

DEPARTMENT OF ENERGY (DOE)
OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY (EERE)

**NEXT GENERATION ELECTRIC MACHINES:
MEGAWATT CLASS MOTORS**

Funding Opportunity Announcement (FOA) Number: DE-FOA-0001208
FOA Type: Initial
CFDA Number: 81.087

FOA Issue Date:	03/18/2015
Informational Webinar	04/01/2015 1:00 pm (ET)
Submission Deadline for Concept Papers:	04/16/2015 5:00 pm (ET)
Submission Deadline for Full Applications:	06/03/2015 5:00 pm (ET)
Submission Deadline for Replies to Reviewer Comments:	07/02/2015 5:00 pm (ET)
Expected Date for EERE Selection Notifications:	August 2015
Expected Timeframe for Award Negotiations	August 2015 – November 2015

- 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 ("FOA FAQs") can be found at <https://eere-exchange.energy.gov> under the "FOA Documents" section for this specific FOA.
- 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.

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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 Amount to be Awarded	Approximately \$20 million
Average Award Amount	EERE anticipates making awards for projects that are currently at Technology Readiness Levels (TRL) 4 or below (see Appendix D) that range from \$3,000,000 to \$5,000,000 not including the cost share. In exceptional cases where opportunity for innovation and impact is very high, a \$6,000,000 single award may be considered. EERE expects the TRL will improve to 6 and beyond at the end of the program.
Types of Funding Agreements	Cooperative Agreements, Work Authorizations, and Interagency Agreements
Period of Performance	24 to 36 months
Eligible Applicants	Individuals, Domestic Entities, Foreign Entities, Incorporated Consortia, Unincorporated Consortia, subject to the definitions in Section III.A.
Cost Share Requirement	A minimum of 20% of Total Project Costs
Submission of Multiple Applications	Applicants may only submit one Concept Paper and one Full Application for consideration under this FOA. If an applicant submits more than one Concept Paper or Full Application, EERE will only consider the last timely submission for evaluation. Any other submissions received listing the same applicant will be considered non-compliant and not eligible for further consideration. This limitation does not prohibit an applicant from collaborating on other applications (e.g., as a potential Subrecipient or partner) so long as the entity is only listed as the Prime Applicant on one Concept Paper and Full Application submitted under this FOA.
Application Forms	Required forms and templates for Full Applications are available on EERE Exchange at https://eere-Exchange.energy.gov .
FOA Summary	Manufacturing is critical to future U.S. innovation, global economic competitiveness, and job growth, particularly the manufacture of clean energy products. But U.S. manufacturing also has an annual energy bill of about \$200 billion, accounts for roughly one-third of U.S. primary energy use, and generates a corresponding significant amount of greenhouse gas (GHG) emissions. ¹ AMO uses financial opportunities to develop high-impact, cross cutting manufacturing and materials technologies thereby reducing both the energy footprint and associated GHG emissions from manufacturing. The Next Generation Electric Machines (NGEM) program is an RD&D effort leveraging recent technology advancements in power electronics and motors to develop a new generation of energy efficient, high power density, high speed integrated MV drive systems for a wide variety of critical energy applications. This specific Financial

¹ Annual Energy Outlook 2014: Reference Case Data, U.S. Energy Information Administration, available from: <http://www.eia.gov/forecasts/aeo/data.cfm>

	Opportunity Announcement (FOA) is focused on developing medium voltage (MV) integrated drive systems that leverage the benefits of state of the art power electronics (i.e., wide band gap devices) with high RPM, high power density and energy efficient megawatt (MW) class electric motors in three primary areas: (1) chemical and petroleum refining industries; (2) natural gas infrastructure; and (3) general industrial applications.
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I. FUNDING OPPORTUNITY DESCRIPTION

A. DESCRIPTION/BACKGROUND

Manufacturing is the use of energy, equipment, information, services, and capital to convert raw materials, components, and parts into goods that meet market expectations. As an economic sector, manufacturing generates 12 percent of U.S. Gross Domestic Product (GDP) and employs 12 million Americans. The DOE Office of Energy Efficiency and Renewable Energy's Advanced Manufacturing Office (AMO) makes research, development, and demonstration (RD&D) investments in advanced manufacturing process and materials technologies. These technologies are foundational, pervasive, and promise crosscutting industrial applications and impact in reducing industry's energy footprint and greenhouse gas (GHG) emissions, as well as supporting the global competitiveness of clean energy products. By targeting the development of energy-related advanced manufacturing technology, AMO's work can create completely new supply chains and stimulate significant economic growth and job creation.

AMO's Next Generation Electric Machines (NGEM) program is an RD&D effort leveraging recent technology advancements in power electronics and electric motors to develop a new generation of energy efficient, high power density, high speed, integrated MV drive systems for a wide variety of critical energy applications. Improvements to these systems can be realized through the application of key enabling technologies, such as wide bandgap devices, advanced magnetic materials, improved insulation materials, aggressive cooling techniques, high speed bearing designs, and improved conductors or superconducting materials. Through this development program, NGEM will facilitate a step-change that enables more efficient use of electricity, as well as reduced drive system size and weight, developing lasting capabilities for motor material development, design, and analysis that are cost-shared with industry stakeholders.

This specific Funding Opportunity Announcement (FOA) is focused on developing MV integrated drive systems that leverage the benefits of state of the art power electronics (i.e., wide band gap devices) with energy efficient, high speed, direct drive, megawatt (MW) class electric motors for efficiency and power density improvements in three primary areas: (1) chemical and petroleum refining industries; (2) natural gas infrastructure; and (3) general industrial applications. These application areas represent a significant number of motor installations, a large amount of electrical energy consumption, and significant opportunities for U.S. technology and manufacturing competitiveness.

In 2013, electricity accounted for approximately 40% of primary energy consumption in the United States and manufacturing was responsible for more than a quarter of end-use

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electricity.² In addition, electricity use at industrial sites is projected to increase by 30% between 2013 and 2040.³ Industrial electric motor systems are employed in a wide range of applications including fans, pumps, compressors, grinding mills, metal rolling, mine hoists, and refineries. Electric motor-driven systems used 68% of this total electricity for essential energy-intensive industrial processes such as refrigeration, pumps, fans, compressors, materials handling, materials processing, and facility HVAC systems.⁴

Advances in integrated power electronics have the potential to develop a new generation of energy efficient, high power density, high speed motors and generators and, in turn, save significant energy. See Table 1 below and further detail later in this section.

Motor Population	Potential Energy Savings Opportunity (% of U.S. end use electricity load)
U.S. industrial motor systems (all sizes & applications)	3.3% to 8.9%
U.S. industrial motor systems (>500 HP, all applications)	1.2% to 3.2%
U.S. industrial motor systems (>1000 HP, i.e., MW Class, all applications)	0.7% to 1.8%

Table 1: *Potential energy savings opportunity from variable speed drive (VSD) deployment in U.S. industrial motor systems.*

Total Industrial Motor Population in U.S.

Fig. 1, from DOE's 2002 electric motor market study and the most recent data currently available, shows the distribution of industrial motors (Table 1-13 in Figure 1) and associated energy consumption (Table 1-14 in Figure 1) in the U.S. by units and horsepower size.⁵

² U.S. Energy Information Administration, *Monthly Energy Review June 2014* (Washington, DC: U.S. Department of Energy, 2012), <http://www.eia.gov/totalenergy/data/monthly/previous.cfm#2014>.

³ "Annual Energy Outlook 2014 with Projections to 2040", U.S. Energy Information Administration (2014), <http://www.eia.gov/oiaf/aeo/tablebrowser/#release=AE02014&subject=0-AE02014&table=2-AE02014®ion=1-0&cases=ref2014-d102413a>.

⁴ Advanced Manufacturing Office calculation: In 2010, 2,841 TBtu of electricity was consumed for process and nonprocess end uses, as shown in the DOE/AMO Manufacturing Energy and Carbon Footprint. Of this total, 68% is estimated to be used for machine driven systems. This includes 1,485 TBtu to "Machine Drive", 212 TBtu to "Process Cooling and Refrigeration", and 241 TBtu to "Facility HVAC". $(1485 + 212 + 241)/2841 = 68.2\%$, http://energy.gov/sites/prod/files/2014/02/f7/2014_all_manufacturing_energy_carbon_footprint.pdf.

⁵ "United States Industrial Electric Motor Systems Market Opportunities Assessment," U.S. Department of Energy Office of Energy Efficiency and Renewable Energy (2002), https://www1.eere.energy.gov/manufacturing/tech_assistance/pdfs/mtrmkt.pdf.

Table 1-13: Distribution of Motor Population by Horsepower Size: Manufacturing Number of Units in Service

Motor Horsepower	28 Chem	26 Paper	33 Metals	29 Petrol.	20 Food	Other	All SICs Percent	All SICs Number
1-5	42.4%	52.2%	55.0%	32.0%	65.8%	63.9%	58.8%	7,306,080
6-20	30.0%	22.3%	26.1%	38.6%	22.6%	25.6%	26.4%	3,288,035
21-50	14.5%	13.0%	10.7%	18.9%	6.2%	7.2%	9.1%	1,129,527
51-100	5.9%	6.3%	3.5%	6.2%	2.4%	1.9%	2.9%	363,940
101-200	4.1%	3.1%	2.1%	2.8%	1.8%	1.2%	1.8%	220,908
201-500	2.2%	2.0%	1.7%	1.0%	0.9%	0.2%	0.7%	86,836
501-1000	0.6%	0.9%	0.7%	0.3%	0.4%	0.0%	0.2%	28,047
1000+	0.4%	0.3%	0.3%	0.2%	0.0%	0.0%	0.1%	10,958
All Sizes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	12,434,330

Table 1-14: Distribution of Motor System Energy by Horsepower Size: Manufacturing

Motor Horsepower	28 Chem	26 Paper	33 Metals	29 Petrol.	20 Food	Other	All SICs Percent	All SICs Number
1-5	1.6%	1.9%	3.8%	1.0%	9.6%	10.4%	4.8%	27,807
6-20	6.4%	4.5%	6.7%	5.9%	14.7%	20.7%	10.4%	60,122
21-50	9.1%	8.8%	9.6%	12.4%	15.6%	19.8%	12.7%	73,111
51-100	9.3%	13.3%	9.9%	12.2%	13.4%	17.0%	12.7%	72,924
101-200	14.3%	12.7%	12.4%	13.9%	15.5%	16.9%	14.4%	83,099
201-500	18.1%	19.6%	19.4%	16.1%	13.6%	9.4%	15.8%	90,819
501-1000	13.7%	20.6%	19.8%	11.0%	14.7%	5.3%	13.4%	77,238
1000+	27.5%	18.5%	18.3%	27.4%	2.9%	0.5%	15.7%	90,307
All Sizes	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	575,428

