U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Next Generation Electric Machines: Megawatt Class Motors

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FOA Webinar

DE-FOA-0001208

April 1, 2015

Anticipated Schedule:

FOA Issue Date:	**3/18/2015**
FOA Informational Webinar:	4/1/2015 1:00 pm (ET)
Submission Deadline for Concept Papers:	4/16/2015 5:00 pm (ET)
Submission Deadline for Full Applications:	6/3/2015 5:00 pm (ET)
Submission Deadline for Replies to Reviewer Comments:	7/2/2015 5:00 pm (ET)
Expected Date for EERE Selection Notifications:	August 2015
Expected Timeframe for Award Negotiations:	August 2015 - November 2015

Notice

- All applicants are strongly encouraged to carefully read the Funding Opportunity Announcement DE-FOA-0001208 **("FOA")** and adhere to the stated submission requirements.
- This presentation summarizes the contents of FOA. If there are any inconsistencies between the FOA and this presentation or statements from DOE personnel, the FOA is the controlling document and applicants should rely on the FOA language and seek clarification from EERE.
- If you believe there is an inconsistency, please contact AMONGEM@go.doe.gov.
- There will not be a question and answer time during this presentation. All questions about the FOA are to be submitted to AMONGEM@go.doe.gov

Agenda

1) FOA Description
2) Topic Areas/Technical Areas of Interest
3) Award Information
4) Statement of Substantial Involvement
5) Cost Sharing
6) Concept Papers
7) Full Applications
8) Merit Review and Selection Process
9) Pre-Selection Interviews
10) Registration Requirements

FOA Description – Section I.A

- 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 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.
- If other applications are proposed, the proposals should contain a statement clearly identifying which application areas or markets are being targeted for technology development.

FOA Description

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.

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%

Topic Areas/Technical Areas of Interest

- 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%.

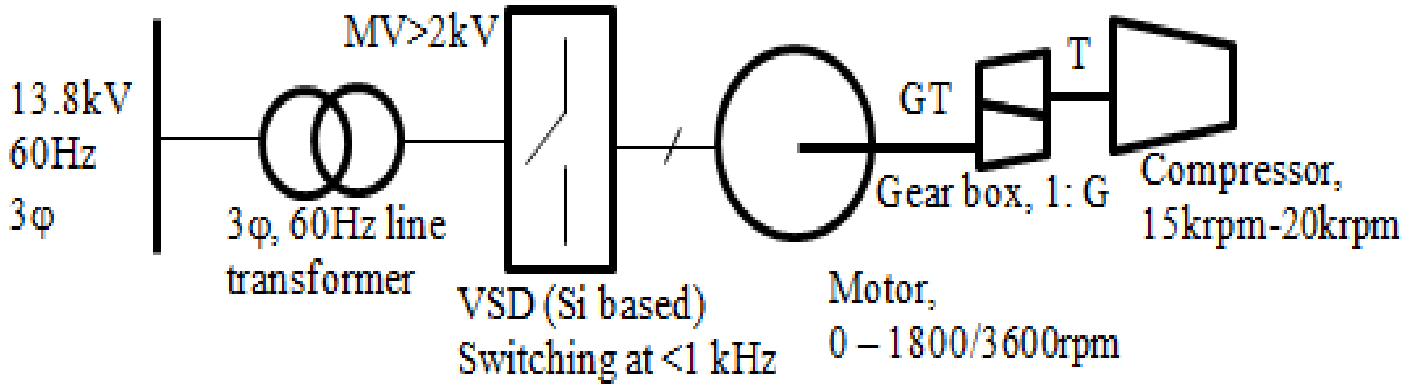
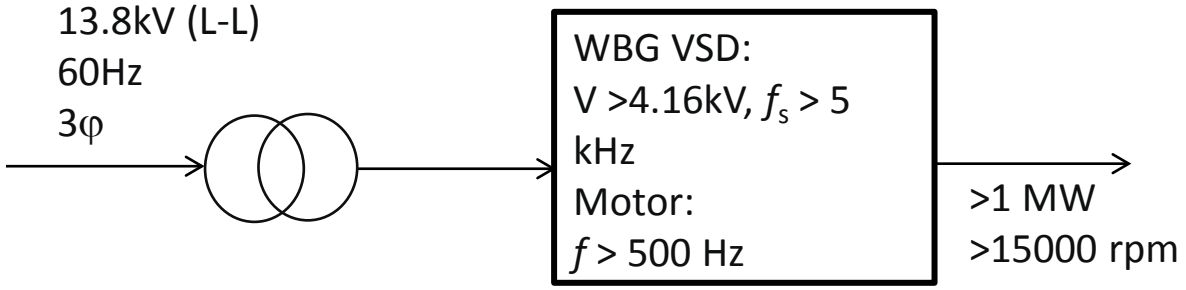


