

DE-FOA-0001840 Solar Energy Technologies Office FY2018 FOA
Topic 2: Concentrating Solar Thermal Power Research and Development
Webinar Script

Slide 1:

Good [afternoon/morning] everyone and welcome to our webinar. Thank you for your interest in the U.S. Department of Energy's efforts on renewable energy and energy efficiency. You are joining us for the Informational Webinar for Applicants and other interested parties for the Solar Energy Technologies Office FY2018 Funding Opportunity Announcement, or FOA, which was issued on April 17th, 2018. Specifically, this webinar is meant to cover the content of Concentrating Solar Power Research and Development, which includes five subtopics. My name is Matthew Bauer and I am a Technology Manager in the solar office within the DOE's Office of Energy Efficiency and Renewable Energy.

Before we begin, I'd like to draw your attention to the email address on the left hand side of this cover page. This is the official mailbox to direct all of your questions during the entire FOA process. Please do not contact EERE individuals directly with questions, including myself. All questions received at this mailbox are posted publicly at the Q&A section of the FOA page on EERE Exchange in an anonymous way. The official answers to your questions will typically also be posted within 3 business days. Please be careful not to submit any language that might be business sensitive, proprietary or confidential.

In addition to emailing this inbox, you may type in the chat bar any questions you have as they come up. Again, please be careful not to submit any language that might be business sensitive, proprietary or confidential. We will be posting answers to these questions to EERE Exchange as well; note that we will not be able to answer these today during the webinar.

Also, just to be clear, there are no particular advantages or disadvantages to the application evaluation process with respect to participating on the webinar today. Your participation is completely voluntary.

Let's get started!

Slide 2: This slide shows the anticipated schedule for the FOA. The FOA has already been posted, and we are conducting the FOA Informational Webinar now. Please note that there are a few requirements that we will go over in the presentation that are different than in past FOAs, such as Replies to Reviewer Comments – we will cover all requirements for this FOA later in the presentation.

Slide 3: READ SLIDE

Slide 4: READ SLIDE

Slide 5: The agenda for this presentation is as follows: READ SLIDE

We encourage you to have a copy of the FOA in front of you for reference as we go through the presentation.

Slide 6: The FOA will support early-stage research that spans the SETO portfolio, seeking to advance both solar photovoltaic (PV) and concentrating solar thermal power (CSP) technologies and to facilitate the swift integration of those technologies into the nation's electricity grid.

It also is designed to support efforts that prepare the workforce for the solar industry's future needs.

Historically, SETO has released separate funding opportunities that address specific stages and types of solar research. For the first time, this funding program combines SETO funding efforts into one FOA for fiscal year 2018 (FY2018). By providing a more streamlined and consistent FOA strategy SETO hopes to further accelerate the advancement of solar research and reduce government overhead.

Lastly, the Innovative Pathways topics you will see in the FOA aim to fund projects are different than typical DOE technology development projects. They do not fund individual technologies along their pathway to market, but instead focus on improving the pathway itself for portfolios of technologies. The projects will seek to unlock private sector support for energy innovation and encourage private funding for later-stage technological development.

Slide 7: The FOA contains 4 high level technical areas of interest.

Topic 1: Advanced Solar Systems Integration Technologies describes SETO research priorities in the seamless integration of high penetrations of solar energy onto the nation's electricity grid. Responsive projects would advance the prediction, monitoring, and control of solar power production, the capabilities of solar power electronics and the integration of solar energy with synergistic technologies.

Topic 2: Concentrating Solar Thermal Power Research and Development describes SETO research priorities that support solar technologies that focus sunlight to generate and store high-temperature heat for electricity generation and other end uses. Responsive projects would contribute to increasing solar power adoption and grid reliability often through combined power and storage.

Topic 3: Photovoltaic Research and Development describes SETO research priorities that support the further development of photovoltaic technologies that improve system reliability, annual energy yield, demonstrate performance of novel PV devices and develop new PV materials. Responsive projects would directly contribute to increasing PV affordability through continuous improvements in PV efficiency and reliability. SETO's work ensures that a pipeline of innovation continues to reduce PV system cost, increase power conversion efficiency, and reduce supply-chain capital expense.

Topic 4: Improving and Expanding the Solar Industry through Workforce Initiatives describes SETO research priorities that support solar workforce development. Responsive projects would focus on increasing the size of the pipeline of skilled workers being employed by the solar industry while simultaneously working to increase the proportion of industry participants from the talent pools of veterans and other communities, providing increased value to the solar industry as a whole.