Fig. 1: Distribution of manufacturing motor population (Table 1-13) and energy consumption (Table 1-14) in the U.S. by units and horsepower size.⁵

From the “All SICs⁶ Percent” columns in these tables, we observe that large motors with greater than 100 HP (i.e., > 0.075 MW) consumed approximately 59% of industrial energy, or approximately 10% of the total end use electricity load, used by electric motors.^{7,8} This is despite these motors only numbering 2.8% of all industrial motors. Similarly, very large motors with greater than 1000 HP (i.e., > 0.75 MW, often loosely termed as the MW class) consumed 15.7% of industrial energy consumption by electric motors, despite these motors only numbering 0.1% of all industrial motors. These large (> 100 HP) to very large (> 1000 HP) motors use either fixed or variable speed drives (VSDs) connected as either standalone motors or tightly integrated with driven mechanical equipment, such as in compressor-integrated high-speed motors. Typically, a motor running at fixed speed, without a VSD to control its speed according to the load requirements, can potentially waste 30% to 80% of energy in mechanical throttles located upstream from the compressor and downstream from the pump.⁵

⁶ SIC: The Standard Industrial Classification (SIC) was a system for classifying industries by a four-digit code. It was used by government agencies to classify industry areas. NAICS replaced the Standard Industrial Classification (SIC) system in 1997. See https://www.osha.gov/pls/imis/sic_manual.html.

⁷ Advanced Manufacturing Office calculation: In 2013, 3.26 quads (26%) of onsite energy electricity were used in the industrial sector, of the 12.6 quads of total U.S. electric load. To estimate the percentage of electricity used by motors with size greater than 100 HP in manufacturing, (% electricity in industrial sector) x (% electricity used in motor drives systems in industrial sector) x (% of motor drive energy consumed by >100 HP motors). 26% x 68% x 59% = 10.4% (or more conservatively 10%). See:

https://flowcharts.llnl.gov/content/energy/energy_archive/energy_flow_2013/2013USEnergy.png.

⁸ DOE Lawrence Livermore National Laboratory, Estimated U.S. Energy Use in 2013, https://flowcharts.llnl.gov/content/energy/energy_archive/energy_flow_2013/2013USEnergy.png.

Potential Savings: VSD Deployment in Industrial Motor Systems (all sizes)

Further, Fig. 2 below shows the distribution of manufacturing motors in the U.S. that have good potential for VSD application.⁵ It shows 70% of total motor systems energy is available for VSD integration. Thus, 90% deployment of VSDs to motors used in these applications throughout the industrial sector would present an energy savings opportunity of up to 3.3% to 8.9% of total U.S. electricity consumption.⁹

Table 1-24: Distribution of Motor Systems with Good Potential for ASD Application

HP Category	Total	AC Motor Systems with No ASD, 2000+ Hours over 20 HP				
		All Applications	Fans	Pumps	Air Comp.	Other
Units						
1-5	7,306,080					
6-20	3,288,035					
21-50	1,129,527	500,058	73,969	135,654	91,807	198,629
51-100	363,940	176,662	17,509	56,745	24,621	77,787
101-200	220,908	104,406	18,417	17,269	18,122	50,598
201-500	86,836	41,897	1,958	8,526	11,916	19,496
501-1000	28,047	10,426	1,224	1,046	1,208	6,947
1000+	10,958	5,294	425	1,063	2,360	1,446
Total	12,434,330	838,744	113,502	220,304	150,034	354,904
Energy: GWh/Year						
1-5	27,807					
6-20	60,122					
21-50	73,111	60,331	9,807	22,433	7,321	20,770
51-100	72,924	61,044	8,020	23,616	5,752	23,656
101-200	83,099	68,559	13,331	18,693	9,035	27,500
201-500	90,819	72,041	6,103	22,860	15,624	27,454
501-1000	77,238	59,200	8,536	8,951	5,500	36,214
1000+	90,307	82,521	11,149	10,972	40,233	20,168
Total	575,428	403,696	56,945	107,524	83,465	155,762

Numbers printed in blue represent centrifugal loads.

Fig. 2: Distribution of motor systems with good potential for ASD application (Table 1-24).⁵

Potential Savings: VSD Deployment in Industrial Motor Systems >500 HP:

By examining motor systems with size >500 HP, Fig. 2 shows that 40% of these large motors in all applications are good candidates for VSD integration, accounting for 25% of total motor systems energy. Motors of these high HP categories are designed as medium voltage (>2 kV) class and will require MV drives for operation. To clarify, medium voltage (MV) drives are built to couple with motors rated from 250 kW and above.¹⁰ Thus, 90% deployment of MV VSDs to motors used in >500 HP applications throughout the industrial sector would present an energy

⁹ Advanced Manufacturing Office calculation: To estimate the percentage of electricity savings in pumps and compressor applications, (% electricity in industrial sector) x (% electricity used in motor drives systems in industrial sector) x (% of system motor energy consumed in pumps and motors applications that are suitable for VSD integration, but not connected) x (assumed % of VSD deployments) x (% energy savings by using VSD). 26% x 68% x 70% x 90% x (30% to 80%) = 3.3% to 8.9%.

¹⁰ Product brochures from Toshiba & Rockwell Automation: "Toshiba Product Offering: Adjustable Speed Drives," https://www.toshiba.com/tic/datafiles/All_Products_Brochure.pdf
 "Allen-Bradley PowerFlex® 6000 Medium Voltage Variable Frequency Drive, Rockwell Automation," http://literature.rockwellautomation.com/idc/groups/literature/documents/sr/6000-sr001_-en-p.pdf.

savings opportunity of up to 1.2% to 3.2% of total U.S. electricity consumption, assuming 30% to 80% energy savings by using MV VSDs.¹¹

Potential Savings: VSD Deployment in Industrial Motor Systems >1000 HP:

Focusing only on MW class (i.e., >1000 HP) motors, which is the target area of technology development and validation in this FOA, Fig. 2 shows that 48% of these very large motors in all applications are good candidates for VSD integration, accounting for 14.3% of total motor system energy. Thus, 90% deployment of MV VSDs to these MW class motors has the potential for energy savings of up to 0.7% to 1.8% of total U.S. electricity consumption.¹²

Despite these large potential VSD-enabled electricity savings, it is estimated that currently only 13%¹³ (6% according to the DOE study⁵) of MW class motors are fitted with medium voltage (>2 kV) VSDs. This low adoption of VSDs in the medium voltage (MV) and high HP range is primarily due to the high capital cost, large footprint, low switching frequency and high losses at MV ratings for today's silicon (Si) power electronics based VSDs. These limitations can be overcome by using more efficient wide band gap (WBG) power electronics that offers higher switching frequency with lower losses at MV ratings than the Si based devices. Therefore, the emphasis of this FOA is that with the recent advancements in wide band gap (WBG) power devices, all high HP systems should be coupled to a MV VSD.

To highlight the application of emerging WBG power electronics enabled MV drives with MW class electric motors, two critical, high impact specific application areas for this technology are identified: 1) chemical and petroleum industries, and 2) compressors in natural gas infrastructure. Additionally, a list of general industrial applications is provided in category 3) that shows how these systems can have a broader impact as well.

1. MEDIUM VOLTAGE (MV) ELECTRIC MOTORS IN CHEMICAL AND PETROLEUM REFINING APPLICATIONS

Fig. 3 shows the results of 2012 study done by Information Handling Services (IHS, Inc.), showing global MV electric motor market data for MV motors in terms of 2012 revenues and growth projections for 2013 and 2014.¹⁴ In 2012, the oil and natural gas sector was the largest market and was projected to remain the largest market for MV electric motor technologies. The study also projects rapid MV electric motor sales growth in the chemical sector. In both the chemical

¹¹ Advanced Manufacturing Office calculation: To estimate the percentage of electricity savings in MV drives applications, (% electricity in industrial sector) x (% electricity used in motor drives systems in industrial sector) x (% of system motor energy in MV applications that are suitable for VSD integration, but not connected) x (assumed % of VSD deployments) x (% energy savings by using MV VSD). 26% x 68% x 25% x 90% x (30% to 80%) = 1.2% to 3.2%.

¹² Advanced Manufacturing Office calculation: 26% x 68% x 14.34% x 90% x (30% to 80%) = 0.7% to 1.8%.

¹³ "High MW Converters: Role of SiC", Waqas Arshad et al., Corporate Research, ABB, http://www.nist.gov/pml/high_megawatt/upload/Approved-Arshad-DoE_HMW-VSD.pdf.

¹⁴ IHS Research Service (www.ihs.com), 2012.

and oil and gas sectors, the MV electric motor applications are primarily in high speed compressors, chemical mixers and, petrochemical extruders, which is the first focus application area of this FOA. Following the chemical and oil and gas industries, the next largest markets were projected to be in drill rigs and hoisting for the mining sector and driving auxiliary loads for the power sector, such as, starters for gas and hydro turbines, pumps and fans etc. The water and waste water sector, consisting mostly of pump applications, is projected as the next largest market for MV electric motors. Although application areas such as metal rolling, mine hoists, grinding mills, variable speed pumps and fans in waste water, pulp and paper sectors can also benefit from using VFD integrated motors, they may not require operations at high speed, hence are not the primary focus area of this FOA.

