PHOTOVOLTAICS RESEARCH AND DEVELOPMENT (PVRD) 2: MODULES AND SYSTEMS

Informational Concept Paper Phase Webinar Script

Slide 0: Hello and welcome to the first webinar for the "Photovoltaics Research and Development 2: Module and Systems" funding opportunity announcement, also known as the PVRD2 FOA. My name is Jonathan Trinastic and I am a member of the DOE SunShot Initiative's Photovoltaics Team.

Today we'll cover everything you need to know about our funding opportunities in general, the objectives of this specific funding opportunity, and how to start your application. A couple notes before we get started. First, this webinar will cover information about this FOA in general, the required Letter of Intent, and the Concept Paper submission after the Letter of Intent. This FOA is broken into three general topic areas – 1, 2, and 3 - that we'll discuss in more detail in a little bit. Topic Area 1 has a slightly different application process than Topics 2 and 3, so pay close attention to the instructions we'll review for each. A future webinar will cover more detailed information about Full Applications for all topics.

Second, at the end of today's webinar, there will be a questionnaire that pops up asking for comments about today's presentation. We ask that you fill this out so we can improve future webinars to maximize their value to you, the applicants. And with that, let's get started!

Slide 1: First, an important disclaimer. You may read this slide in its entirety later when this presentation is posted on the EERE Exchange website, which we'll give you a link for later. Basically, we include this slide to make sure you're aware that the ultimate authority on how this funding opportunity is constructed and the rules for applying to it is the funding opportunity document posted on the EERE Exchange website. This webinar is meant to be a guide only.

Slide 2: OK, now let's begin discussing the structure of the PVRD2 funding opportunity. This is the entire process we'll be discussing related to the application process and award management in this webinar and a second one in a couple months. All proposals begin with a Letter of Intent, at the top, but different Topic Areas will have different Concept Paper and Full Application requirements as we'll see in a bit. Award negotiation and project management are the final steps in the lifecycle.

Slide 3: However, in today's webinar, we'll only be talking about the Letter of Intent and Concept Paper for this funding opportunity. Once we start

accepting SIPS Applications and Full Applications, we will present a second webinar on February 7 of next year to cover these submissions and the award negotiation and management process for both of them.

Slide 4: Before we get into details about the path for applications, we'll discuss some high-level concepts and useful facts about our funding opportunities in general. There are two helpful websites that you may use to learn more about PVRD2 and other funding opportunities after this webinar has ended: one is Grants.gov and the other is EERE Exchange. By the way, EERE stands for Energy Efficiency and Renewable Energy. EERE is a division of the Department of Energy, and the SunShot Initiative is one office inside EERE.

Grants.gov is a great resource for exploring most of the funding opportunities that exist throughout the federal government. On the other hand, Exchange is where all funding-opportunity-related business relevant to an applicant occurs for EERE. Please note that you may find useful information about EERE funding opportunities on Grants.gov, but all of the business of the funding opportunity is done on Exchange, including the most up-to-date information regarding any post-release modifications. The first step for applying to this FOA will be registering as an applicant through Exchange.

Slide 5: In addition to these resources, DOE uses several methods to educate audiences about the goals of our funding opportunities. One is this webinar! Of particular note to applicants should also be the Frequently Asked Questions, or FAQ pages, shown here in the middle column. Each funding opportunity has its own FAQ document or webpage that shows relevant questions asked by the community of applicants as well as the answers to those questions. Note that DOE will not respond to individual questions through one-on-one communication: to ensure the fairest application process possible, all questions are answered on these public FAQ pages. Questions may be submitted via the chat function in webinars such as this one or via email to the funding opportunity's mailbox address, which is shown on this page – PVRD2@ee.doe.gov. If you ask questions through the chat function in today's webinar, please submit them through the "Questions" interface. These will be collected after the webinar and the most relevant answers will be posted on the FAQ. Finally, always check EERE Exchange for any updated changes made to the FOA.

Slide 6: Let's move on to talk more about PVRD2's application process. The left graphic lays out the beginning application process for Topic 1, and the right side describes the steps for Topics 2 and 3. Each circle is a single step in the application process, and the red box highlights the parts of the process we'll cover today.