Slide 8: Topic 2.1 is titled "Small, Innovative Projects in Solar (SIPS): CSP" This topic area will fund small, focused projects investigating the applicability of emerging thermal or optical manipulation processes, and related material systems, to the CSP application. The limitations to manipulating heat and light (both in terms of feasibility and cost) are core constraints to CSP plant design. Innovations for controlling energy in these forms may create an opportunity for novel solar thermal concepts and enable new types of CSP systems. Such concepts, if successfully proven, should support dramatic progress towards the CSP 2030 levelized cost of electricity (LCOE) goal of 5¢/kWh for baseload or 10¢/kWh for peaking power generation. Applications to this topic should propose projects that seek to prove or disprove a central hypothesis that would disruptively alter the design of CSP plants in such a way as to enable the targeted costs. Applicants must demonstrate an understanding of the major issues impeding the proposed technical approach, and clearly identify the particular barrier(s) that will be the target of the research effort.

Slide 9: Topic 2.2 is titled "Advanced CSP Collectors" This topic will fund research and development of innovations in novel CSP collectors, which direct solar flux to an absorber (receiver), where it is converted to heat, as well as technologies associated with collector installation and operation. The solar collector field is one of the single largest components of the cost of constructing a CSP plant (approximately 25% of the direct capital costs). The component must efficiently concentrate light while minimizing fabrication, installation, and operating costs. Collectors that are able to cost-effectively achieve high concentration ratios can directly improve the efficiency of the receiver. This effect becomes particularly

impactful at high receiver temperatures. With these factors in mind, R&D concepts supporting a significant decrease in CSP LCOE and satisfying the below figure of merit (FOM) by accounting for Cost per reflective surface area (in \$/m²), efficiency times 100 (Eff), and concentration ratio (CR) are of primary interest.

$$FOM = \text{CostEff} + CR/50 < 0.65$$

For example, a heliostat with a cost of \$60/m², a 55% annualized optical efficiency, and ability to achieve a concentration ratio of 2000 suns, would satisfy the FOM: $0.631 < 0.65$. Hardware of interest should be operable for 30 years or have a viable replacement strategy. Cost must account for all contributions to installed cost. Environmental impacts on the collector, particularly operable wind speeds and survivable wind speeds, should be considered.

Beyond development of the core collector hardware, applications which address collector assembly and installation in support of the above figure of merit will also be considered. A connection should be drawn between metrics that can be investigated in the project (such as time and motion studies) and their impact on the figure of merit.

Finally, applications which propose technologies addressing the operation and/or maintenance of CSP collectors are also sought. Such applications may address optical losses not generally dictated by the optical hardware (aiming technology, control systems, performance degradation, collector down time, wind mitigation, etc.) as well as operational cost of the collector field. Applicants may describe the effect of the proposed technology on avoided collector capital cost, annual efficiency improvement, or other variables relatable to the LCOE of a CSP plant.

Slide 10: Topic 2.3 is “Advanced Power Cycles for CSP”

This topic will fund innovations in power cycles compatible with cost competitive CSP. The power cycle subsystem converts collected thermal energy from the CSP receiver and/or thermal energy storage into electricity. Under this topic, applications developing advanced power cycles are sought. Appropriate power cycles must be able to convert thermal energy to electricity at an efficiency greater than 50%, must have a capital cost of less than \$900/kW (including heat exchange into the power cycle), must be compatible with dry cooling, and support 30 years of CSP operation. While this topic is open to a variety of high-efficiency, low-cost thermal-to-electric power cycles, the supercritical CO₂ (sCO₂) cycle is of particular interest. EERE, with the Offices of Nuclear Energy and Fossil Energy, have collaboratively focused on the development of the sCO₂ Brayton cycle.¹⁶ Shared research goals have accelerated the development of critical components and broadened the foundational knowledge related to this cycle.

Applicants proposing further R&D of the sCO₂ cycle must be familiar with state of the art developments fostered by this initiative as well as external entities.