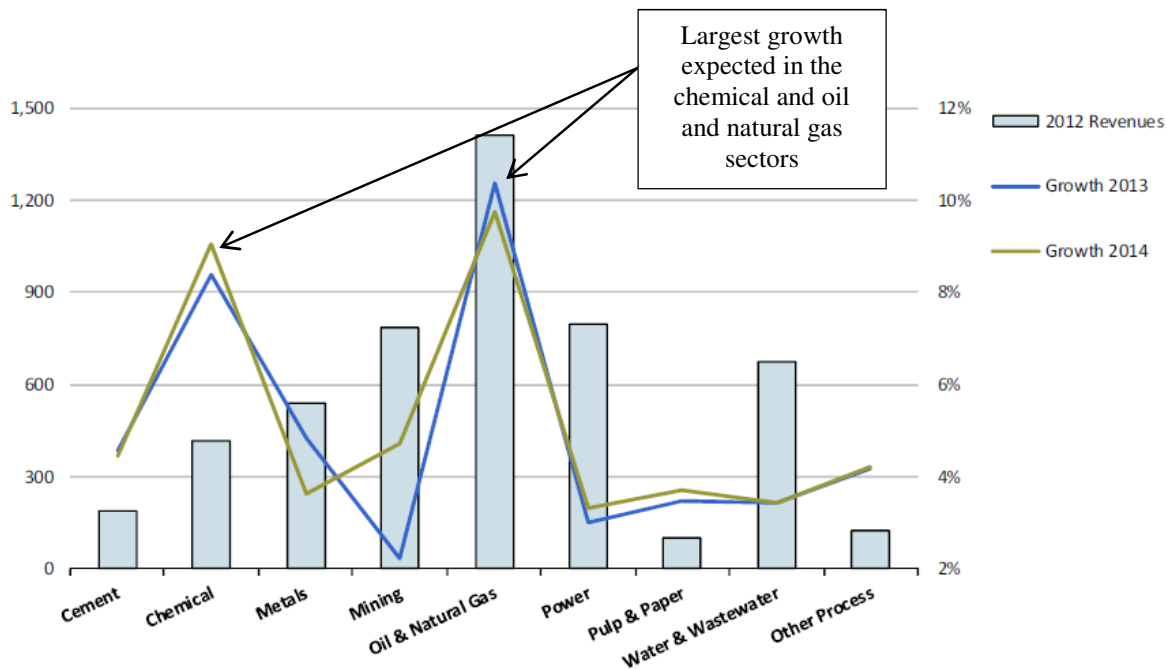


Fig. 3: The world market for MV electric motors – Market breakdown in 2012. Industry Sector by Revenues (\$M) and Growth (%).¹⁴

In addition to this significant market impact, the chemical and petroleum refining industries are the two most energy consuming sub-sectors within the industrial sector, consuming 4.25 quads and 3.54 quads of primary energy as fuel in 2010.¹⁵ These sub-sectors are also two of the three largest energy consuming sub-sectors in terms of overall motor energy usage and MW class motor energy usage, as shown in Fig. 1 and footnote 15. As such, the development and deployment of more efficient emerging WBG power electronics enabled MV drives with MW

¹⁵ DOE/AMO Manufacturing Energy and Carbon Footprints for the Chemicals (NAICS 325) and Petroleum Refining (NAICS 324110) sectors, 2014.

http://energy.gov/sites/prod/files/2014/02/f7/2014_chemicals_energy_carbon_footprint.pdf

http://energy.gov/sites/prod/files/2014/02/f7/2014_petroleum_refining_energy_carbon_footprint.pdf

class electric motors has the potential for significant energy savings in these energy intensive industries.

2. MV ELECTRIC MOTORS IN NATURAL GAS INFRASTRUCTURE

Another area of great opportunity for next generation high efficiency MV electric motors is in the natural gas transportation infrastructure area. Due to necessary turnover of aging existing infrastructure and increased build out of new infrastructure due to the U.S. shale oil and gas boom, oil and gas transportation infrastructure investments are expected to increase by nearly \$8 billion annually over the next decade.¹⁶ This will include significant investments in new compressors due to the addition of several booster stations along pipelines and the establishment of small and medium sized liquefied natural gas (LNG) plants that will need to liquefy fuel using compressors to transport via tankers and rail cars.^{16,17} With the U.S. expected to be an LNG net exporter by 2018, the Federal Energy Regulatory Commission has recently approved several major pipeline projects that will increase capacity.¹⁸ As of 2008, the U.S. and Canadian natural gas transportation network consisted of over 300,000 miles of transportation pipeline, including 217,000 miles operated by interstate pipelines with a capacity of 183 billion cubic feet per day.¹⁹ This network includes a number of 30 to 50 year old legacy compressor systems that have low efficiencies (as low as 16% - 28%) and are costly to maintain.²⁰ Recent DOE analysis shows that these existing gas-turbine and gas-engine driven compressors consume up to 7% of the 26 quads of natural gas consumed in the U.S.²¹ Furthermore, according to the Southwest Research Institute, a minimum of 3.7 million horsepower must be replaced in the next 15 years for interstate pipeline compressors.²² Therefore, the introduction of high-efficiency electrically driven compressors into the natural gas transportation sector represents a nationwide opportunity of significant energy savings and productivity increase.

Furthermore, an all-electric drive system for an LNG liquefaction plant can provide significant near-term benefits over traditional gas turbine drives when electric drives are factored in at an early stage in the plant's design. These savings result from increased up-time, lower

¹⁶ "Natural Gas Demand Sustains Growth in the Mature Compressor Market," Frost & Sullivan Press Release, 12 June 2013, available online: <http://www.frost.com/prod/servlet/press-release-print.pag?docid=279715035>.

¹⁷ Natural Gas Vehicle Market Whitepaper USA 2013-2014, FC Business Intelligence Ltd, 2013, <http://www.etenv.com/wp-content/uploads/2014/03/NGV-Whitepaper-web.pdf>

¹⁸ "Annual Energy Outlook 2014 with Projections to 2040," U.S. Energy Information Administration, April 2014, [http://www.eia.gov/forecasts/aeo/pdf/0383\(2014\).pdf](http://www.eia.gov/forecasts/aeo/pdf/0383(2014).pdf).

¹⁹ "Liquefied Natural Gas: Understanding the Basic Facts," U.S. Department of Energy Office of Fossil Energy, August 2005, http://energy.gov/sites/prod/files/2013/04/f0/LNG_primerupd.pdf.

²⁰ "Interstate Natural Gas Pipeline Efficiency," Interstate National Gas Association of America, November 2010, <http://www.ingaa.org/11885/Reports/10927.aspx>

²¹ "Factsheet: An Initiative to Help Modernize Natural Gas Transmission and distribution Infrastructure," U.S. Department of Energy, July 2014, <http://energy.gov/articles/factsheet-initiative-help-modernize-natural-gas-transmission-and-distribution>

²² "Future Compressor Station Technologies and Applications," Southwest Research Institute, February 2012, <http://www.gaselectricpartnership.com/GFuture%20Compression%20Station%20Final.pdf>.

maintenance costs, increased shaft power efficiency, lower fuel gas consumption, and increased emissions control.²³ Fig. 4 shows two compressor options for an LNG plant. Fig. 4a is the traditional approach of using a gas or a diesel-engine-driven turbine as the prime mover. While the advantage of this traditional approach is having an independent power plant that is isolated from the public grid, exhaust emissions and low turbine efficiency are its two major downsides. Traditional gas-turbine-driven and diesel-engine-driven generators and compressors have total efficiencies as low as 20%-25% (25% gas turbine, or 30% diesel engine at 1MW rating x 82% compressor) and consume large amounts of fuel.

The opportunity exists to replace the traditional turbines and engines used in natural gas liquefaction shown in Fig. 4a with the higher efficiency electric drive compressor systems shown in Fig. 4b. In large applications like a remote LNG plant where local power production is necessary, using a 100+ MW commercial power generation gas turbine typically provides 47% efficiency in a single cycle and improves to >55% with CHP.²³ Therefore, the electrified compressor with onsite generation can improve the overall plant efficiency to 36% - 42% with all electric compressor drive approach (see Fig. 4b).²⁴ It is reasonable to expect that an onsite gas power plant with combined heat and power (CHP) can operate at even higher net efficiency.²⁵ If successful, the electrification of natural gas compressor would not only reduce pollution but would also improve overall gas utilization by using the same fuel more efficiently in large power generation sites.

Although electric compressors have the option to be powered directly from the grid, poor efficiency and strict power quality compliances of the grid system have often deterred the industries from using grid-tied compressor solutions.

²³ "All electric LNG plants: Better, safer, more reliable - and profitable", Håvard Devold, Tom Nestli and John Hurter, ABB Process Automation Oil and Gas, 2006, [http://www08.abb.com/global/scot/scot216.nsf/veritydisplay/9e770a172afc8d7ec125779e004b9974/\\$file/Paper%20LNG_Rev%20A_lowres.pdf](http://www08.abb.com/global/scot/scot216.nsf/veritydisplay/9e770a172afc8d7ec125779e004b9974/$file/Paper%20LNG_Rev%20A_lowres.pdf).

²⁴ Referring to Fig. 4b, 36% = 47% (onsite power generation) x 99% (transformer) x 98.5% (VSD) x 96.5% (motor) x 82% (compressor) and 42% = 55% (onsite CHP power generation) x 99% (transformer) x 98.5% (VSD) x 96.5% (motor) x 82% (compressor).

²⁵ "CHP: A Clean Energy Solution," U.S. Department of Energy, Advanced Manufacturing Office, August 2012, <http://energy.gov/eere/amo/advanced-manufacturing-office>

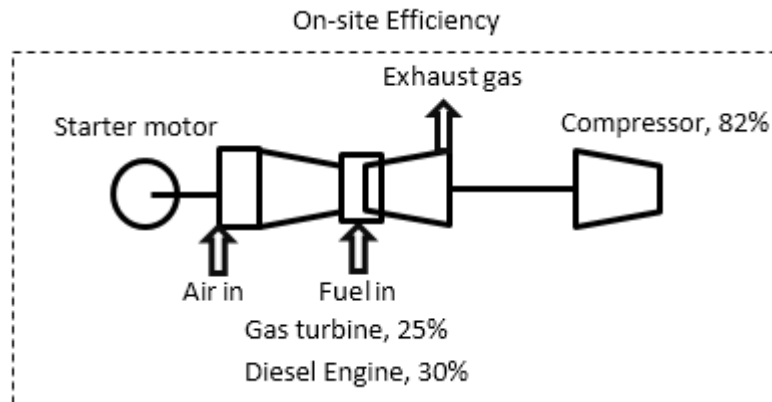


Fig. 4a: Traditional Solution for Pipeline Compressor Stations, LNG Plants and CO₂ Injection.²³ The overall efficiency is typically 20% to 25%.

