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

SOLID-STATE LIGHTING ADVANCED TECHNOLOGY R&D – 2016

SSL-FOA0001364@netl.doe.gov

Solid-State Lighting Advanced R&D -2016 Webinar

DE-FOA-0001364

November 6, 2015

Notice

- All applicants are strongly encouraged to carefully read the Funding Opportunity Announcement DE-FOA-0001364 **("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 may seek clarification from EERE as needed.
- If you believe there is an inconsistency, please contact SSL-FOA0001364@netl.doe.gov

Solid-State Lighting Advanced Technology R&D – 2016
DE-FOA-0001364

Anticipated Schedule:

FOA Issue Date:	**10/29/15**
FOA Informational Webinar:	11/06/15
Submission Deadline for Concept Papers:	11/20/15
Submission Deadline for Full Applications:	01/20/16
Submission Deadline for Replies to Reviewer Comments:	03/14/16
Expected Date for EERE Selection Notifications:	June 2016
Expected Timeframe for Award Negotiations:	September 2016

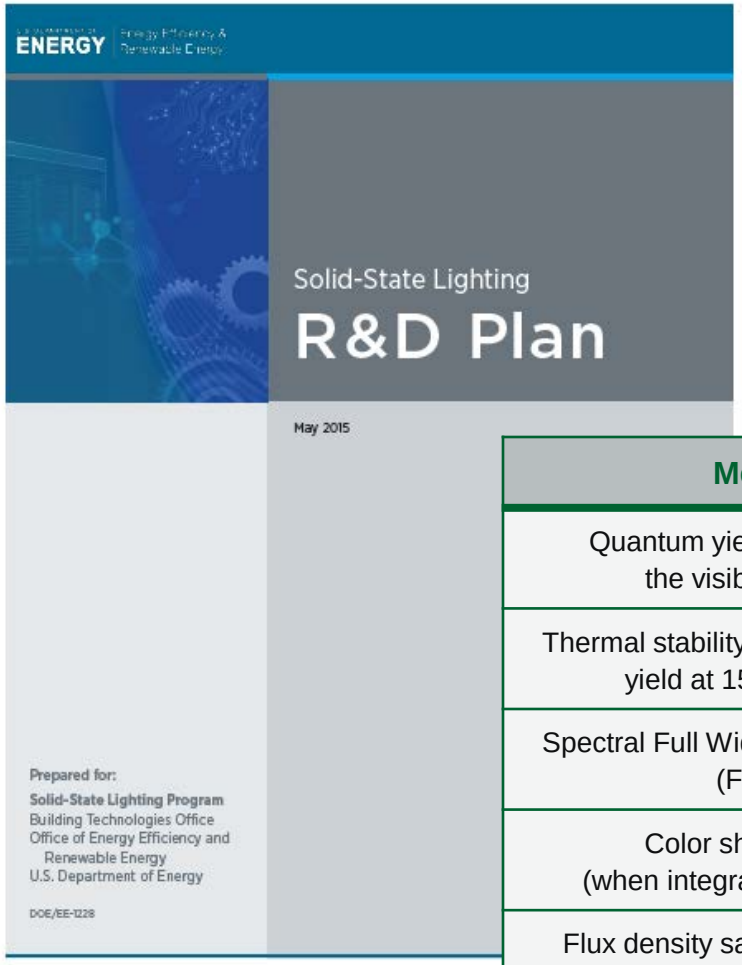
FOA Description - Objectives

- Maximize the energy-efficiency of SSL products in the marketplace;
- Remove market barriers through improvements to lifetime, color quality, and lighting system performance;
- Reduce costs of SSL sources and luminaires;
- Improve product consistency while maintaining high quality products; and
- Encourage the growth, leadership, and sustainability of domestic U.S. manufacturing within the SSL industry.

FOA Description – Technology Thrusts

- **Core Technology Research** – Applied research encompassing scientific efforts that focus on new knowledge or understanding of the subject under study, with specific application to SSL. Core Technology Research aims to demonstrate scientific principles, technical application, and application benefits.
- **Product Development** – The development of commercially viable, state-of-the-art SSL materials, devices, or luminaires using concepts from basic and applied research.
- **Manufacturing R&D** – Research to develop advanced manufacturing approaches to reduce cost of SSL sources and luminaires and improve product consistency and quality, with the additional benefit of supporting the development of U.S. based manufacturing.