First we'll talk about the path of a SIPS application, which is Topic 1 in the FOA, as shown on the left. SIPS stands for 'Small Innovative Projects in Solar'. SIPS Applications are a type of submission that began with last year's PVRD funding opportunity, but the application is slightly different this year. Further details will be given later in this webinar, but we just wanted to point out here that the path a SIPS Application follows is not the same as that for the usual EERE Full Application packages. The SIPS process begins with the required Letter of Intent submission, followed by an extremely short, minimal Concept Paper stage. This minimal submission is mainly intended to give us a preliminary idea about your proposal idea and your budget. The minimal Concept Paper for Topic 1 will not be scored or evaluated, however both the Letter of Intent and Concept Paper must be submitted through Exchange in order to proceed with the application. Both the Letter of Intent and minimal Concept Paper for SIPS can be done at the same time in Exchange, if you like.

The next step is a SIPS Application to be submitted at the same time as Full Applications corresponding to Topics 2 and 3. We'll discuss the SIPS Application in much more detail in a second webinar.

In contrast to SIPS, Topics 2 and 3 will follow a different process outlined here on the right. As with SIPS, applicants will submit a Letter of Intent. However, after this step, applicants must submit a required Concept Paper that is more involved compared to Topic 1. Concept Papers are much shorter than the Full Applications, which come later, and are also briefer than SIPS Applications. In some ways, they may be thought of as pre-proposals. Concept Papers should be relatively faster to write than a Full Application and therefore they save applicants' time if their proposed work is not programmatically aligned with DOE's interests. To determine this alignment, DOE will notify those submitting Concept Papers of its interest in their work by sending an Encourage or Discourage Notification after a review of all submissions. DOE will also provide applicants with the written review comments of their Concept Papers to better inform them of the strengths and weaknesses of the application. Please note that a Discourage Notification does not prohibit you from submitting a Full Application, but you should see it as an indication to pay attention to reviewer comments. Note also that **Full Applications will not be accepted from teams that did not submit a Concept Paper**.

So, to review, SIPS applications require a Letter of Intent, a minimal Concept Paper submission that will not be technically evaluated, and finally a SIPS application. In contrast, Topics 2 and 3 applications require a Letter of Intent, a Concept Paper that will be evaluated with an Encourage/Discourage recommendation, and finally a Full Application to be considered.

Again, the red box shown here indicates the portion of this process that we're discussing today. The rest of the application process, beginning with Full Application submission, will be discussed during the second webinar.

Slide 7: Let's chat a little bit more about the minimal Concept Paper submission required for Topic 1 SIPS applications. Immediately after submitting the Letter of Intent, a SIPS Concept Paper submission will be open to you in Exchange that you can submit at any time before the deadline – even right after the Letter of Intent if you want. The submission will consist of tabs at the top of the screen, as shown in the screenshot here, which will take you to fields to fill out about your contact information, team, preliminary budget, et cetera. The final tab, shown here, includes a button to upload a file, however **no document needs to be uploaded for SIPS Topic 1 Concept Papers**. Instead, ignore the 'Add New File' button and just be sure to complete all the fields in each tab, then click 'Submit' in the bottom-right corner to complete this step. After this minimal Concept Paper has been submitted, the next step would be to submit your SIPS Application before its deadline found in the FOA.

Slide 8: Now let's take a moment to look at the Topics 2 and 3 Concept Paper process that occurs internally at DOE, and see how it differs compared to SIPS applications. After the deadline for submitting Concept Papers has passed, we review all entries for completeness – this is the Eligibility Review. If an applicant has submitted an incomplete or otherwise non-compliant Concept Paper, the submission is deemed ineligible for review and the applicant is notified of this fact. Detailed eligibility information can be found in Section III of the FOA. Once deemed eligible, compliant Concept Papers are then passed on to a group of merit reviewers that will read and evaluate them based upon the ideas presented. Note that this Eligibility Review step is also performed on SIPS applications in a similar manner but during the Full Application process, since only a minimal Concept Paper is required in the SIPS case. Note again the reminders at the bottom of this slide regarding Discourage notifications and the fact that Concept Papers are needed to qualify for submitting a Full Application for Topics 2 & 3.