Fig. 5: *Conventional Si-VSD driven standard speed motor with gear-box in a compressor application.*

Topic Areas/Technical Areas of Interest

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

- 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,
- Replace the low speed 60 Hz motor with an 8x higher power density high speed motor, and
- Eliminate the use of the speed-increasing gearbox.



Topic Areas/Technical Areas of Interest

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

- Input: > 13.8kV (L-L)
- 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.
- 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.
- Switching frequency of WBG devices: > 5 kHz
- Motor fundamental electrical frequency: > 500 Hz
- Speed: > 15000 rpm
- Output: Power > 1MW

Topic Areas/Technical Areas of Interest

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

- Overall volumetric power density: < 6.31 m^3/MW
- Overall foot print: < 3.06 m^2/MW
- Overall full load efficiency: > 93%
- Overall total harmonic distortion (THD) (1^{st} … 49^{th}): < 2%
- Cost: <$1.00/Watt per system for 500 systems/year

Secondary Targets:

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

Topic Areas/Technical Areas of Interest

Deliverables:

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

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.

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.

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.

Non-Responsive Applications

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

- Applications that fall outside the technical parameters specified in Section I.B of the FOA, including but not limited to :
  - 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).

Award Information

Total Amount to be Awarded	**$20 million***
Average Award Amount	EERE anticipates making four to six awards that range from $3 million to $5million.
Types of Funding Agreements	EERE intends to use Cooperative Agreements under this FOA.
Period of Performance	24 to 36 months
Cost Share Requirement	20% of Total Project Costs

*Subject to the availability of appropriated funds

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:

- EERE shares responsibility with the Recipient for the management, control, direction, and performance of the Project.
- 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.
- 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.
- EERE participates in major project decision-making processes.

Cost Sharing Requirements

- Applicants must contribute a minimum of **20**% of the total project costs for R&D projects.

Contributions must be:

- Specified in the project budget
- Verifiable from the Prime Recipient's records
- Necessary and reasonable for proper and efficient accomplishment of 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

Allowable Cost Share

- Cost Share must be allowable and must be verifiable upon submission of the Full Application
- Refer to the following applicable Federal cost principles:

Entity	Cost Principles
For-profit entities	FAR Part 31
All other non-federal entities	2 CFR Part 200 Subpart E – Cost Principles

Allowable Cost Share

- Cash Contributions
  - May be provided by the Prime Recipient, Subrecipients, or a Third Party
- Other Contributions
  - Can include, but are not limited to: personnel costs, indirect costs, facilities and administrative costs, rental value of buildings or equipment, and the value of a service, other resource, or third party in-kind contribution