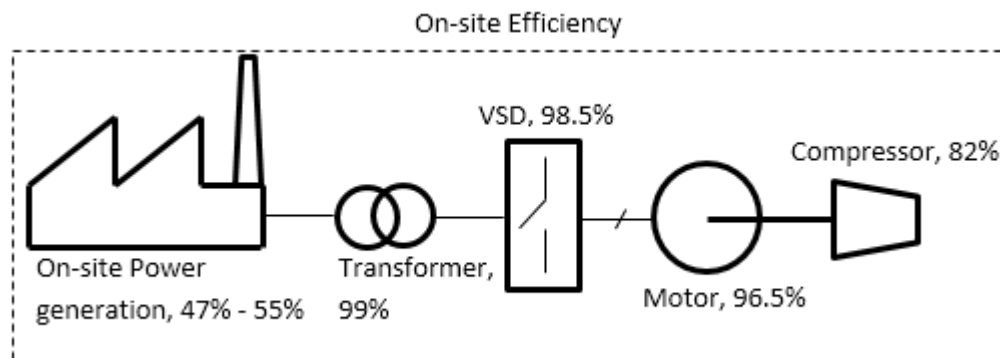


Fig. 4b: Electrification leads to higher overall efficiency when driven from onsite power generation from a gas turbine that is typically about 47% efficient in a single cycle, but climbs as high as 55% for CHP.²³ Therefore the overall efficiency with the all electric compressor drive approach is 36% to 42%.

3. MV ELECTRIC MOTORS IN GENERAL INDUSTRIAL APPLICATIONS

The introduction of large-scale high efficiency next generation industrial electric motors into the chemical processing and petroleum refining sectors, along with the motorization of large compressors in oil and gas transportation and LNG liquefaction plants, represent urgent medium term technology opportunities for energy savings and environmental sustainability and a window of opportunity exists for the U.S. to lead the effort to transform these energy sectors by integrating MW class motors with emerging WBG technology based VSDs. Other application areas where high efficiency compact MV high-speed electric motors could have significant impacts were identified in a recent workshop, and included the following:²⁶

²⁶ 2014 High Megawatt Variable Speed Drive Technology Workshop, National Institute of Standards and Technology, April 2014, www.nist.gov/pml/high_megawatt/2014_workshop.cfm.

- 1) Electrical submersible pumps (ESPs)
- 2) Water handling and Pumping - Desalination, waste water treatment, flood control and drainage, water purification, irrigation
- 3) Drilling and hoist motors
- 4) Industrial desalination plants pumping systems
- 5) HVAC systems and industrial compressors: vapor compression chiller systems
- 6) Recycle compressors (air separation compressors)
- 7) Marine electrified propulsion systems
- 8) All electric underground mining vehicles
- 9) Geothermal systems
- 10) Refrigeration turbo compressors
- 11) Other space-constrained industry applications

Integrating MW Class Motors with MV drives:

Development and validation of the concept of an integrated high-speed VSD-motor-mechanical system in the MV regime is needed to demonstrate the reliability and robustness of this new integrated system technology and to drive further private investment and development. If successful in this program, the U.S. would gain a competitive technical advantage in the design and manufacture of integrated MV-class electric motor system.

This integrated systems approach will create a value proposition that will be advantageous to U.S. motor manufacturers. U.S. companies have in recent years been at the forefront of WBG power electronics device research and a development. One objective of PowerAmerica - the DOE funded Manufacturing Innovation Institute on next generation power electronics - is to ensure that WBG power electronics manufacturing has a competitive opportunity within the USA.²⁷ Hence, integrating high frequency motors with development in WBG power electronic based drives through tighter systems integration requirements will provide an opportunity to leverage this investment.

Beyond this current FOA, AMO envisions a multiyear programmatic “Next Generation Electric Machines (NGEM)” RD&D effort to realize the complete vision of developing a new generation of energy efficient, high power density, high speed integrated MV drive systems for a wide variety of critical energy applications. Future NGEM programmatic funding opportunities may emphasize key technologies that can enable further weight reduction and energy efficiency enhancement for NGEM, such as the development of soft magnetic materials, high voltage insulation materials, next generation electrical conductors, and rapidly improving superconducting wire technologies. As these key technologies mature, AMO will also focus on

²⁷ Power America (web page), U.S. Department of Energy, Advanced Manufacturing Office, <http://energy.gov/eere/amo/power-america>.

integrating these technologies into the system and on increasing the system power level from 1MW to 5MW and beyond.

B. TOPIC AREAS/TECHNICAL AREAS OF INTEREST

In all of the three target application cases described earlier, the technology development goals are the same – integrating a MW scale high speed motor with WBG power electronics based MV class VSD. The high speed compressor application for natural gas transportation described earlier (in Fig. 4b) was chosen to quantify the targets specified below for this FOA’s technology development effort, but these system targets also align well with high speed petrochemical extruders and chemical mixers. The goal is to develop a 1MW electric motor, operating at 15,000 rpm, driven by a WBG based MV VSD, with a minimum system efficiency of 93%. Applicants may pursue applications different than the aforementioned primary application markets. If other applications are proposed, the proposals should contain a statement clearly identifying which application areas or markets are being targeted for technology development.

Traditionally the fundamental operating frequency of electric motors has been limited to the line frequency of 60 Hz. The emergence of variable speed drive (VSD) power electronics, which enabled higher operating frequencies of around 200 Hz in applications such as electric vehicle, aerospace, and marine propulsion. However, the technologies available today are only for low voltage (<2 kV) class, kW range applications. MW-scale motors operating beyond 200 Hz are at low technology readiness level (TRL) today. The technical challenges remain in designing and manufacturing a high speed motor that can pair well with high-frequency VSD. The focus of this FOA is to challenge U.S. motor manufacturers to address this issue by taking an integrated systems approach. This FOA seeks to integrate MV-VSD using WBG power devices with MW class high speed, direct drive motors and demonstrate significant reductions in the volume and weight of the integrated system by utilizing higher switching frequencies and junction temperatures, as well as the inherent higher voltage capabilities of WBG devices.

Technical Topic Area – Integrated Motor Drive Development and Validation:

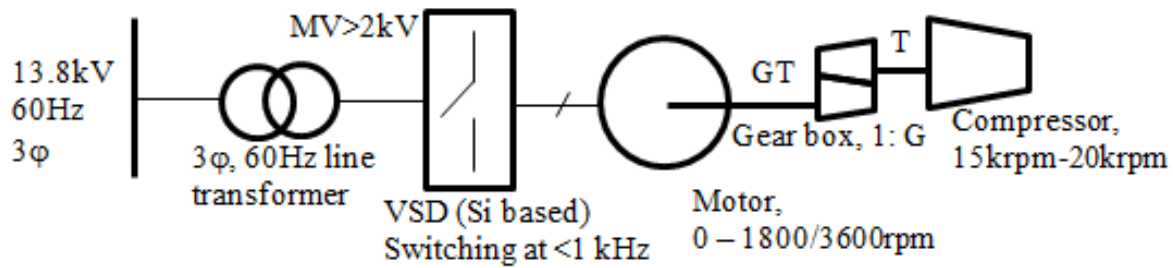


Fig. 5: Conventional Si-VSD driven standard speed motor with gear-box in a compressor application.

Fig. 5 is a schematic of the current state-of-the-art for electric motor systems for high speed compressor applications where a conventional Si-based VSD is integrated with a standard 60 Hz motor driving the compressor through a speed increasing gear box. A gear box is necessary since the standard 60 Hz motors usually operate at a fixed 1800 rpm or 3600 rpm while the compressor runs in the range from 15 to 20 krpm. In addition, a bulky 3 phase, 60 Hz line transformer across the power line is needed for voltage step down and isolation. The estimated volumetric power density per MW, total footprint per MW, and energy conversion efficiency from the grid's electrical output to the mechanical input to the compressor for today's state-of-the-art Si-based VSD integrated compressor motor technology are included in Table 2 below.²⁸ All components are considered to be totally-enclosed, forced-air cooled (TEFC), and in compliance with the installation guidelines of industrial norms. Typically, a MV variable speed drive is integrally packaged with the line transformer, which makes it the bulkiest item of the overall system, as seen in row 1 of Table 2. With both sections roughly occupying 50% of the overall package, the individual contributions of the transformer and VSD sections are separated and calculated in rows 2 and 3 of the table.

²⁸ "Next Generation of Electric Machines," A. Agarwal, S. Boyd and Z. Rahman, Presentation at NIST/DOE workshop on High Megawatt Direct Drive Motors and Front End Power Electronics, September 2014, http://www.nist.gov/pml/high_megawatt/sept2014_presentations.cfm

Components	Inverse Volumetric Density (m ³ /MW) ²⁹	Footprint (m ² /MW) ³⁰	Efficiency (%)
Transformer integrated VSD (Si Based) ³¹	9.091	3.29	96
Transformer section	4.545	1.645	98
VSD (Si based) section	4.545	1.645	98
Motor ³²	2	2.5	96
Gear Box ³³	2.631	1.65	98
Total System ³⁴	13.721	7.44	90

Table 2: Performance metrics of today's Si-based VSD integrated compressor motor technology.

In the technology development effort supported in this FOA, AMO's vision is to:

- 1) Replace the Si based switching devices with WBG based switching devices in the high switching frequency sections of the circuit with a goal of achieving 3x higher power density in the VSD section and higher electrical drive speed,
- 2) Replace the low speed 60 Hz motor with an 8x higher power density high speed motor, and
- 3) Eliminate the use of the speed-increasing gearbox.

This FOA is not interested in replacing the traditional transformer with a solid-state version. It is understood that replacing a 60 Hz transformer with a solid state transformer alone will result in dramatic improvements in power density and footprint of the overall system even if the rest of the system remains the same. The solid-state transformer may be embedded in front-end electronics and VSD if deemed as a commercially attractive option as long as the reductions in VSD and motor sections are also addressed. Also, conventional Si based devices can be proposed in the rectification and active front-end section of the VSD where high switching frequency is not required. A 50% reduction in loss enabled by using WBG devices compared to Si devices and elimination of the gear box can contribute to a >30% reduction in overall losses for the high speed motor and WBG drive systems compared to current 60 Hz motor and Si based drive systems. The estimated performance metrics are provided in Table 3 and a summary of the % improvements targeted from WBG based VSD integrated gearless advanced compressor motor technology over Si-based VSD integrated geared motor technology are

²⁹ Volume = Length x Width x Height

³⁰ Foot print = Length x Width

³¹ The metrics for VSD are averaged using product data from T300MVi of Toshiba, 7000-sg010 of Allen Bradley and data provided by TECO-Westinghouse at the NIST/DOE workshop, September 2014, http://www.nist.gov/pml/high_megawatt/april-2014_presentations.cfm.