Supercritical CO₂ Power Cycles

The supercritical CO₂ (sCO₂) cycle is a viable candidate to satisfy the cost and efficiency requirements stated above. It is advantageous for its high conversion efficiency, dry cooling compatibility, small size (influencing construction and O&M costs), and efficient integration with CSP heat transfer media. Applications of interest for this subtopic fall into 4 categories:

1. Component innovations supporting sCO₂ cycle variations uniquely advantageous to operation of a complete CSP plant
2. Component innovations for the sCO₂ Recompression Closed Brayton Cycle
3. Materials and Manufacturing Innovations supporting the cycle's use with CSP
 - a. Emphasis is placed on innovations supporting the primary heater which couples the power cycle to a specific CSP HTF or TES system. Innovations relevant to other components throughout the cycle are encouraged
4. Cycle Operations and Maintenance Technology Innovations

Novel Power Cycles Impacting CSP Market Viability

Alternative thermal-to-electric conversion processes may offer improved performance, be more amenable to CSP, or allow a CSP system to operate in some superior embodiment. Research into such alternative cycles which enable a transformative step in CSP may be proposed as part of this topic. Proposals must indicate a power cycle efficiency target, cost target, and the constraints placed on other CSP subsystems. All proposed CSP configurations must be amenable to integration with thermal energy storage.

Slide 11: Topic 2.4 is "Advanced CSP Thermal Transport Systems and Components"

All CSP components between the collector field and the power cycle can be collectively labeled the thermal transport system. This begins where the incident photon is converted to thermal energy, and ends immediately before the thermal energy is exchanged into the power cycle. Components in this section include the receiver panel, heat transfer media (HTM), HTM piping, HTM structure (e.g. tower), HTM movement (pump, circulator, elevator, etc.), thermal energy storage (TES) media, TES containment and heat exchange, heat tracing, system sensors, and controls. To be compatible with the CSP LCOE target of 5¢/kWh, these systems must collectively cost less than \$615/kWh while supporting a 50% efficient power cycle, a 90% efficient receiver panel, 14 hours of TES with 99% energetic efficiency and 95%

exergetic efficiency, and total parasitic losses no more than 6% of the turbine gross power. These targets must be met by a reliable system able to operate for 30 years at the temperature conditions required by the targeted power cycle.

Research and development applications are sought for individual components or collections of components compatible with the above cost and efficiency paradigm. Research projects can include sub-commercial scale versions of the component to test operational compatibility. Projects should include detailed cost modelling for the economic viability of the component at scale. Targeted power cycles must be identified (which determine the temperature of the thermal transport system). If a targeted power cycle has an efficiency below 50%, additional savings or performance improvements elsewhere must offset the performance loss in the power cycle.

As described in the introduction to Topic 2, concepts redundant with the Gen3 CSP initiative are not of interest.¹⁷ New opportunities to achieve cost competitive CSP are sought by exploring new temperature paradigms, new basic research solutions several steps from component integration, and innovations supporting system architectures unique from the described Gen3 system and pathways.

Slide 12: Topic 2.5 is “innovative pathways: Concentrating solar power”

The final subtopic in Topic 3 is known as Innovative Pathways. This topic area will fund innovative approaches and models to accelerate the transfer of CSP and related technologies from the lab to the private sector. Instead of direct technology solutions, successful applicants will research and develop new methods to advance solar research portfolios and overcome challenges endemic to the solar technology transfer space. These challenges could include knowledge gaps between research and industrial communities, or constraints on access to necessary resources.

Some areas of interest include, but are not limited to: alternative capital for technology transfer, new ways to incentivize industry-researcher collaboration, methods to reduce barriers for new entrants in the industry to leverage existing facilities, data and build capacity, and methods to drive down the cost or accelerate hardware validation and certification processes.

Slide 13: Projects within each subtopic of Topic 2 will be provided different amounts of estimated funding and will last for different lengths of time. For SIPS Topic 2.1, EERE expects to make approximately \$3 million of Federal funding available for new awards under this FOA subject to the availability of appropriated funds. The average award amount is anticipated to be around \$300,000 dollars and each award will last around 18 months.

For Topics 2.2, 2.3 and 2.4, EERE expects in total to make approximately 20 million dollars of Federal funding available for new awards, with around 2 million per award, and the average project lasting about 3 years.

For Innovative Pathways, Topic 2.5, EERE expects to make about 1 award with around 1 million dollars of Federal funding available. The award will last about 3 years.

EERE intends to fund mostly cooperative agreements under this FOA, but may also fund Grants, TIAs, Work Authorizations, and Interagency Agreements. Cooperative Agreements include Substantial Involvement, which we will discuss next. A minimum of 20% cost share is required across all subtopic areas for Topic 2.