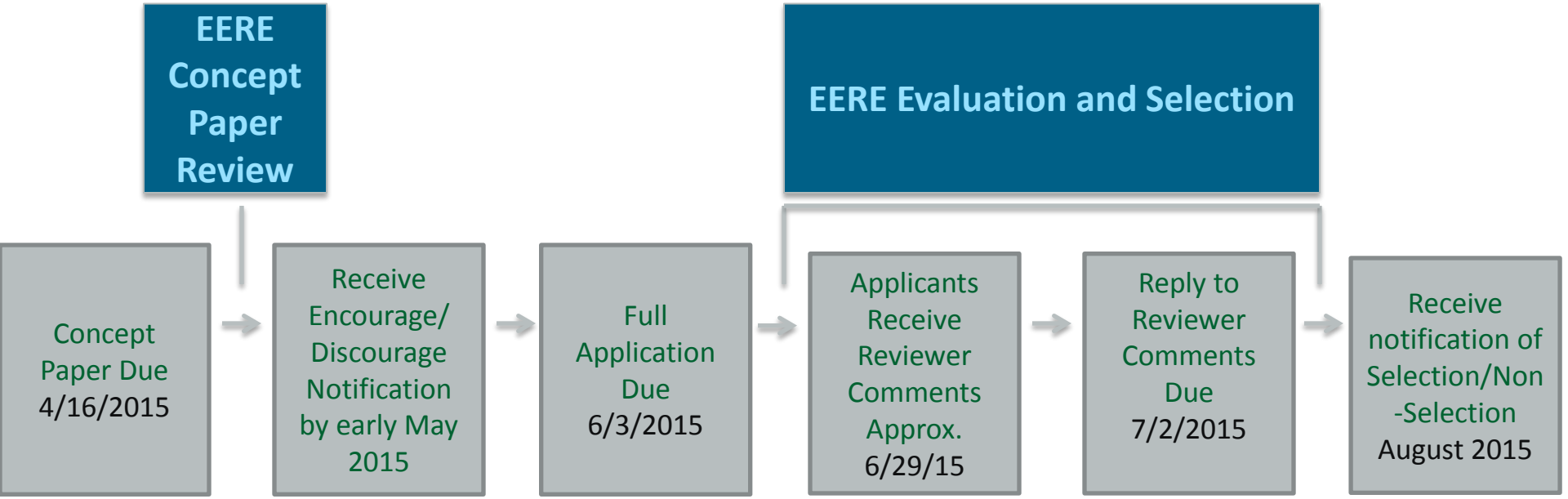
Unallowable Cost Share

- The Prime Recipient may not use the following sources to meet its cost share obligations including, but not limited to:
  - Revenues or royalties from the prospective operation of an activity beyond the project period
  - Proceeds from the prospective sale of an asset of an activity
  - Federal funding or property
  - Expenditures reimbursed under a separate Federal Technology Office
  - Independent research and development (IR&D) funds
  - The same cash or in-kind contributions for more than one project or program

Cost Share

- Recipients must provide documentation of the cost share contribution, incrementally over the life of the award
- The cumulative cost share percentage provided on each invoice 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. See Section III.B.6 of the FOA.

FOA Timeline



EERE anticipates making awards by November 2015

Concept Papers

- Applicants must submit a Concept Paper
  - Each Concept Paper must be limited to a single concept or technology
- The Concept Paper must include a technology description (See Section IV.C of the FOA)
  - The technology description is limited to 2 pages
  - The Concept Paper can also include an Addendum (graphs, charts, or other data - limited to 1 page.
- Concept Papers must be submitted by **4/16/2015, 5:00pm ET**, through EERE Exchange, and must comply with the content and form requirements in Section IV.C of the FOA.
- EERE provides applicants with: (1) an "encouraged" or "discouraged" notification, and (2) the reviewer comments.
- 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.

Concept Paper Review

EERE evaluates the Concept Papers based on the following technical review 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.

Full Applications

- The Full Application includes:
  - **Technical Volume**: The key technical submission - info relating to the technical content, project team members, etc.
  - **SF-424 Application for Federal Assistance:** The formal application signed by the authorized representative of the applicant.
  - **SF-424A Budget & Budget Justification:** a detailed budget and spend plan for the project.
  - **Summary for Public Release**
  - **Summary Slide**
  - **Administrative Documents:** E.g., U.S. Manufacturing Plan, Draft IP Management Plan, Conflict of Interest Statement (if applicable), FFRDC Authorization (if applicable), Disclosure of Lobbying Activities, etc.

Full Applications: Technical Volume Content

- **Technical Volume: the key technical component of the Full Application**

Content of Technical Volume	Suggested % of Technical Volume
Cover Page	
Project Overview	10%
Technical Description, Innovation and Impact	25%
Workplan	50%
Technical Qualifications and Resources	15%

Full Application Eligibility Requirements

- Applicants must submit a Full Application by **6/3/2015, 5:00pm ET**
- Full Applications are eligible for review if:
  - The Applicant is an eligible entity (Section III.A of FOA);
  - The Applicant submitted an eligible Concept Paper;
  - The Cost Share requirement is satisfied (Section III.B of FOA);
  - The Full Application is compliant (Section III.C of FOA); and
  - The proposed project is responsive to the FOA (Section III.D of FOA)
  - Applicants may only submit one Concept Paper and one Full Application for consideration under this FOA as the Prime Applicant.
  - The Full Application meets any other eligibility requirements listed in Section III.E of the FOA.

Who's Eligible to Apply?