³² Data obtained from 1250 HP compressor motor in production by TECO-Westinghouse. Part Number JH12504.

³³ Data provided by David Brown gear systems, <http://www.davidbrown.com>.

³⁴ Total system metrics is the sum of individual components, excluding connections and wiring harnesses.

shown in Table 4. As seen from these tables, an overall >2x improvement in total volume and footprint is targeted.

Components	Inverse Volumetric Density (m ³ /MW)	Footprint (m ² /MW)	Efficiency (%)
Transformer section (no change from Table 2)	4.545	1.645	98
VSD (WBG based) section (3x improvement in density & 50% reduction in loss relative to Table 2)	1.515	0.791 ³⁵	99
Motor (8x improvement in density without degradation in performance)	0.25	0.625 ³⁵	96
Gear Box (Eliminated)	-	-	-
Total System	6.31	3.061	93

Table 3: *Estimated performance metrics of WBG based VSD integrated gearless compressor motor technology.*

Metrics	Si-based VSD integrated motor system from Table 2	WBG-based VSD integrated motor system from Table 3	Improvement
Efficiency	90%	93%	30% loss reduction
Inverse volumetric power density	13.72 m ³ /MW	6.31 m ³ /MW	217% increase in power density
Foot print	7.44 m ² /MW	3.061 m ² /MW	243% decrease in foot print.

Table 4: *Percent improvements targeted from WBG based VSD integrated gearless advanced compressor motor technology over Si-based VSD integrated geared motor technology.*

The range of electrical frequencies for the motor can be calculated from the following equation:

$$f = \frac{pN}{120}$$

This equation provides the sinusoidal fundamental electrical frequency f of a motor with p number of poles rotating at a speed of N rpm. With the minimum number of motor poles being 2, frequency f ranges from 250 to 333 Hz for $N=15-20$ krpm. This is 4 to 5 times higher than the usual 60 Hz operation. As a rule of thumb, for a VSD to be able to synthesize this frequency, minimum switching frequency should be an order of magnitude higher than the fundamental

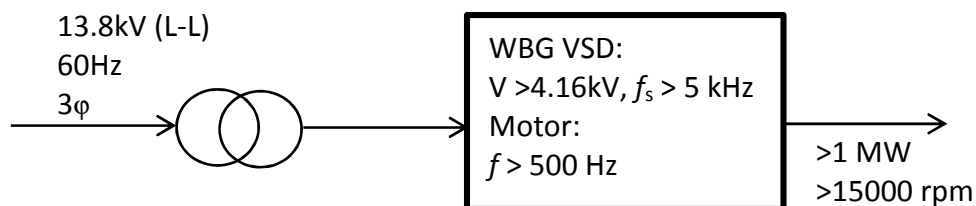
³⁵ Improvement in power density is assumed to effect equally on package length, width and height. For example, an 'X' reduction in overall volume is assumed as $X^{1/3}$ reduction in length, width and height separately. Therefore, reduction in foot print will be by a factor of $X^{2/3}$.

electrical frequency³⁶. This means the required minimum switching frequency for the directly coupled system will need to be around 2.5 to 3.33 kHz. However, to counter the flexing issue of a 'skinny' rotor design suitable for high speed operation and for achieving further weight reduction in the motor, it is likely that a 4 pole design could be suitable for such application³⁷, hence doubling the electrical frequency to 500-666 Hz and minimum required switching frequency to 5 - 7 kHz.

FOA Technical targets:

The primary and secondary targets for this technology development FOA are as follows,

Minimum System Requirements:



1. Input: > 13.8kV (L-L)
2. Input voltage to VSD: > 4.16kV (Medium Voltage Class). A standard 60 Hz line transformer can be used for the demonstration or a Solid State Transformer may be embedded in front-end electronics and VSD.
3. Rectifier can use Si devices. The inverter must use WBG devices that exist either commercially or on a custom basis, and can use any topology.
4. Switching frequency of WBG devices: > 5 kHz
5. Motor fundamental electrical frequency: > 500 Hz
6. Speed: > 15000 rpm
7. Output: Power > 1MW

Primary Targets (with integrated 60 Hz step down transformer):

1. Overall volumetric power density: < 6.31 m³/MW
2. Overall footprint: < 3.06 m²/MW
3. Overall full load efficiency: > 93%
4. Overall total harmonic distortion (THD) (1st ... 49th): < 2%
5. Cost: <\$1.00/Watt per system for 500 systems/year

³⁶ Brushless Permanent-Magnet and Reluctance Motor Drives, by TJE Miller, Oxford Science Publications, 1989, ISBN # 0198593694.

³⁷ "Technical Note: Comparison of 4-pole and 2-pole designs for large motors and generators (typically rated over 7 MW)," ABB, 2011, [http://www08.abb.com/global/scot/scot234.nsf/veritydisplay/73538d3f2dd243edc125788d003def44/\\$file/Technical note Comparison of 4pole and 2pole designs for large motors and generators EN 052011.pdf](http://www08.abb.com/global/scot/scot234.nsf/veritydisplay/73538d3f2dd243edc125788d003def44/$file/Technical%20note%20Comparison%20of%204pole%20and%202pole%20designs%20for%20large%20motors%20and%20generators%20EN_052011.pdf).

Secondary Targets:

1. Overall half load efficiency: >90%@1/2 rated torque; >85%@1/2 rated speed
2. Input power factor: > 0.99
3. Noise level: <85 dB @ 1 meter perimeter

Deliverables:

1. An integrated motor drive system that includes:
 - a. Any necessary front end power processing unit
 - b. Medium voltage class WBG semiconductor based VSD
 - c. High speed motor that can be directly coupled to an appropriate industrial load without a gearbox

2. Test Plan

A test plan will be developed to ensure an adequate pathway for a thorough validation of system characteristics. Details will include test description, pass/fail criteria, equipment used, and test sequencing and timing. Validation on a dynamometer of appropriate power level is acceptable. Field demonstration is NOT required.

3. Test Results

A report detailing all test methods, equipment, and data will be provided to assess the system performance and their conformance to the specifications in the FOA.

4. Tech to Market Plan

A report detailing path forward on how to make the proposed system cost competitive with today's technology and plans for commercialization.

Proposals are requested for successful development and test validation of this integrated system from initial design phase to full power testing.

II. AWARD INFORMATION

A. AWARD OVERVIEW

1. ESTIMATED FUNDING

EERE expects to make approximately \$20 million of Federal funding available for new awards under this FOA subject to the availability of appropriated funds. EERE anticipates making four to six new awards under this FOA. EERE may issue one, multiple, or no awards.

Individual awards may vary between \$3 million and \$5 million, not including the recipient cost share. In exceptional circumstances where opportunity for innovation and impact is very high,

Note: Effective 12/26/2014, the DOE Financial Assistance regulations contained in 10 CFR 600 will be superseded by the Financial Assistance regulations contained in 2 CFR Part 200 as amended by 2 CFR Part 910.

Questions about this FOA? Email: AMONGEM@go.doe.gov. Problems with EERE Exchange? Email EERE-ExchangeSupport@hq.doe.gov. Include FOA name and number in subject line.

EERE may consider providing \$6 million, not including recipient cost share, for an individual award where the application includes a vertically integrated team and a sound plan for commercialization, field demonstration, and rapid deployment of the technology.

EERE may establish more than one budget period for each award and initially fund only the first budget period(s). Funding for all budget periods, including the first budget period, is not guaranteed. Before the expiration of each budget period, EERE will perform a Go/No-Go decision review (See FOA, Section VI.C.13). Continued Federal funding will be contingent upon availability of funds appropriated by Congress for the purpose of this program, the availability of future-year budget authority, satisfactory performance, and the Go/No-Go decision review process.

2. PERIOD OF PERFORMANCE

EERE anticipates making awards that will run up to 24-36 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.

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.

1. COOPERATIVE AGREEMENTS

EERE generally uses Cooperative Agreements to provide financial and other support to Prime Recipients. EERE intends to use Cooperative Agreements under this FOA.

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, FEDERAL AGENCIES AND FEDERAL INSTRUMENTALITIES

In most cases, Federally Funded Research and Development Centers (FFRDC) are funded independently of the remainder of the Project Team. The FFRDC then executes an agreement with any non-FFRDC 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.

III. ELIGIBILITY INFORMATION

A. ELIGIBLE APPLICANTS

1. INDIVIDUALS

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

2. DOMESTIC ENTITIES

For-profit entities, educational institutions, and nonprofits³⁸ that are incorporated (or otherwise formed) under the laws of a particular State or territory of the United States are eligible to apply for funding as a Prime Recipient or Subrecipient.

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

DOE/NNSA Federally Funded Research and Development Centers (FFRDCs) are eligible to apply for funding as a Prime Recipient or Subrecipient.

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

³⁸Nonprofit 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.

Federal agencies and instrumentalities (other than DOE) are eligible to apply for funding as a Subrecipient, but are not eligible to apply as a Prime Recipient.

3. FOREIGN ENTITIES

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

Other than as provided in the “Individuals” or “Domestic Entities” sections above, all Prime Recipients receiving funding under this FOA must be incorporated (or otherwise formed) under the laws of a 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 and objectives 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 Subrecipient.

4. INCORPORATED CONSORTIA

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

Entities” above. For consortia incorporated in foreign countries, please refer to the requirements in “Foreign Entities” above.

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

5. UNINCORPORATED CONSORTIA

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

Upon request, unincorporated consortia must provide the 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

The cost share must be at least 20% of the total allowable costs (i.e., the sum of the Government share, including FFRDC costs if applicable, and the recipient share of allowable costs equals the total allowable cost of the activity) and must come from non-Federal sources unless otherwise allowed by law. (See 2 CFR 200.306 & 2 CFR 910.130 for the applicable cost sharing requirements.)

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

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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 subawards 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 Subrecipients. Allowable in-kind contributions include, but are not limited to: personnel costs, indirect costs, facilities and administrative costs, rental value of buildings or equipment, and the value of a service, other resources, 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;

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- 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 2 CFR 200.306 as amended by 2 CFR 910.130, & 10 CFR 603.525-555 for additional guidance on cost sharing.

4. COST SHARE CONTRIBUTIONS BY FFRDCs

Because FFRDCs are funded by the Federal Government, costs incurred by FFRDCs 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.