Slide 14: READ SLIDE

Please note that nonprofit organizations described in Section 501(c)(3) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995, are not eligible to apply for funding.

Also, note that 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.

Slide 15: The following types of applications will be deemed nonresponsive and will not be reviewed or considered for an award. Examples of non-responsive applications include:

Undifferentiated research, products, and/or solutions: This FOA seeks innovative solutions that help achieve SETO goals. Incremental advancement of undifferentiated or duplicative efforts is insufficient to meet SETO goals and is not of interest to this FOA.

Projects lacking influential impact from federal funds: This FOA intends to fund projects where Federal funds will provide a clear and measurable impact, (e.g. retiring risk sufficiently for follow-on investment or catalyzing development.) Projects that have sufficient monies and resources to be executed regardless of federal funds are not of interest.

Re-funding the same idea at the same technology readiness level: This FOA does not intend to re-fund prior SETO awardees for the same idea at the same technology readiness level.

Slide 16: Under cooperative agreements, there will be what is known as “substantial involvement” between EERE and the Recipient during the performance of the project.

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Slide 18: The total budget presented in the application must include both Federal (DOE), and Non-Federal (cost share) portions, thereby reflecting TOTAL PROJECT COSTS proposed. All costs must be verifiable from the Recipient’s records and be necessary and reasonable for the accomplishment of the project.

Slide 19: Cost Share must be allowable and must be verifiable upon submission of the Full Application. Please refer to this chart for your entity’s applicable cost principles. It is imperative that you follow the applicable cost principles when creating your budget for the full application.

Slide 20: Every cost share contribution must be allowable under the applicable Federal cost principles, as described in Section IV.J.1 of the FOA.

Project Teams may provide cost share in the form of cash or in-kind contributions. Cost share may be provided by the Prime Recipient, Subrecipients, or third parties (entities that do not have a role in performing the scope of work). Vendors/Contractors may not provide cost share.

Cash contributions include, but are not limited to: personnel costs, fringe costs, supply and equipment costs, indirect costs and other direct costs.

In-kind contributions are those where a value of the contribution can be readily determined, verified and justified but where no actual cash is transacted in securing the good or service comprising the contribution. Allowable in-kind contributions include, but are not limited to: the donation of space or use of equipment.

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.

Slide 21: Be aware that there are items that are considered unallowable cost share. If a cost is considered unallowable, it cannot be counted as cost share. This slide provides some examples of cost share that is unallowable.

Slide 22: Cost Share must be provided on an invoice basis, unless a waiver is requested and approved by the DOE Contracting Officer.

Slide 23: EERE's Evaluation and Selection Process is shown in blue here. EERE will review Concept Papers, Replies to Reviewer Comments (which we will cover later in the presentation), and Full Applications. The gray boxes represent the actions that apply to applicants throughout the FOA process.

Slide 24: As part of the merit review process, EERE may invite certain applicants to participate in Pre-Selection Interviews.

The invited applicants will meet with EERE I to allow the Merit Review Panel to seek clarification on the contents of the Full Applications and otherwise ask questions regarding the proposed project. The information provided by applicants to EERE through Pre-Selection Interviews contributes to EERE's selection decisions.

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.

EERE will arrange to meet with the invited applicants in person at EERE's offices, a mutually agreed upon location, or virtually via web conference. EERE may also arrange site visits at certain Applicants' facilities.

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.

Slide 25: Letters of Intent will be used by EERE to plan for the merit review process. In order to submit a Concept Paper and Full Application, applicants are REQUIRED to submit a Letter of Intent by May 4, 2018.

Slide 26: Concept Papers are required for this FOA. Concept Papers are brief descriptions of the proposed project. It allows applicants to submit their ideas with minimal time and expense. EERE will provide feedback on the proposed project so the Applicant can make an informed decision whether to expend additional resources to prepare a full application.

If an applicants fails to submit an eligible Concept Paper, the applicant is not eligible to submit a Full Application.

Concept Papers must be submitted by May 9 2018 at 3 pm Eastern, through EERE Exchange.

EERE will provide applicants with either an encouraged or discouraged notification as well as reviewer comments. A “discouraged” notification conveys EERE’s lack of programmatic interest in the proposed project. An applicant who receives a “discouraged” notification may still submit a Full Application.

