952.227-11, suitably modified to identify the parties, in all subcontracts, regardless of tier, for experimental, developmental, or research work to be performed by a small business firm or nonprofit organization, except where the work of the subcontract is subject to an Exceptional Circumstances Determination by DOE. In all other subcontracts, regardless of tier, for experimental, developmental, demonstration, or research work, the Contractor shall include the patent rights clause at 48 CFR 952.227-13 (suitably modified to identify the parties).

(2) The Contractor shall not, as part of the consideration for awarding the subcontract, obtain rights in the subcontractor's subject inventions.

(3) In the case of subcontractors at any tier, the Department, the subcontractor, and Contractor agree that the mutual obligations of the parties created by this clause constitute a contract between the subcontractor and the Department with respect to those matters covered by this clause.

(4) The Contractor shall promptly notify the Contracting Officer in writing upon the award of any subcontract at any tier containing a patent rights clause by identifying the subcontractor, the applicable patent rights clause, the work to be performed under the subcontract, and the dates of award and estimated completion. Upon request of the Contracting Officer, the Contracting Officer shall furnish a copy of such subcontract, and, no more frequently than annually, a listing of the subcontracts that have been awarded.

(h) Reporting on utilization of subject inventions.

(1) The Contractor agrees to submit on request periodic reports no more frequently than annually on the utilization of each waived subject invention or on efforts at obtaining such utilization that are being made by the Contractor and any of its licensees or

assignees including compliance with paragraph (t) of this clause. Each report shall include information regarding the status of development, date of first commercial sale or use, products that embody or are made through the use of the waived subject invention, manufacturing locations of such products and such other data and information as DOE may reasonably specify. The report shall further include a certification from the Contractor that the Contractor, including its licensees, is in compliance with the requirements of this clause.

(2) The Contractor also agrees to provide additional reports as may be requested by DOE in connection with any march-in proceedings undertaken by DOE in accordance with paragraph (j) of this clause.

(3) To the extent data or information supplied under this paragraph is considered by the Contractor, its licensee or assignee to be privileged and confidential and is so marked, DOE agrees that, to the extent permitted by law, it shall not disclose such information to persons outside the Government.

(i) Preference for United States industry.

Notwithstanding any other provision of this clause, the Contractor agrees that neither it nor any assignee will grant to any person the exclusive right to use or sell any subject invention in the United States unless such person agrees that any products embodying the subject invention will be manufactured substantially in the United States. However, in individual cases, the requirement for such an agreement may be waived by DOE upon a showing by the Contractor or its assignee that reasonable but unsuccessful efforts have been made to grant licenses on similar terms to potential licensees that would be likely to manufacture substantially in the United States or that under the circumstances domestic manufacture is not commercially feasible.

(j) March-in rights.

The Contractor agrees that with respect to any subject invention in which it has acquired title, DOE has the right in accordance with the procedures in 48 CFR 27.304-1(g) to require the Contractor, an assignee, or exclusive licensee of a subject invention to grant a nonexclusive, partially exclusive, or exclusive license in any field of use to a responsible applicant or applicants, upon terms that are reasonable under the circumstances, and if the Contractor, assignee, or exclusive licensee refuses such a request, DOE has the right to grant such a license itself if DOE determines that--

(1) Such action is necessary because the Contractor or assignee has not taken, or is not expected to take within a reasonable time, effective steps to achieve practical application of the subject invention in such field of use;

(2) Such action is necessary to alleviate health or safety needs which are not reasonably satisfied by the Contractor, assignee, or their licensees;

(3) Such action is necessary to meet requirements for public use specified by Federal regulations and such requirements are not reasonably satisfied by the Contractor, assignee, or licensees; or

(4) Such action is necessary because the agreement required by paragraph (i) of this clause has not been obtained or waived or because a licensee of the exclusive right to use or sell any subject invention in the United States is in breach of such agreement.

(k) Background Patents [reserved]

(l) Communications.

All reports and notifications required by this clause shall be submitted to the Patent Counsel unless otherwise instructed.

(m) Other inventions.

Nothing contained in this clause shall be deemed to grant to the Government any rights with respect to any invention other than a subject invention, except with respect to Background Patents, above.

(n) Examination of records relating to inventions.

(1) The Contracting Officer or any authorized representative shall, until 3 years after final payment under this contract, have the right to examine any books (including laboratory notebooks), records, and documents of the Contractor relating to the conception or first actual reduction to practice of inventions in the same field of technology as the work under this contract to determine whether--

(i) Any such inventions are subject inventions;

(ii) The Contractor has established and maintains the procedures required by paragraphs (f)(2) and (f)(5) of this clause; and

(iii) The Contractor and its inventor have complied with the procedures.

(2) If the Contracting Officer determines that an inventor has not disclosed a subject invention to the Contractor in accordance with the procedures required by paragraph (f)(5) of this clause, the Contracting Officer may, within 60 days after the determination, request title in accordance with paragraphs (d)(2) and (d)(3) of this clause. However, if the Contractor

establishes that the failure to disclose did not result from the Contractor's fault or negligence, the Contracting Officer shall not request title.

(3) If the Contracting Officer learns of an unreported Contractor invention which the Contracting Officer believes may be a subject invention, the Contractor may be required to disclose the invention to DOE for a determination of ownership rights.

(4) Any examination of records under this paragraph shall be conducted in such a manner as to protect the confidentiality of the information involved.