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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

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; and,

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- The Applicant entered 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. NONRESPONSIVE APPLICATIONS

The following types of applications will be deemed nonresponsive and will not be reviewed or considered:

- Applications that include or require significant semiconductor device or power module development.
- Applications that use only Silicon semiconductors.
- Applications that do not propose the development of an integrated system including a MV class motor drive with MW range high speed motor.
- Applications for proposed technologies that are not based on sound scientific principles (e.g., violates the law of thermodynamics).

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 SUBRECIPIENT

DOE/NNSA and non-DOE/NNSA FFRDCs may be proposed as a Subrecipient 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. Limit on FFRDC Effort

The scope of work to be performed by the FFRDC may not be more significant than the scope of work to be performed by the applicant.

vi. 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 only submit one Concept Paper and one Full Application for consideration under this FOA. If an applicant submits more than one Concept Paper or Full Application, EERE will only consider the last timely submission for evaluation. Any other submissions received listing the same applicant will be considered noncompliant and not eligible for further consideration. This limitation does not prohibit an applicant from collaborating on other applications (e.g., as a potential Sub recipient or partner) so long as the entity is only listed as the Prime Applicant on one Concept Paper and Full Application submitted under this 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 an eligible 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 ineligible 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.

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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; and,
- Each must not exceed the specified maximum page limit, including cover page, charts, graphs, maps, and photographs when printed using the formatting requirements set forth above and single spaced. If Applicants exceed the maximum page lengths indicated below, EERE will review only the authorized number of pages and disregard any additional pages.

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

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

1. ADDITIONAL INFORMATION ON EERE EXCHANGE

EERE Exchange is designed to enforce the deadlines specified in this FOA. The “Apply” and “Submit” buttons will automatically disable at the defined submission deadlines. Should applicants experience problems with Exchange, the following information may be helpful:

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Applicants that experience issues with submission PRIOR to the FOA deadline: In the event that an Applicant experiences technical difficulties with a submission, the Application should contact the Exchange helpdesk for assistance (EERE-ExchangeSupport@hq.doe.gov). The Exchange helpdesk and/or the EERE Exchange system administrators will assist Applicants in resolving issues.

Applicants that experience issue with submissions that result in late submissions: In the event that an Applicant experiences technical difficulties so severe that they are unable to submit their application by the deadline, the Applicant should contact the Exchange helpdesk for assistance (EERE-ExchangeSupport@hq.doe.gov). The Exchange helpdesk and/or the EERE Exchange system administrators (EERE-ExchangeSupport@hq.doe.gov) will assist the Applicant in resolving all issues (including finalizing submission on behalf of and with the Applicant's concurrence). PLEASE NOTE, however, that Applicants who are unable to timely submit their application due to their waiting until the last minute when network traffic is at its heaviest to submit their materials will not be able to use this process.

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:

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SECTION	PAGE LIMIT	DESCRIPTION
Technology Description	2 pages maximum	<p>Applicants are required to describe succinctly:</p> <ul style="list-style-type: none"> • 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 page maximum	<p>Applicants may provide graphs, charts, or other data to supplement their Technology Description.</p> <p>Applicants are required to describe succinctly the qualifications, experience, and capabilities of the proposed Project Team, including:</p> <ul style="list-style-type: none"> • 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 eligible 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

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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 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., ControlNumber_ApplicantName_Full_Application).

1. FULL APPLICATION CONTENT REQUIREMENTS

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

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	ControlNumber_LeadOrganization_Slide

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	PowerPoint format)	
	Subaward Budget Justification (EERE 159);	ControlNumber_LeadOrganization_Subawardee_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

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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 30 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

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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, 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 1-2 pages)	<p>The Project Overview should contain the following information:</p> <ul style="list-style-type: none"> • 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 8-10 pages)	<p>The Technical Description should contain the following information:</p> <ul style="list-style-type: none"> • 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 10-14 pages)	<p>The Workplan should contain the following information:</p> <ul style="list-style-type: none"> • 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

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	<p>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.</p> <ul style="list-style-type: none"> • 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 Specific, Measurable, Achievable, Relevant, and Timely. 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
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	<p>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.</p> <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> ○ The overall approach to and organization for managing the work ○ The roles of each Project Team member ○ Any critical handoffs/interdependencies among Project Team members ○ The technical and management aspects of the management plan, including systems and practices, such as financial and project management practices ○ The approach to project risk management ○ A description of how project changes will be handled ○ If applicable, the approach to Quality Assurance/Control ○ 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: <ul style="list-style-type: none"> ○ Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including a mitigation plan ○ 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.
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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

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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 addressed 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 3 to 4 pages)	<p>The Technical Qualifications and Resources should contain the following information:</p> <ul style="list-style-type: none"> • Describe the Project Team’s unique qualifications and expertise, including those of key subrecipients • 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 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: <ul style="list-style-type: none"> ○ The roles and the work to be performed by each PI and Key Participant; ○ Business agreements between the Applicant and each PI and Key Participant; ○ How the various efforts will be integrated and managed; ○ Process for making decisions on scientific/technical direction; ○ Publication arrangements; ○ Intellectual Property issues; and ○ Communication plans
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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”.

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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 Subrecipients and Contractors, and provide all requested documentation (e.g., a Federally-approved forward pricing rate agreement, Defense Contract Audit Agency or Government Audits and Reports, if available). Applicants should include costs associated with required annual audits and incurred costs proposals in their proposed budget documents. The “Instructions and Summary” included with the Budget Justification Workbook will “auto-populate” as the Applicant enters information into the Workbook. Applicants must carefully read the “Instructions and Summary” tab provided within the Budget Justification Workbook. Save the Budget Justification Workbook in a single Microsoft Excel 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 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);

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- 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. SUBAWARD BUDGET JUSTIFICATION (EERE159)

Applicants must provide a separate budget justification, EERE 159 (i.e., budget justification for each budget year and a cumulative budget) for each subawardee that is expected to perform work estimated to be more than \$250,000 or 25 percent of the total work effort (whichever is less). The budget justification must include the same justification information described in the "Budget Justification" section, above. Save each subaward budget justification in a Microsoft Excel 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/0412.1-BOrder-a/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 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 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 Subrecipients may not use any Federal funds to influence or attempt to influence, directly or indirectly, congressional action on any legislative or appropriation matters.

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

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

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

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 IV.I.3 lists the necessary information that must be included in a request to waive the Performance of Work in the United States requirement.

12. U.S. MANUFACTURING COMMITMENTS

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 Applicant’s 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.

13. DATA MANAGEMENT PLAN

Applicants whose Full Applications are selected for award negotiations will be required to submit a Data Management Plan during the award negotiations phase. The Data Management Plan is a document that outlines the proposed plan for data sharing or preservation. Submission of this plan is required, and failure to submit the plan may result in the termination of award negotiations. As a courtesy, guidance for preparing a Data Management Plan is provided in Appendix D of the FOA.

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 complying with national policies prohibiting discrimination (See 10 CFR 1040.5)
- Representation of Limited Rights Data and Restricted Software, if applicable
- Environmental Questionnaire

F. CONTENT AND FORM OF REPLIES TO REVIEWER COMMENTS

EERE will provide Applicants with reviewer comments following evaluation of all eligible Full Applications. Applicants will have approximately three business days to prepare a short Reply to Reviewer Comments responding to comments however they desire or supplementing their Full Application. EERE will notify applicants via email when the Reviewer Comments are available for reply. The expected submission deadline is on the cover page of the FOA; however, it is the applicant's responsibility to monitor email in the event that the expected date changes. The deadline will not be extended for applicants who are unable to timely submit their reply due to failure to check email or relying on the expected date alone.

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

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

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

G. SUBMISSION DATES AND TIMES

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

H. INTERGOVERNMENTAL REVIEW

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

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:

- FAR Part 31 for For-Profit entities; and
- 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

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2. PRE-AWARD COSTS

Selectees may charge pre-award costs incurred on R&D awards within the 90-day period immediately preceding the effective date of the award. Pre-award costs are those incurred prior to the effective date of the Federal award directly pursuant to the negotiation and in anticipation of the Federal award where such costs are necessary for efficient and timely performance of the scope of work. Such costs are allowable only to the extent that they would have been allowable if incurred after the date of the Federal award and **only** with the written approval of the Federal awarding agency, through the Contracting Officer assigned to the award.

Pre-award costs cannot be incurred prior to the Selection Official signing the Selection Statement and Analysis. Pre-award costs can only be incurred if such costs would be reimbursable under the agreement if incurred after award.

Pre-Award expenditures are made at the Selectee's risk; EERE is not obligated to reimburse costs: (1) in the absence of appropriations; (2) if an award is not made; or (3) if an award is made for a lesser amount than the Selectee anticipated.

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.

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3. PERFORMANCE OF WORK IN THE UNITED STATES

a. Requirement.

All work performed under EERE awards must 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 supplies and equipment within the United States. The Prime Recipient must flow down this requirement to its subrecipients.

b. Failure to Comply.

If the Prime Recipient fails to comply with the Performance of Work in the United States requirement, EERE may deny reimbursement for the work conducted outside the United States and such costs may not be recognized as allowable Recipient cost share. The Prime Recipient is responsible should any work under the award be performed outside the United States, absent a waiver, regardless of if the work is performed by the Prime Recipient, subrecipients, vendors or other project partners.

c. Waiver.

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 United States requirement, the Applicant must submit a written waiver request to EERE, which includes the following information:

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

For the rationale, the Applicant must demonstrate to the satisfaction of EERE that a waiver would further the purposes and objectives of this FOA and is otherwise in the interests of EERE and the United States. EERE may require additional information before considering a waiver request. Save the waiver request(s) in a single PDF file titled "ControlNumber_PerformanceofWork_Waiver". The applicant does not have the right to appeal this decision concerning a waiver request.

4. 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

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obtain written authorization from the Contracting Officer before incurring any major construction costs.

5. 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.

6. EQUIPMENT AND SUPPLIES

To the greatest extent practicable, all equipment and products purchased with funds made available under this FOA should be American-made. 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 2 CFR Part 200 as amended by 2 CFR Part 910: 2 CFR 200.310 – 200.316 as amended by 2 CFR 910.360.

7. LOBBYING

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

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

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

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 shown below.

Criterion 1: Technical Merit, Innovation, and Impact (40%)

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 analyses that support the viability of the proposed work.