Slide 9: Before we move on to the specifics of the PVRD2 FOA, here are some final thoughts on how to stay on track with your applications. The Letter of Intent deadline is the most important deadline because Concept Papers, SIPS Applications, and Full Applications cannot be submitted without a Letter of Intent. Also, the instructions in the funding opportunity aren't suggestions, they're requirements**.** Finally, changes can be made to applications after they have been submitted on Exchange, but all documents must be resubmitted in that case to ensure that DOE gets the newly-changed submission.

Slide 10: Now we can discuss some of the specifics of the Photovoltaics Research & Development 2: Modules and Systems funding opportunity. You can find a detailed discussion of the award information in Section II of the FOA. The total amount we'll be awarding in this funding opportunity is approximately $25 million. We expect that there will be 20 to 30 awards made across all application types. For Topic 1, DOE will issue around 10 awards ranging from $100,000 to $225,000. Around 10-20 awards will be issued for awards in Topics 2 and 3, ranging from $450,000 to $1.6 million each. EERE utilizes Cooperative Agreements as its funding vehicle, which we'll talk about in more detail in the next webinar. More information may also be found, as always, in the Funding Opportunity Announcement document on EERE Exchange.

The Period of Performance dictates how long each project will be and depends on which Topic you apply to. Topic 1 projects, which are the SIPS projects, will only be 1 year in length. Topics 2 and 3 requiring Full Applications will be 2 to 4 years in length. It is important to note that DOE may establish more than one budget period for each award and choose to fund only the initial budget period. Applicants should determine for themselves the amount of time required for their project to have impact in a given Topic Area and construct their work plan accordingly.

There are also cost share requirements for any applications to this funding opportunity. Cost shares are amounts of money or in-kind services that must be provided by an entity other than the Federal government for a given project. PVRD2 applications require a 20% cost share, with the possibility of a 10% cost share for eligible organizations. The types of organizations eligible for a 10% cost share are domestic institutions of higher education, domestic nonprofit entities, FFRDCs, or U.S. state, local, or tribal governments. In order to qualify for this reduced cost share, the Prime Recipient of the funds must be one of these types of organizations and must perform at least 50% of the work in the project, as measured by the Total Project Cost. The equation for calculating your Cost Share is given at the bottom of the slide here. Note that the cost share is calculated for the entirety of the funds used for this project.

More detailed information about cost shares can be found in Section III.B of the FOA, which gives a complete list of entities that are eligible to apply as prime- or sub-recipients to this program.

Slide 11: Let's now move to the technical objectives of the PVRD2 funding opportunity. The next few slides will summarize information discussed in more detail in Section I of the FOA. The purpose of this funding opportunity is to support continued innovation in photovoltaic modules and systems, which will help to achieve SunShot's goal of realizing a 6 cents/kWh levelized

cost of utility-scale, solar-generated electricity by 2020 and 3 cents/kWh by 2030. As the figure here shows, multiple factors must be addressed to achieve this mission: increasing cell efficiency and energy output, improving reliability and durability, and reducing both manufacturing costs across the supply chain and installation costs. This graphic indicates the variety of possible solutions that can be used to attain SunShot's goal. It's important to note that we don't expect any one application to provide a comprehensive pathway to the cost targets. Instead, applications should focus on one innovation that would combine with other solutions to achieve the SunShot 2020 and 2030 goals.

Slide 12: These are just a few types of projects that DOE is particularly interested in funding through the PVRD2 opportunity. This list is not meant to be comprehensive. Possible ideas include projects that develop innovative PV technologies, reduce PV manufacturing costs, improve the lifetime of PV components or systems, increase the value of solar in terms of both dollar per DC power or fielded energy output, and finally, projects that aim to decrease solar installation times through improved hardware or design solutions as well as streamlining codes and standards.

Slide 13: Here we list the Topic numbers and titles present in this funding opportunity. Topic Area 1 is the SIPS Application topic with the special application process already discussed. Topic Area 2 is all about the fabrication, characterization, and analysis of advanced module systems. This area is further broken down into two subareas: 2A focuses on module design and fabrication, whereas 2B will fund new methods and techniques related to characterization, modeling, and analysis. Topic Area 3 is Rapid PV System Deployment, which will focus on increasing the ease of access to solar, such as through decreasing installation times or streamlining codes and standards development. We'll talk about each in more detail in a few minutes. All of these topic areas are described in Sections I.A and I.B of the FOA.