Please note that regardless of the date applicants receive the Encourage/Discourage notifications, the submission deadline for the Full Application remains the date stated on the FOA cover page

Slide 27: READ SLIDE

Slide 28: READ SLIDE

Slide 29: READ SLIDE

Slide 30: The Full Application includes:

Technical Volume: The key technical submission. Applicants submit info pertaining 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. Includes cost share amounts and Federal certifications and assurances.

Summary Slide: Powerpoint slide that provides quick facts about the technology. Slide content requirements are provided in the FOA.

And other Administrative Documents

Slide 31: To streamline the application process for applicants, the documents listed on the slide will only be requested upon selection, including the Budget Justification Workbook (EERE 335) and US. Manufacturing Commitments.

Other documents or clarifying information that can be requested at the time of Selection for Negotiation can be found on the slide.

Slide 32: The key technical component of the full application is the Technical Volume, which helps applicants frame the technical information that the application will be evaluated on. The Technical Volume provides information regarding what the project is, how the project tasks will be accomplished, and the project timetable.

The Technical Volume is comprised of

The Cover Page will be a one page document and provides basic information on their project, such as title, topic area, points of contact, etc.

The Project Overview provides information on project background, goals, impact of EERE funding

The Technical Description, Innovation, and Impact section provides information on project relevance and outcomes, feasibility, and innovation/impacts. This ultimately provides the justification as to why EERE should fund the project.

The Summary Statement of Project Objectives (SOP) or “Workplan” details the proposed milestones and project schedule. If selected for award negotiations, the Workplan serves as the starting point when negotiating the Statement of Project Objectives.

The Technical Qualifications and Resources section provides applicants an opportunity to provide information about the proposed project team and demonstrate how the applicant will facilitate the successful completion of the proposed project.

And Appendices as needed

There are not strict page limits on sections to allow applicants the flexibility to structure the application in a way to best articulate the project and address the content requirements. The applicant should consider the

weighting of each of the evaluation criteria (see Section V.A.2 of the FOA) when preparing the Technical Volume.

Slide 33: As we previously pointed out, applicants must submit full applications by June 26, 2018. EERE will conduct an eligibility review, and full application will be deemed eligible if:

READ SLIDE

Slide 34: READ SLIDE

Slide 35: READ SLIDE

Slide 36: Applications will be evaluated against the following merit review criteria:

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Slide 37: READ SLIDE

Slide 38: READ SLIDE

Slide 39: The Full Application are reviewed by experts in the FOA topic area(s). After those experts review the applications, EERE will provide applicants with reviewer comments. Applicants will have a brief opportunity to review the comments and prepare a short Reply to Reviewer Comments responding to comments however they desire. The Reply to Reviewer Comments is due by the date and time provided on this slide. Applicants should anticipate receiving the independent reviewer comments approximately three business days before this due date. The Reply to Reviewer Comments is an optional submission; applicants are not required to submit a Reply to Reviewer Comments.

This a **customer centric** process that provides applicants with a unique opportunity to correct misunderstandings and misinterpretations and to provide additional data that might influence the selection process in their favor. The Replies are considered by the reviewers and the selection official.

Replies to Reviewer Comments must conform to the content and form requirements listed here, including maximum page lengths. 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.

Please see Sections IV.F. and V.A.3 for additional information regarding Replies to Reviewer Comments

Slide 40: READ SLIDE

Slide 41: After the Merit Review process, the Selection Official may consider program policy factors to come to a final selection decision.

READ SLIDE

Slide 42: READ SLIDE

Slide 43: There are several one-time actions before submitting an application in response to this FOA, and it is vital that applicants address these items as soon as possible. Some may take several weeks, and failure to complete them could interfere with an applicant's ability to apply to this FOA, or to meet the negotiation deadlines and receive an award if the application is selected.

DUNS Number

Obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number.

System for Award Management

Register with the System for Award Management (SAM). 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. We specifically want to emphasize the importance of SAM registration as we have run into numerous problems in the past. Selections and Awards cannot be made without SAM registration.

Fedconnect

Register in FedConnect. 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 the FedConnect site.

Grants.gov

Register in Grants.gov to receive automatic updates when Amendments to this FOA are posted. However, please note that Letters of Intent, Concept Papers, and Full Applications will not be accepted through Grants.gov.

Slide 44: All required submissions must come through EERE Exchange. EERE will not review or consider applications submitted through any other means.

Slide 45: READ SLIDE

Slide 46: READ SLIDE

Slide 47: READ SLIDE