Impact of Technology Advancement

- How 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.

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Criterion 2: Project Research and Commercialization Plan (25%)

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

- Discussion and demonstrated understanding 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 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 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, and Data Management Plan, U.S. manufacturing plan etc., and product distribution.

Criterion 3: Team and Resources (10%)

- 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;
- Level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan; and
- Reasonableness of budget and spend plan for proposed project and objectives.

Criterion 4: Commitment to U.S. Manufacturing (25%)

- Extent of measurable and enforceable commitments made by applicant in its U.S.

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Manufacturing Plan (see Section IV.D.12) to support U.S. manufacturing of solutions, technologies, and/or hardware resulting from the proposed project; and

- Extent to which the proposed measurable and enforceable commitments are realistic and viable.

Merit Reviewers may be asked to comment on other aspects of the application, such as the reasonableness of the proposed budget or environmental concerns. Those comments may provide useful information that must be addressed prior to any award, but will not be considered in the rating of technical merit.

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 eligible 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 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; and
- 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; and
- Whether the proposed project will advance the goals of the Climate Action Champion initiative, as committed to by the designated Champion pursuant to its designation

agreement. The Climate Action Champion initiative goals include improving climate resilience and reducing greenhouse gas emissions.

Note: The Climate Action Champion initiative program policy factor is only applicable to (1) projects proposed by Climate Action Champions³⁹ as designated under DOE's Request for Applications DE-FOA-0001189; (2) projects proposed by a member of a regional collaboration or consortium designated as a Champion and (3) projects proposed in a Climate Action Champion community where the applicant submits a letter from the Champion confirming the proposed project would further the Champion's goals under the Climate Action Champion Initiative.) If an applicant is seeking to receive consideration under (3), the applicant must contact the applicable Champion to obtain a letter of support.

D. EVALUATION AND SELECTION PROCESS

1. OVERVIEW

The evaluation process consists of multiple phases that each includes 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 evaluation and selection process, EERE may invite one or more applicants to participate in 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 invited applicant(s) will meet with EERE representatives to provide clarification on the contents of the Full Applications and to provide EERE an opportunity to ask questions regarding the proposed project. The information provided by applicants to EERE through Pre-Selection Interviews contributes to EERE's selection decisions.

³⁹ In recognition of the importance of the dual policy goals of reducing greenhouse gas emissions and enhancing climate resilience, the U.S. Department of Energy (DOE) – in close collaboration with other Federal agencies – launched the Climate Action Champion initiative to identify and showcase U.S. local and tribal governments that have proven to be climate leaders through pursuing opportunities to advance both of these goals in their communities. Recently, DOE selected sixteen (16) U.S. local governments and tribal governments – or regional collaborations or consortia thereof – that demonstrated a strong and ongoing commitment to implementing strategies that both reduce greenhouse gas emissions and enhance climate resilience, with a particular emphasis on strategies that further both goals. <http://www.whitehouse.gov/blog/2014/12/03/announcing-first-class-climate-action-champions>.

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 site visits at certain Applicants' facilities. In the alternative, EERE may invite certain 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 Pre-Selection Interviews that will be used to make a final selection determination. EERE may select applications for funding and make awards without Pre-Selection Interviews. Participation in Pre-Selection Interviews 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 technical merit, the Federal Consensus Board's recommendations, 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 2015 and making awards as early as September 2015.

B. AWARD NOTICES

1. *INELIGIBLE SUBMISSIONS*

Ineligible Concept Papers and Full Applications will not be further reviewed or considered for award. The Contracting Officer will send 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 ineligible and not considered for further review.

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 for award. 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.

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

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. *ALTERNATE SELECTION DETERMINATIONS*

In some instances, an applicant may receive a notification that its application was not selected for award and EERE designated the application to be an alternate. As an alternate, EERE may consider the Full Application for Federal funding in the future. A notification letter stating the Full Application is designated as an alternate 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

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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 http://www.fedconnect.net/FedConnect/Marketing/Documents/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.

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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 2 CFR Part 200 as amended by 2 CFR Part 910.

3. LIMITATIONS ON COMPENSATION COSTS

The annual compensation costs for an individual allowable under this Award are limited to \$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 subrecipients 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).

For purposes of this requirement only, the term "annual compensation costs" is defined to include the total amount of wages and salary paid to the employee, which have been approved by the Contracting Officer.

4. SUBAWARD AND EXECUTIVE REPORTING

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

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 Recipients selected for an award will be required to assist in the timely and effective completion of the NEPA process in the manner most pertinent to their proposed project.

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 2014)

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

(1) It is **not** a corporation that has been convicted of a felony criminal violation under any Federal law within the preceding 24 months,

(2) 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 FEDERAL STEWARDSHIP

EERE will exercise normal Federal stewardship in overseeing the project activities performed under EERE Awards. Stewardship Activities include, but are not limited to, conducting site visits; reviewing performance and financial reports, providing assistance and/or temporary intervention in usual circumstances to correct deficiencies that develop during the project; assuring compliance with terms and conditions; and reviewing technical performance after project completion to ensure that the project objectives have been accomplished.

9. STATEMENT OF SUBSTANTIAL INVOLVEMENT

EERE has substantial involvement in work performed under awards made following this FOA. In addition to the administrative requirements of the award, 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:

1. EERE shares responsibility with the Recipient for the management, control, direction, and performance of the Project.
2. EERE may intervene in the conduct or performance of work under the award for programmatic reasons. Intervention includes the interruption or modification of the conduct or performance of project activities.
3. EERE may redirect or discontinue funding the Project based on the outcome of EERE's evaluation of the Project at that the Go/No-Go decision point.
4. EERE participates in major project decision-making processes.

10. 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);

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- 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.

11. SUBJECT INVENTION UTILIZATION REPORTING

To ensure that Prime Recipients and Subrecipients holding title to subject inventions are taking the appropriate steps to commercialize subject inventions, EERE 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.

12. 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>.

13. 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/2013/05/f0/Attch_FA_RepReqChecklist_COMBINED_FINAL_4-23-13%20%283%29_0.pdf.

14. Go/No-Go REVIEW

Each project selected under this FOA will be subject to a period project evaluation referred to as a Go/No-Go Review. Federal funding beyond the Go/No-Go decision point is contingent on (1) the availability of funds appropriated by Congress for the purpose of this program and the

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availability of future-year budget authority; (2) meeting the objectives, milestones, deliverables, and decision point criteria of Recipient's approved project and obtaining approval from EERE to continue work on the project; and (3) the submittal of required reports in accordance with the statement of project objectives.

As a result of the Go/No-Go Review, 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.

The Go/No-Go decision is distinct from a non-compliance determination. In the event a recipient fails to comply with the requirements of an award, EERE may take appropriate action, including but not limited to, redirecting, suspending or terminating 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: AMONGEM@go.doe.gov no later than 3 business days prior to the application due date.

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

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

VIII. OTHER INFORMATION

A. FOA MODIFICATIONS

Amendments to this FOA will be posted on the EERE Exchange website and the Grants.gov system. However, you will only receive an email when an amendment or a FOA is posted on these sites if you register for email notifications for this FOA in Grants.gov. EERE recommends

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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 WEBINAR

EERE will conduct one informational webinar during the FOA process. It will be held after the initial FOA release but before the due date for Concept Papers.

The purpose of this webinar is 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. Specific dates for the webinar can be found on the cover page of the FOA. Here is information on how to register for the webinar:

The Next Generation Electric Machines: Megawatt Class Motors FOA Informational Webinar will be held Wednesday, April 1, 2015 at 1:00 p.m. - 2:00 p.m. EDT. Standard application questions regarding the EERE Office and FOA procedures will be discussed.

Title: Next Generation Electric Machines: Megawatt Class Motors FOA Informational Webinar

Date: Wednesday, April 1, 2015

Time: 1:00 PM - 2:00 PM ET

Reserve your Webinar seat now at:

<https://attendee.gotowebinar.com/register/8422946628127173121>

After registering you will receive a confirmation email containing information about joining the Webinar.

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.

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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 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

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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 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 Patent Waiver:
DOE has issued a class waiver that applies to this FOA. Under this class waiver, domestic large businesses may elect title to their subject inventions similar to the right provided to the domestic small businesses, educational institutions, and nonprofits by law. In order to avail itself of the class waiver, a domestic large business must agree that any products embodying or produced through the use of a subject invention first created or

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reduced to practice under this program will be substantially manufactured in the United States, unless DOE agrees that the commitments proposed in the U.S. Manufacturing Plan are sufficient.

- **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):** Each applicant is required to submit a U.S. Manufacturing Plan as part of its application. If selected, the U.S. Manufacturing Plan shall be incorporated into the award terms and conditions. DOE has determined that exceptional circumstances exist that warrants 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 U.S. Manufacturing Plan. For example, the commitments and enforcement of a U.S. Manufacturing Plan may be tied to subject inventions. Any Bayh-Dole entity (domestic small business or nonprofit organization) affected by this DEC has the right to appeal it.

M. GOVERNMENT RIGHTS IN SUBJECT INVENTIONS

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

1. GOVERNMENT USE LICENSE

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

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 Subrecipient who has elected to retain title to a subject invention (or their assignees or exclusive licensees), to grant a license for use of the invention to a third party. In addition, the Government may grant licenses for use of the subject invention when a Prime Recipient, Subrecipient, or their assignees and exclusive licensees refuse to do so.

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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.

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

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O. COPYRIGHT

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

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

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- 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

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- 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 \$750,000 or more of Federal funds during the entity's fiscal year, an annual compliance audit performed by an independent auditor may be required. For additional information, please refer to 2 C.F.R. § 910.501 and Subpart F through the link below.

<http://www.ecfr.gov/cgi-bin/retrieveECFR?gp=1&SID=0ad8c722e3f878b7e8133fc80d48fea1&ty=HTML&h=L&r=PART&n=pt2.1.910>.

If an educational institution, non-profit organization, or state/local government is a Prime Recipient or Subrecipient and has expended \$750,000 or more of Federal funds during the non-Federal entity's fiscal year, then a single or program-specific audit is required. For additional information, please refer to 2 C.F.R. § 200.501 and Subpart F through the link below.

http://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title02/2cfr200_main_02.tpl

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.

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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 2 CFR 200.24 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 2 CFR 200.306 as amended by 2 CFR 910.130.

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“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.