Slide 14: Some of you may know already that the SunShot Technology-to-Market team has also released an Incubator and SolarMat FOA at the same time as the Photovoltaics team is releasing PVRD2, so we want to clarify which funding opportunity is appropriate for different types of proposals. As a general rule, PVRD2 proposals should prove or validate concepts that could become an entire new class of commercial product. In contrast, Technology-to-Market FOA proposals will focus on a specific product or specific business plan. This flow chart gives further guidance on how to decide which funding opportunity is appropriate and can also be found in the FOA. First, a non-profit entity can only apply to PVRD2. A for-profit entity can apply to either PVRD2 or the Technology-to-Market FOA, but new concepts with broad applicability should be submitted to PVRD2. In contrast, proposals for specific products with less than about three years to market should be

submitted to the Technology-to-Market Incubator and SolarMat funding opportunity.

There may be cases where a proposal significantly overlaps with both of these funding opportunities. In that case, it is up to the applicant's discretion to decide which funding opportunity to apply to.

Slide 15: We've already discussed what the submission process looks like for a SIPS Application, but let's define a bit better what SIPS is all about. SIPS proposals are meant to be innovative, high-impact projects that can make significant advances in a short amount of time, with one year of funding. Successful projects would ideally demonstrate promise in a particular direction that would motivate future funding for a larger project. Proposals should clearly show how the idea can have a high impact on cost, reliability, or efficiency to make progress toward SunShot's 2020 or 2030 cost targets. As we discussed earlier, SIPS Applications are longer than a Concept Paper and shorter than a Full Application. They are meant to not only be executed quickly by awardees but also to be evaluated quickly on DOE's end, hence the lack of a pre-proposal step like Concept Papers.

Note again that no uploaded Concept Paper document is required for SIPS applications. Instead, after you submit your Letter of Intent, you will be given immediate access to the Concept Paper online submission stage. Here, you just need to complete the necessary fields in Exchange and click 'Submit' without uploading any document. Then, the next step will be the SIPS Application due at a later time, which we'll talk about in the second webinar.

Slide 16: Now let's discuss Topic Areas 2 and 3. Recall that Topic Area 2 is split into two subareas, so we'll begin by discussing Topic Area 2A. Applications to this area should propose and demonstrate significant improvements to the energy output, reliability, and/or manufacturability of completed PV modules. Because of the focus on module-level systems in this FOA, project teams for this area should describe their capability to fabricate the modules they intend to use for the project. More information about these Team and Resources criteria can be found in the FOA, Section V.A.iii.

Here we give just a few examples of targets for improving module performance suitable for this proposal. This could include high-performance, low-cost modules, more sophisticated cell interconnection methods, minimized power losses from degradation and failure, improved manufacturing processes across the supply chain, or improved energy yield and certainty across a variety of environments. Just as one example, the graph on the left shows how cell to module conversion is one of the costlier parts of the PV supply chain, so reducing these costs could be one type of proposal focus. The pie chart on the right shows the breakdown of costs

during module assembly, which gives a sense of where the largest reductions can be found. These figures can also be found in the FOA. Note that this is not an exhaustive list of possibilities, but is rather meant to serve as inspiration for applicants who are wondering where the most room for module improvements may exist.

Slide 17: Topic Area 2B addresses similar issues but focuses on the development of unique characterization, diagnostic, and modeling methods related to PV modules and systems. Successful projects should develop or apply new methods to understand module performance in factory or fielded environments with the aim of improving performance and/or predictability. Some sample areas of interest could be the monitoring, analysis, and prediction of degradation mechanisms in critical components both in module-level electronics and balance-of-system components. Modeling methods not previously implemented with PV materials are also of interest. Finally, new methods of data aggregation and analysis to identify critical knowledge gaps and mitigation strategies are suitable for this topic area.

All proposals in this area should address the balance between the added value of a proposed technique and its potential cost. In addition, the dissemination of results derived from funded projects in this area should be addressed in these proposals. Since these projects will require test modules for characterization and analysis, each proposal should include a known module source for use in the project. More details about these Team and Resources criteria can be found in the FOA, Section V.A.iii.