FOA Description – Research & Development Plan



Sample Table from RDP

Metrics	2014 Status	2020 Targets
Quantum yield (25°C) across the visible spectrum	95% (Green) 90% (Red)	99% (Green) 95% (Red)
Thermal stability – Relative quantum yield at 150°C vs. 25°C	90%	95%
Spectral Full Width at Half Maximum (FWHM)	100 nm (Red/Green)	30 nm (Red) 70 nm (Green)
Color shift over time (when integrated into pc-LED)	$\Delta u'v'$ <0.007 at 6,000 hours	$\Delta u'v'$ <0.002 over life
Flux density saturation – Relative quantum yield (QY) at 1 W/mm^2 (optical flux) vs. peak QY	-	95%

Award Information

Total Amount to be Awarded	**$10.5 million***
Average Award Amount	EERE anticipates making awards up to $1.5 million Federal funding
Types of Funding Agreements	Cooperative Agreements, Grants, Technology Investment Agreements, Work Authorizations, and Interagency Agreements
Period of Performance	18 to 24 months with decision points depending upon topic area
Cost Share Requirement	20-50% of Total Project Costs depending upon topic area

*Subject to the availability of appropriated funds

Statement of Substantial Involvement

EERE has substantial involvement in work performed under Awards made following this FOA. EERE does not limit its involvement to the administrative requirements of the Award. Instead, EERE has substantial involvement in the direction and redirection of the technical aspects of the project as a whole. Substantial involvement includes, but is not limited to, the following:

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

Topic Areas/Technical Areas of Interest

For some topics, DOE may place a greater emphasis on certain Priority Research Areas (subtopics) than others. This determination is made when taking account of the active and concluded portfolio of SSL Program R&D projects. The current LED R&D project portfolio can be found at http://energy.gov/eere/ssl/led-rd. The current OLED R&D project portfolio can be found at http://energy.gov/eere/ssl/oled-rd. The historical portfolio of all SSL R&D projects can be found at http://energy.gov/eere/ssl/downloads/2015-project-portfolio. Applicants are required to submit applications which are unique and provide advances beyond the existing portfolio.

Topic Areas/Technical Areas of Interest

- Topic Area 1: LED Core Technology Research
- Topic Area 2: OLED Core Technology Research
- Topic Area 3: LED Product Development
- Topic Area 4: OLED Product Development
- Topic Area 5: LED Manufacturing Research and Development
- Topic Area 6: OLED Manufacturing Research and Development

Topic Areas/Technical Areas of Interest

Topic Area 1: LED Core Technology Research

- Subtopic A.1.2 – LED Emitter Materials Research

- Efficient red, green, amber direct emitters
  - New materials
  - Thick InGaN layers
  - Green gap
- Efficiency droop (electrical and thermal)
  - Theoretical and experimental approach
  - Preferred teaming of US LED manufacturer and academia/national laboratory
- Priority to direct emitters due to existing portfolio addressing droop

Topic Areas/Technical Areas of Interest

Topic Area 1: LED Core Technology Research

- Subtopic A.1.3 – LED Down Converters

- Wavelength conversion materials for warm-white LEDs
- Improved color quality, thermal stability, and longevity
- Encourage non-rare earth and nontoxic down-converters
- Must have clear and unique advantage over portfolio of down-converter projects

Topic Areas/Technical Areas of Interest

Topic Area 1: LED Core Technology Research

- Subtopic A.2.2 – Novel Emitter Architectures

- Must demonstrate a pathway to increased chip-level functionality
  - Luminaire or system
  - Must address efficiency, color stability, and emission directionality
  - Include component level metrics and holistic lighting system cost and performance metrics

Topic Areas/Technical Areas of Interest

Topic Area 2: OLED Core Technology Research

- Subtopic C.1.2 – OLED Stable White Devices

- Novel materials and structures for highly efficient and stable white OLED devices
- Should address color, lifetime, and efficiency at high brightness
- Should also address aspects of cost, complexity, and scale-up
- Materials/structures must be demonstrated and characterized in an OLED device

Topic Areas/Technical Areas of Interest

Topic Area 2: OLED Core Technology Research

- Subtopic C.6.3 – OLED Novel Light Extraction and Utilization

- New optical and device designs for improving light extraction
  - Within the OLED stack, within or adjacent to the electrodes, or external to the device
  - Retain thin profile and performance of panel
- Should discuss energy loss due to waveguided or plasmon modes
  - Should include modeling or quantitative analysis in support
- Light shaping techniques are also acceptable
- Must be demonstrated on OLED panels

Topic Areas/Technical Areas of Interest

Topic Area 3: LED Product Development

- Subtopic B.3.2 – LED Encapsulation

- New encapsulant formulations that improve LED efficiency or light output
- May include development of down-converter matrix materials
- Proposed approach must include a demonstration of the encapsulant on state-of-the-art LED packages

Topic Areas/Technical Areas of Interest

Topic Area 3: LED Product Development

- Subtopic B.3.6 – LED Package/Module Architecture Integration

- White, green, or amber LED packages or novel integration schemes combined with other luminaire subsystems or sensors into Level 2+ LED module

- Suggested minimum targets:

Metrics	Efficacy (lm/W)	Price ($/klm)
Cool White	225	0.6
Warm White	220	0.7
Direct Green	210	
Direct Amber	105	