Eligible applicants for this FOA include:

1. Individuals
2. Domestic Entities
3. Foreign Entities
4. Incorporated Consortia
5. Unincorporated Consortia

For more detail about each eligible applicant, please see Section III.A of the FOA for eligibility requirements

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

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

Merit Review and Selection Process (Full Applications)

- The Merit Review process consists of multiple phases that each include an initial eligibility review and a thorough technical review
- Rigorous technical reviews are conducted by reviewers that are experts in the subject matter of the FOA
- Ultimately, the Selection Official considers the recommendations of the reviewers, along with other considerations such as program policy factors, to make the selection decisions

Technical Merit Review Criteria

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.

Technical Merit Review Criteria - Continued

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.

Technical Merit Review Criteria - Continued

Criterion 2, Continued

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, Data Management Plan and Open Source Software Distribution Plan , U.S. manufacturing plan etc., and product distribution.

Technical Merit Review Criteria - Continued

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.

Technical Merit Review Criteria – Continued

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

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

Replies to Reviewer Comments

- EERE provides applicants with reviewer comments
- Applicants have approximately three business days to prepare a Reply to Reviewer Comments ("Reply") to respond to comments
  - Page Limit: 3 Pages, including charts, graphs, etc.
- Applicants are not required to submit a Reply - it is optional
- To be considered by EERE, a Reply must be submitted by 7/2/2015, 5:00pm ET and submitted through EERE Exchange
- Please see Sections IV.F. and V.A.3 for additional information regarding Replies to Reviewer Comments

Pre-Selection Interviews

- EERE may invite one or more applicants to participate in Pre-Selection Interviews
- All interviews will be conducted in the same format
- 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
- Participation in Pre-Selection Interviews with EERE does not signify that applicants have been selected for award negotiations

Selection Factors

The Selection Official may consider the merit review recommendation, Program Policy Factors, and the amount of funds available in arriving at selections for this FOA.

Program Policy Factors

- The Selection Official may consider the following program policy factors in making his/her selection decisions:
  - The degree to which the proposed project, including proposed cost share, optimizes the use of available EERE funding to achieve programmatic objectives
  - The level of industry involvement and demonstrated ability to commercialize energy or related technologies
  - Technical, market, organizational, and environmental risks associated with the project
  - Whether the proposed project 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.
  - 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

Registration Requirements

- To apply to this FOA, Applicants must register with and submit application materials through EERE Exchange: https://eere-Exchange.energy.gov
- Obtain a "control number" at least 24 hours before the first submission deadline
- Although not required to submit an Application, the following registrations must be complete to received an award under this FOA:

Registration Requirement	Website
DUNS Number	http://fedgov.dnb.com/webform
SAM	https://www.sam.gov
FedConnect	https://www.fedconnect.net
Grants.gov	http://www.grants.gov

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 will not review or consider applications submitted through other means
- The Users' Guide for Applying to the Department of Energy EERE Funding Opportunity Announcements can be found at https://eere-Exchange.energy.gov/Manuals.aspx

Key Submission Points

- Check entries in EERE Exchange
  - Submissions could be deemed ineligible due to an incorrect entry
- EERE strongly encourages Applicants to submit **1-2 days** prior to the deadline to allow for full upload of application documents and to avoid any potential technical glitches with EERE Exchange
- Make sure you hit the submit button
  - Any changes made after you hit submit will un-submit your application and you will need to hit the submit button again
- For your records, print out the EERE Exchange Confirmation page at each step, which contains the application's Control Number

Selected Applicant Points-of-Contact

- Applicants must designate primary and backup points-of-contact in EERE Exchange with whom EERE will communicate to conduct award negotiations
- It is imperative that the Applicant/Selectee be responsive during award negotiations and meet negotiation deadlines
  - Failure to do so may result in cancellation of further award negotiations and rescission of the Selection

Questions

- Questions about this FOA? Email AMONGEM@go.doe.gov
  - All Q&As related to this FOA will be posted on EERE Exchange
    - You must select this specific FOA Number in order to view the Q&As
  - EERE will attempt to respond to a question within 3 business days, unless a similar Q&A has already been posted on the website
- Problems logging into EERE Exchange or uploading and submitting application documents with EERE Exchange? Email EERE- ExchangeSupport@hq.doe.gov.
  - Include FOA name and number in subject line
- All questions about this FOA must be submitted to:

  AMONGEM@go.doe.gov