Slide 18: The final topic area of this proposal covers a separate but important component to reducing prices for 'going solar'. As seen in these graphs of price breakdowns for residential and utility PV installations, balance-of-system, hardware, on-site labor, and permitting-inspection-interconnection, or PII, together exceed the cost of the module itself. Week- or month-long delays in installing a purchased PV system or connecting it to the grid will reduce returns on investment and increase the costs of customer acquisition. To address this area of module and system costs, this topic area will fund projects that increase the speed and ease of PV system deployment.

Slide 19: Here we break down proposals for this topic area into two major types. First, projects are encouraged that focus on new hardware and design to increase installation speed and ease, such as automated installation, reduced on-site assembly, or other strategies that also maintain quality assurance. These projects should consider outcomes like reduced man-hours, reduced calendar days, or simplified PII procedures as targets. As an example, SunShot's Plug and Play opportunity, launched in 2012, served as foundational work in this area and could provide inspiration for new ideas. This type of project should include information about a partner or partners

who can verify the commercial effectiveness of the proposed technologies and practices.

The second type of proposal would work to remove barriers to deployment by helping groups in the PV industry engage with authorities having jurisdiction, known as AHJs, to make sure code- and standard-making bodies have enough information to efficiently govern PV deployment. Projects in this area could analyze data to inform ongoing codes and standards development or streamline activities between the PV industry and AHJ's. These projects must demonstrate an already-existing relationship with codes- and standards-making bodies in the proposal. Once again, Section V.A.iii contains detailed information about these Teams and Resources requirements.

Slide 20: Before moving on to details about the Letter of Intent and Concept Paper, we want to highlight Topic Areas Not of Interest. Projects that fall outside the technical parameters just discussed, found in Section I.B of the FOA, will not be considered. In particular, projects that only address central and string-level power electronics – inverters, transformers, etc. – are not appropriate for this funding opportunity. An important exception to this rule is any application that addresses power electronics that are included in the module or sub-module system, as this is part of advanced module design that is central to this FOA. Also, anything outside the scope of PV technology will not be considered for this funding opportunity. Please see section I.C of the FOA for further details regarding Topic Areas Not of Interest.

Slide 21: We'd like to end the webinar today by emphasizing some specifics about the format of the Letter of Intent and Concept Paper. Remember, Letters of Intent are the first submission required for all topic areas. We are requiring Letters of Intent to ensure that we get a proper gauge of the number of applications we should expect and what the breadth of the topics will be in those applications. This helps us get an early start on ensuring that the most appropriate expert reviewers are recruited to evaluate the application packages we receive.

The Letter of Intent will be submitted through fields that you will fill in directly in EERE Exchange, as shown in the screenshot here. Examples of the required information include your project title, organization, project team description, technical topic, and an abstract. The abstract should give a short explanation of the proposed project and should not be more than 200 words in length. As always, the most detailed description of what is required in terms of format, length, and content can be found in the funding opportunity document itself - Section IV.B in the case of the Letter of Intent.

Slide 22: The Concept Paper document for Topics 2 and 3 is a simpler and shorter application than the Full Application, and it is required for Topics 2 and 3. It should focus on a single concept or technology and has three components: the Cover Page, Technology Description, and Team and Resources Description. Each of these sections are described in more detail in the FOA in Section IV.C, which, in particular, describes specific page limits for each section. Any extra material beyond the page limits will be redacted or removed, so please pay particular attention to these instructions. Note that all three parts should be submitted as a single PDF document. Also, there is an optional template on Exchange that can be used for the entirety of the Concept Paper – we highly encourage you to utilize this optional template.

Slide 23: This Concept paper template can be found on the Exchange website for the PVRD2 funding opportunity. It can be a little confusing to find so I want to briefly walk you through the process. Even though it is optional, the template can be found under the 'Required Application Documents' header within the PVRD2 funding description in Exchange, as indicated by the black arrow in the top screenshot here. If you click 'View Required Application Documents', the section will expand and list all the available documents for the Concept Paper as well as the Full Application, as shown in the bottom screenshot,. You'll be returning to this area for the Full Application, which we'll cover in the second webinar, but for now just remember that the optional Concept Paper template can be found here, highlighted by the orange arrow in the bottom screenshot. If you click on that link, you'll open up the template as a Word document. Again, the Concept Paper is required for Topics 2 and 3, but this is just an optional template to make your submissions a little easier.