Topic Areas/Technical Areas of Interest

Topic Area 3: LED Product Development

- Subtopic B.6.4 – Novel LED Luminaire Systems

- Novel luminaires and architectures utilizing advantages of LEDs
- Will not accept lamps (A-lamp, MR16, etc.) or retrofit luminaires (direct replacement troffers)
- Must achieve minimum 170 lm/W in warm-white with advanced features

Topic Areas/Technical Areas of Interest

Topic Area 4: OLED Product Development

- Subtopic D.4.2 – OLED Luminaire

- OLED luminaire systems and components to provide pathway to greater market adoption
- Should address unique aspects of performance, color tunability, modularity, form factor, efficient power supply, improved electrical connections, etc.
- Should address cost-benefit comparison and competitive analysis of luminaire

Topic Areas/Technical Areas of Interest

Topic Area 4: OLED Product Development

- Subtopic D.6.3 – OLED Panel Light Extraction and Utilization

- Development of manufacturable approaches to improve light extraction for OLED panels
- Retains thin profile and OLED performance
- Must be demonstrated with high performance, large area OLEDs devices (>25 cm^2)
- Must be amenable to low-cost manufacturing
- Required to achieve >60% extraction efficiency by project end

Topic Areas/Technical Areas of Interest

Topic Area 5: LED Manufacturing R&D

- Subtopic M.L.1 – Luminaire Manufacturing

- Flexible manufacturing activities
  - Advanced LED package and die integration (e.g., chip on board, chip on flex) into the luminaire
  - More efficient use of components and raw materials
  - Simplified thermal designs
  - Weight and total materials reduction
  - Optimized designs for efficient and low-cost manufacturing (such as ease of assembly)
  - Increased integration of mechanical, electrical, and optical functions
  - Reduced manufacturing costs through automation, improved manufacturing tools or product design software

Topic Areas/Technical Areas of Interest

Topic Area 5: LED Manufacturing R&D

- Subtopic M.L.3 – Test and Inspection Equipment

- Development of high-throughput, high-resolution, non-destructive test equipment with standardized test procedures and appropriate metrics for any stage within the LED lighting product manufacturing process (including sub-components and materials)

Topic Areas/Technical Areas of Interest

Topic Area 5: LED Manufacturing R&D

- Subtopic M.L.6 – LED Package Manufacturing

- Aggressive LED packaging concepts
  - LED package cost reduction
  - Yield improvement
  - Performance enhancement
- Targets cost-effective LED packaging in the US
- Suggested metrics include package cost normalized to state-of-the art

Topic Areas/Technical Areas of Interest

Topic Area 6: OLED Manufacturing R&D

- Subtopic M.O.5 – OLED Panel Manufacturing

- Focus on one or more of
  - Integration of processing steps
  - Reliability
  - Reproducibility and yield
  - Changes in design or process flow to reduce manufacturing costs
  - Optimized designs/processes for efficient & low-cost manufacturing
- Must be demonstrated on OLEDs at market relevant performance

Topic Areas/Technical Areas of Interest

Topic Area 6: OLED Manufacturing R&D

- Subtopic M.O.6 – Roll-to-Roll OLED Manufacturing

- Development of materials, processes, and equipment for roll-to-roll manufacturing
  - Includes materials that support roll-to-roll manufacturing
- Should be demonstrated within context of a full, feasible roll-to-roll process

Cost Share Contributions

- 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
  - o May be provided by the Prime Recipient, Subrecipients, or a Third Party
- In-Kind Contributions
  - o 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