(o) Withholding of payment.
NOTE: This paragraph does not apply to subcontracts or grants.

(1) Any time before final payment under this contract, the Contracting Officer may, in the Government's interest, withhold payment until a reserve not exceeding $50,000 or 5 percent of the amount of the contract, whichever is less, shall have been set aside if, in the Contracting Officer's opinion, the Contractor fails to--

(i) Establish, maintain, and follow effective procedures for identifying and disclosing subject inventions pursuant to paragraph (f)(5) of this clause;

(ii) Disclose any subject invention pursuant to paragraph (c)(1) of this clause;

(iii) Deliver acceptable interim reports pursuant to paragraph (f)(7)(I) of this clause;

(iv) Provide the information regarding subcontracts pursuant to paragraph (f)(6) of this clause; or

(v) Convey to the Government, using a DOE-approved form, the title and/or rights of the Government in each subject invention as required by this clause.

(2) Such reserve or balance shall be withheld until the Contracting Officer has determined that the Contractor has rectified whatever deficiencies exist and has delivered all reports, disclosures, and other information required by this clause.

(3) Final payment under this contract shall not be made before the Contractor delivers to the Patent Counsel all disclosures of subject inventions required by paragraph (c)(1) of this clause, an acceptable final report pursuant to paragraph (f)(7)(ii) of this clause, and all past due confirmatory instruments, and the Patent Counsel has issued a patent clearance certification to the Contracting Officer.

(4) The Contracting Officer may decrease or increase the sums withheld up to the maximum authorized above. If the maximum amount authorized above is already being withheld under other provisions of the contract, no additional amount shall be withheld under this paragraph. The withholding of any amount or the subsequent payment thereof shall not be construed as a waiver of any Government right.

(p) Waiver Terminations.

Any waiver granted to the Contractor authorizing the use of this clause (including any retention of rights pursuant thereto by the Contractor under paragraph (b) of this clause) may be terminated at the discretion of the Secretary or his designee in whole or in part, if the request for waiver by the Contractor is found to contain false material statements or nondisclosure of material facts, and such were specifically relied upon by DOE in reaching the waiver determination or the cost share requirement as set forth in the applicable statement of considerations is not met. Prior to any such termination, the Contractor will be given written notice stating the extent of such proposed termination and the reasons therefor, and a period of 30 days, or such longer period as the Secretary or his designee shall determine for good cause shown in writing, to show cause why the waiver of rights should not be so terminated. Any waiver termination shall be subject to the Contractor's minimum license as provided in paragraph (e) of this clause.

(q) Atomic Energy.

No claim for pecuniary award or compensation under the provisions of the Atomic Energy Act of 1954, as amended, shall be asserted by the Contractor or its employees with respect to any invention or discovery made or conceived in the course of or under this contract.

(r) Publication.

It is recognized that during the course of work under this contract, the contractor or its employees may from time to time desire to release or publish information regarding scientific or technical developments conceived or first actually reduced to practice in the course of or under this contract. In order that public disclosure of such information will not adversely affect the patent interests of DOE or the contractor, approval for release of publication shall be secured from Patent Counsel prior to any such release or publication. In appropriate circumstances, and after consultation with the contractor, Patent Counsel may waive the right of prepublication review.

(s) Forfeiture of rights in unreported subject inventions.

(1) The contractor shall forfeit and assign to the Government, at the request of the Secretary of Energy or designee, all rights in any subject invention which the contractor fails to report to Patent Counsel within six months after the time the contractor:

(i) Files or causes to be filed a United States or foreign patent application thereon; or

(ii) Submits the final report required by paragraph (f)(7)(ii) of this clause, whichever is later.

(2) However, the Contractor shall not forfeit rights in a subject invention if, within the time specified in paragraph (n)(1) of this clause, the contractor:

(i) Prepares a written decision based upon a review of the record that the invention was neither conceived nor first actually reduced to practice in the course of or under the

contract and delivers the decision to Patent Counsel, with a copy to the Contracting Officer; or
(ii) Contending that the subject invention is not a subject invention, the contractor nevertheless discloses the subject invention and all facts pertinent to this contention to the Patent Counsel, with a copy to the Contracting Officer, or
(iii) Establishes that the failure to disclose did not result from the contractor's fault or negligence.

(3) Pending written assignment of the patent application and patents on a subject invention determined by the Contracting Officer to be forfeited (such determination to be a Final Decision under the Disputes clause of this contract), the contractor shall be deemed to hold the invention and the patent applications and patents pertaining thereto in trust for the Government. The forfeiture provision of this paragraph shall be in addition to and shall not supersede any other rights and remedies which the Government may have with respect to subject inventions.

(t) U. S. Competitiveness

The Contractor agrees that any products embodying any waived invention or produced through the use of any waived invention will be manufactured substantially in the United States unless the Contractor can show to the satisfaction of the DOE that it is not commercially feasible to do so. In the event the DOE agrees to foreign manufacture, there will be a requirement that the Government's support of the technology be recognized in some appropriate manner, e.g., recoupment of the Government's investment, etc. The Contractor further agrees to make the above condition binding on any assignee or licensee or any entity otherwise acquiring rights to any waived invention, including subsequent assignees or licensees. Should the Contractor or other such entity receiving rights in the invention undergo a change in ownership amounting to a controlling interest, then the waiver, assignment, license, or other transfer of rights in the waived invention is suspended until approved in writing by the DOE.

(End of clause)