Slide 24: After submission, Concept Papers for Topics 2 and 3 will be reviewed and be given an Encourage or Discourage recommendation as described earlier. These recommendations will be sent out by email to technical and administrative points of contact.

Review scores are equally weighted between two criteria as shown here. The Overall Scientific and Technical Merit and Impact criterion measures 1) the ability of the idea to improve upon the relevant state of the art; 2) the quality of the description of the current state of the art; and 3) how the idea will advance areas particular to this funding opportunity, as described in Section I.

The Project Strategy and Team criterion evaluates 1) the ability of the project team to be successful in all aspects of the proposed work; 2) the quality of the necessary activities' description; and 3) the quality of the discussion of the risks inherent in the work, including both the challenges faced and how

the proposal could overcome potential obstacles. More details about these review criteria can be found in Section V.A.i of the FOA.

Slide 25: Before you go, we'd like to emphasize the most important deadlines for PVRD2. For all Topic Areas, a Letter of Intent must be submitted before any other application materials are sent in. The deadline for Letters of Intent is 5:00 PM Eastern time, December 1st.

Slide 26: Another reminder for those interested in submitting a proposal for Topic Areas 2 and 3: applicants must have submitted a compliant Concept Paper in order to later be eligible to submit a Full Application. The due date for Concept Papers for Topics 2 and 3 is 5:00 PM Eastern time, on December 14th. If you are interested in the SIPS Application, no formal Concept Paper is required, however you still need to click through the Concept Paper submission on Exchange and fill out the few necessary fields.

Slide 27: Here are some final suggestions to have the best possible application experience. Make sure you thoroughly check your application documents before submitting them on Exchange. Also, take care when crafting summary slides, since these are often used when discussing applications internally at DOE. Budget summaries that are well-thought-out and well-justified are also very important. Finally, make sure that you submit application materials to Exchange multiple hours before the deadline, to ensure you have enough time to deal with any technical difficulties that may arise. The Funding Opportunity Announcement recommends that you submit your documents 48 hours in advance to be as safe as possible.

Slide 28: One more reminder just to be sure you remember! Letters of Intent are required for all submissions to this funding opportunity. These Letters are due by 5:00 PM Eastern time on December 1st.

Also, for Topic Areas 2 and 3, applicants must have submitted a compliant Concept Paper in order to later be eligible to submit a Full Application. The due date for Concept Papers is 5:00 PM Eastern time, on December 14th.

Slide 29: Looking forward, we'd like to invite you to our next webinar for this funding opportunity that will occur on February 7th of next year at 3:00pm Eastern Time. In that webinar, we'll cover SIPS Applications, the Full Application process, PVRD2-specific guidance for the Full Application phase, and what the next steps will be for those awards that are selected, including work-plan negotiations.

Slide 30: Finally, we're very excited to let you know about an upcoming webinar that will discuss the SunShot office's newly released 2030 goals and what they mean for the solar industry and future funding opportunities.

Please join us on Tuesday, December 6 at 12:00PM Eastern Time. You can register using the link shown here.

Slide 31: Thank you for joining us today! We hope you've learned helpful information in this webinar and are now inspired to submit a groundbreaking application to this funding opportunity that can help bring more solar technology into the world! We would like to remind you that any questions about this funding opportunity should be submitted to PVRD2@ee.doe.gov and that answers to questions submitted via that mailbox or through the Questions bar in today's webinar will be answered on the FAQ page for this funding opportunity on EERE Exchange.

Also, please take a moment when this webinar ends to answer the questions that will pop up. If you don't have time to do so now, a link to the questions will be included in the follow-up email sent to all attendees of this webinar, so please keep an eye out for that. These questions are completely optional, so you may fill out as many or as few as you like. Any responses you could give us, however, will be very helpful in guiding our changes for future webinars. Thank you and have a wonderful day!