“EERE Exchange” is the Department of Energy, Energy Efficiency and Renewable Energy’s web system for posting Federal FOAs and receiving applications. EERE Exchange may be found at <https://eere-exchange.energy.gov>.

“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 2 CFR 200.203 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

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point for over 900 grant programs offered by the 26 Federal grant-making agencies. It can be accessed at <http://www.grants.gov>.

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

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

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

“Modification” means a revision to a FOA.

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

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

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

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

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

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

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

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

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

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

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

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

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

“Tribal Energy Resource Development Organization” 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.

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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, 2 CFR 910.130, 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%

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:

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- FAR Part 31 for For-Profit entities, (48 CFR Part 31); and
- 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

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.

DOE Financial Assistance Rules 2 CFR Part 200 as amended by 2 CFR Part 910

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

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b. Other types of organizations. Allowability of costs incurred by other types of organizations that may be Subrecipients under a prime award is determined as follows:

- i. Institutions of higher education. Allowability is determined in accordance with: 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities
- ii. Other nonprofit organizations. Allowability is determined in accordance with: 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities
- iii. Hospitals. Allowability is determined in accordance with the provisions of: 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities
- iv. Governmental organizations. Allowability for State, local, or federally recognized Indian tribal government is determined in accordance with: 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities

(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:

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- 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.

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APPENDIX C - DATA MANAGEMENT PLANS

A data management plan (“DMP”) explains how data generated in the course of the work performed under an EERE award will be shared and preserved or, when justified, explains why data sharing or preservation is not possible or scientifically appropriate.

DMP Requirements

In order for a DMP to be considered acceptable, the DMP must address the following:

At a minimum, the DMP must describe how data sharing and preservation will enable validation of the results from the proposed work, or how results could be validated if data are not shared or preserved.

The DMP must provide a plan for making all research data displayed in publications resulting from the proposed work digitally accessible at the time of publication. This includes data that are displayed in charts, figures, images, etc. In addition, the underlying digital research data used to generate the displayed data should be made as accessible as possible in accordance with the principles stated above. This requirement could be met by including the data as supplementary information to the published article, or through other means. The published article should indicate how these data can be accessed.

The DMP should consult and reference available information about data management resources to be used in the course of the proposed work. In particular, a DMP that explicitly or implicitly commits data management resources at a facility beyond what is conventionally made available to approved users should be accompanied by written approval from that facility. In determining the resources available for data management at DOE User Facilities, researchers should consult the published description of data management resources and practices at that facility and reference it in the DMP. Information about other DOE facilities can be found in the additional guidance from the sponsoring program.

The DMP must protect confidentiality, personal privacy, Personally Identifiable Information, and U.S. national, homeland, and economic security; recognize proprietary interests, business confidential information, and intellectual property rights; avoid significant negative impact on innovation, and U.S. competitiveness; and otherwise be consistent with all laws (e.g., export control laws), and DOE regulations, orders, and policies.

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Data Determination for a DMP

The Principal Investigator should determine which data should be the subject of the DMP and, in the DMP, propose which data should be shared and/or preserved in accordance with the DMP Requirements noted above.

For data that will be generated through the course of the proposed work, the Principal Investigator should indicate what types of data should be protected from immediate public disclosure by DOE (referred to as “protected data”) and what types of data that DOE should be able to release immediately. Similarly, for data developed outside of the proposed work at private expense that will be used in the course of the proposed work, the Principal Investigator should indicate whether that type of data will be subject to public release or kept confidential (referred to as “limited rights data”). Any use of limited rights data or labeling of data as “protected data” must be consistent with the DMP Requirements noted above.

Suggested Elements for a DMP

The following list of elements for a DMP provides suggestions regarding the data management planning process and the structure of the DMP:

Data Types and Sources: A brief, high-level description of the data to be generated or used through the course of the proposed work and which of these are considered digital research data necessary to validate the research findings or results.

Content and Format: A statement of plans for data and metadata content and format including, where applicable, a description of documentation plans, annotation of relevant software, and the rationale for the selection of appropriate standards. Existing, accepted community standards should be used where possible. Where community standards are missing or inadequate, the DMP could propose alternate strategies for facilitating sharing, and should advise the sponsoring program of any need to develop or generalize standards.

Sharing and Preservation: A description of the plans for data sharing and preservation. This should include, when appropriate: the anticipated means for sharing and the rationale for any restrictions on who may access the data and under what conditions; a timeline for sharing and preservation that addresses both the minimum length of time the data will be available and any anticipated delay to data access after research findings are published; any special requirements for data sharing, for example, proprietary software needed to access or interpret data, applicable policies, provisions, and licenses for re-use and re-distribution, and for the production of derivatives, including guidance for how data and data products should be cited; any resources and capabilities (equipment, connections, systems, software, expertise, etc.) requested in the research proposal that are needed to meet the stated goals for sharing and

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preservation (this could reference the relevant section of the associated research proposal and budget request); and whether/where the data will be preserved after direct project funding ends and any plans for the transfer of responsibilities for sharing and preservation.

Protection: A statement of plans, where appropriate and necessary, to protect confidentiality, personal privacy, Personally Identifiable Information, and U.S. national, homeland, and economic security; recognize proprietary interests, business confidential information, and intellectual property rights; and avoid significant negative impact on innovation, and U.S. competitiveness.

Rationale: A discussion of the rationale or justification for the proposed data management plan including, for example, the potential impact of the data within the immediate field and in other fields, and any broader societal impact.

Additional Guidance

In determining which data should be shared and preserved, researchers must consider the data needed to validate research findings as described in the Requirements, and are encouraged to consider the potential benefits of their data to their own fields of research, fields other than their own, and society at large.

DMPs should reflect relevant standards and community best practices and make use of community accepted repositories whenever practicable.

Costs associated with the scope of work and resources articulated in a DMP may be included in the proposed research budget as permitted by the applicable cost principles.

To improve the discoverability of and attribution for datasets created and used in the course of research, EERE encourages the citation of publicly available datasets within the reference section of publications, and the identification of datasets with persistent identifiers such as Digital Object Identifiers (DOIs). In most cases, EERE can provide DOIs free of charge for data resulting from DOE-funded research through its Office of Scientific and Technical Information (OSTI) DataID Service.

Definitions

Data Preservation: Data preservation means providing for the usability of data beyond the lifetime of the research activity that generated them.

Data Sharing: Data sharing means making data available to people other than those who have generated them. Examples of data sharing range from bilateral communications with

colleagues, to providing free, unrestricted access to anyone through, for example, a web-based platform.

Digital Research Data: The term digital data encompasses a wide variety of information stored in digital form including: experimental, observational, and simulation data; codes, software and algorithms; text; numeric information; images; video; audio; and associated metadata. It also encompasses information in a variety of different forms including raw, processed, and analyzed data, published and archived data.

Research Data: The recorded factual material commonly accepted in the scientific community as necessary to validate research findings, but not any of the following: preliminary analyses, drafts of scientific papers, plans for future research, peer reviews, or communications with colleagues. This 'recorded' material excludes physical objects (e.g., laboratory samples).

Research data also do not include:

(A) Trade secrets, commercial information, materials necessary to be held confidential by a researcher until they are published, or similar information which is protected under law; and

(B) Personnel and medical information and similar information the disclosure of which would constitute a clearly unwarranted invasion of personal privacy, such as information that could be used to identify a particular person in a research study.”

Validate: In the context of DMPs, validate means to support, corroborate, verify, or otherwise determine the legitimacy of the research findings. Validation of research findings could be accomplished by reproducing the original experiment or analyses; comparing and contrasting the results against those of a new experiment or analyses; or by some other means.

APPENDIX D – DEFINITION OF TECHNOLOGY READINESS LEVELS

<u>Identifier</u>	<u>Description</u>	<u>Example</u>	<u>Output</u>
TRL-1	Basic principles observed and reported: This is lowest level of technology readiness. Scientific research begins with a systematic study directed toward greater knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications or products in mind. The knowledge or understanding will later be translated into applied research and development.	An example might include studies of a technology's basic properties.	Published papers, new innovations
TRL-2	Technology concept and/or application formulated: Invention begins. Once basic principles are observed, practical applications can be invented. Applications are speculative and there may be no proof or detailed analysis to support the assumptions. Practical application invented. Research to improve feasibility.	Examples are still limited to analytical studies.	Published papers, patents, preliminary investigation
TRL-3	Analytical and experimental critical function and/or characteristic proof of concept: Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology.	Examples include components that are not yet integrated or representative.	Patents, prototypes of various unit operations built
TRL-4	Component and/or breadboard validation in laboratory environment: Basic technological components are integrated to establish that they will work together. This is relatively "low fidelity" compared to the eventual system.	Examples include integration of "ad hoc" hardware in the laboratory.	Patents, integrated prototypes, informs engineering scale designs, possible application of Stage Gate Processing.
TRL-5	Component and/or breadboard validation in relevant environment: Fidelity of breadboard technology increases significantly. The basic	Examples include "high fidelity" laboratory integration of components.	Integrated prototypes at bench scale, informs pilot plant designs, IP owned or licensed,

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	technological components are integrated with reasonably realistic supporting elements so it can be tested in a simulated environment.		initiation of Stage Gate Process/tracking.
TRL-6	System/subsystem model or prototype demonstration in a relevant environment: Representative model or prototype system, which is well beyond that of TRL-5, is tested in a relevant environment. This represents a major step up in a technology's demonstrated readiness.	Examples include testing a prototype in a high-fidelity laboratory environment or in simulated operational environment.	Integrated prototypes at pilot scale, informs demonstration scale designs. Progress through the Stage Gate Process.
TRL-7	System prototype demonstration in an operational environment: This represents a major step up from TRL-6. It requires the demonstration of an actual system prototype in an operational environment, such as in a light duty vehicle on the road.	Examples include testing at demonstration scale in simulated operational environment.	Integrated prototypes at the demonstration scale, informs commercial scale designs.
TRL-8	Actual system completed and qualified through test and Demonstration: Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL-8 represents the end of true system development.	Examples include developmental test and evaluation of the system in its intended parent system to determine if it meets design specifications.	
TRL-9	Actual system proven through successful mission operations: The technology is applied and operated in its final form and under real life conditions, such as those encountered in operational test and evaluation. In almost all cases, this is the end of the last "bug fixing" aspects of true system development.	Examples include using the system under various real life conditions.	Integrated prototypes at the commercial scale. Operational procedures that are nearly complete.

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