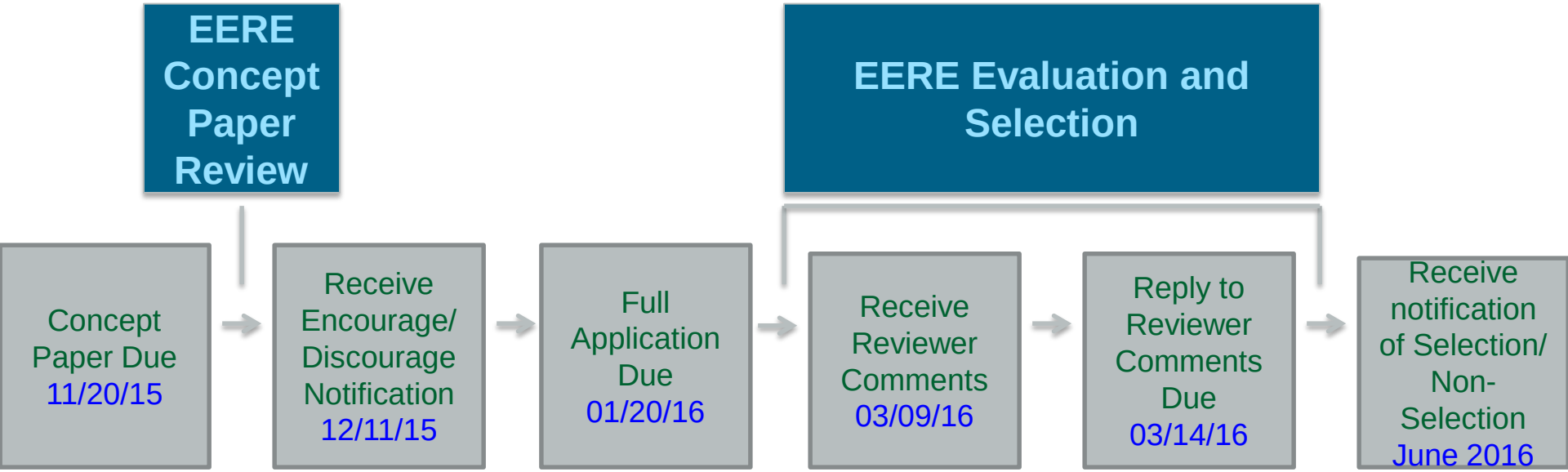
Unallowable Cost Share

- 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 Payment

- 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 September 2016

Concept Papers

- Applicants must submit a Concept Paper
  - Each Concept Paper must be limited to a single concept or technology
- Concept Paper components
  - Cover page – 1 page
  - Technology description - 3 pages maximum
    - may provide graphs, charts, or other data
  - Project team – 1 page
- Concept Papers must be submitted by 11/20/15, 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

Concept Paper Review

EERE evaluates the Concept Papers based on the following:

- The applicant clearly describes the proposed technology, describes how the technology is unique and innovative, and how the technology will advance the current state-of-the-art;
- The applicant has identified risks and challenges, including possible mitigation strategies, and has shown the impact that EERE funding and the proposed project would have on the relevant field and application;
- The applicant has the qualifications, experience, capabilities and other resources necessary to complete the proposed project; and
- The proposed work, if successfully accomplished, would clearly meet the objectives as stated in the FOA.

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, 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	30%
Workplan and Market Transformation Plan	40%
Technical Qualifications and Resources	20%

Full Application Eligibility Requirements

- Applicants must submit a Full Application by 01/20/16
- 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
  - The Full Application meets any other eligibility requirements listed in Section III 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.

Foreign National Involvement

All applicants selected for an award resulting from this FOA may be required to provide information to the Department of Energy (DOE) in order to facilitate our responsibilities associated with foreign national access to DOE sites, information, technologies, equipment, programs or personnel. Foreign national is defined as any person who was born outside the jurisdiction of the United States, is a citizen of a foreign government, and has not been naturalized under U.S. law. If the selected applicant, including subrecipients/contractors, anticipates utilizing a foreign national in the performance of an award, the selected applicant may be responsible for providing to the DOE specific information about the foreign national(s) to ensure compliance with all of the requirements for access approval. Access approval for individuals from countries identified on the U.S. Department of State list of State Sponsors of Terrorism must receive final approval authority from the Secretary of Energy before they can commence work.

Performance of Work in the United States

- All work performed under EERE Awards must be performed in the United States
  - Does not apply to the purchase of supplies and equipment
    - should make every effort to purchase supplies and equipment within the United States
  - Must flow down requirement to subrecipients
- Failure to comply may result in denied reimbursement and/or unrecognized cost share
- In limited circumstances, a waiver may be granted

Multiple Applications

Applicants may submit more than one application to this FOA, provided that each application describes a unique, scientifically distinct project

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 (50%)

Technical Merit and Innovation

- Extent to which the proposed technology or process is innovative and has the potential to advance the state of the art;
- Degree to which the current state of the technology and the proposed advancement are clearly described;
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state of the art to the proposed advancement; and
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and revolutionary, including relevant data, calculations and discussion of prior work in the literature with 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 Transformation Plan (30%)

Research Approach, Workplan and SOPO

- 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 and SOPO 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.

Technical Merit Review Criteria - Continued

Criterion 2, Continued

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 market transformation 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, U.S. manufacturing plan etc., and product distribution.

Technical Merit Review Criteria - Continued

Criterion 3: Team and Resources (20%)

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

Replies to Reviewer Comments

- EERE provides applicants with reviewer comments
- Applicants are not required to submit a Reply - it is optional
- To be considered by EERE, a Reply must be submitted by 03/14/16 and submitted through EERE Exchange
- Content and form requirements:

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.

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 is likely to lead to increased employment and manufacturing in the United States;
  - Whether the proposed project will accelerate transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty;
  - 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; and
  - The degree to which the proposed project directly addresses EERE's statutory mission and strategic goals.

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

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

  SSL-FOA0001364@netl.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 asked during this presentation will be posted on EERE Exchange