FINANCIAL ASSISTANCE
FUNDING OPPORTUNITY ANNOUNCEMENT

U.S. Department of Energy
Golden Field Office

Foundational Program to Advance Cell Efficiency (F-PACE)

Funding Opportunity Announcement Number: DE-FOA-0000492

Announcement Type: Amendment 002

CFDA Number: 81.087

***** All questions regarding this Funding Opportunity Announcement (FOA) must be submitted to F-PACE@go.doe.gov not later than 3 calendar days prior to the full application due date *****

Issue Date:	**April 8, 2011**
Concept Paper Applications Due:	**May 9, 2011**
Invitations for Full Applications Sent:	**May 23, 2011**
Full Applications Due:	**June 30, 2011****

****Only Applicants who submitted Concept Paper Applications by the due date and whose Concept Paper Applications were deemed compliant will be allowed to submit a Full Application.**

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

DE-FOA-0000492
Amendment No. 002

DATE: June 1, 2011
FROM: Lalida Crawford, Contracting Officer
TO: All Prospective Applicants

SUBJECT: Amendment No. 002 to Announcement DE-FOA-0000492, "Foundational Program to Advance Cell Efficiency (F-PACE)"

I. The purpose of this amendment is to:

A) Extend the Full Application deadline to June 30, 2011 at 11:59pm Eastern Time

II. All other parts of the FOA remain unchanged.

III. The areas which have changed are highlighted within the Funding Opportunity Announcement.

Department of Energy
Golden Field Office
1617 Cole Boulevard
Golden, Colorado 80401-3393

DE-FOA-0000492
Amendment No. 001

DATE: May 10, 2011
FROM: Lalida Crawford, Contracting Officer
TO: All Prospective Applicants

SUBJECT: Amendment No. 001 to Announcement DE-FOA-0000492, "Foundational Program to Advance Cell Efficiency (F-PACE)"

II. The purpose of this amendment is to:

A) Update the Resume File language in Section IV.D.3.iv of the Funding Opportunity Announcement, on pages 24-25, to specify the requirement of a "Coordination and Management Plan" if a project includes multiple principal investigators.

II. All other parts of the FOA remain unchanged.

III. The areas which have changed are highlighted within the Funding Opportunity Announcement.

REGISTRATION AND APPLICATION SUBMISSION REQUIREMENTS

REGISTRATION REQUIREMENTS

There are several one-time actions the applicant should complete before submitting an Application in response to this Funding Opportunity Announcement (FOA). The applicant should:

- Register through the EERE Exchange at http://eere.energy.gov/financing/Exchange
- Obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number at http://fedgov.dnb.com/webform
- Register with the Central Contractor Registry (CCR) at https://www.ccr.gov/
- Register in FedConnect at https://www.fedconnect.net/; use "Register as a Vendor" link. To create an organization account, your organization's CCR MPIN is required

Beside the Exchange registration system, which does not have a delay, **these registration requirements could take several weeks to process and are necessary in order for a potential applicant to receive an award under this announcement**. Therefore, although not required in order to submit an Application through the EERE Exchange site, **all potential applicants lacking a DUNS number, or not yet registered with CCR or FedConnect should complete those registrations as soon as possible**.

EERE Web-Based Submission Information

All Application submissions are to be made via the EERE Exchange at http://eere.energy.gov/financing/exchange.To gain access to the EERE Exchange, the applicant must first register and create an account on the main EERE Exchange site. This account will then allow the user to register for any open EERE FOAs that are currently in Exchange. It is recommended that each organization or business unit, whether acting as a team or a single entity, utilize one account as the appropriate contact information for each submission.

The applicant will receive an automated response when the Concept Paper or Full Application is received; this will serve as a confirmation of EERE receipt – please do not reply to the automated response. The applicant will have the opportunity to re-submit a revised Concept Paper or Full Application for any reason so as long as the relevant submission is submitted by the specified deadline. A "User Guide" for the EERE Exchange can be found on the EERE website http://eere.energy.gov/financing/exchange/Manuals.aspx after logging in to the system.

To receive notices regarding an announcement, such as modifications to the announcement or the posting of new questions and answers, applicants must first register for the FOA by initiating a submission to that FOA.

Any other questions that arise during the application process should be sent to EERE-ExchangeSupport@hq.doe.gov.

Questions related to the Funding Opportunity Announcement should be submitted to F-PACE@go.doe.gov and should be submitted not later than 3 calendar days prior to the full application due date. Questions submitted after that date may not allow the Government sufficient time to respond. Answers to questions will be posted on the Exchange website under this FOA. Applicants are encouraged to review the posted questions and answers daily.

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SECTION I – FUNDING OPPORTUNITY ANNOUNCEMENT (FOA) DESCRIPTION

OBJECTIVES

The U.S. Department of Energy (DOE) seeks to fund applied scientific research that provides the technical foundation for significant increases in solar photovoltaic (PV) cell efficiency, to enable commercial and near-commercial PV technologies to achieve $1 per watt installed system cost targets by the end of the decade.[1] Combined with the technical and funding resources from the National Science Foundation (NSF), this joint Funding Opportunity Announcement (FOA) for the "Foundational Program to Advance Cell Efficiency" (F-PACE) will identify and fund solar device physics and photovoltaic technology research and development that will improve PV cell performance and reduce module cost for grid-scale commercial applications. Projects funded under this FOA are intended to address identified cost and efficiency barriers through advances in the PV science knowledge base, improved materials and processes for PV cell components, and innovative approaches for closing the gap between production cell efficiency and laboratory cell efficiency, and between laboratory cell efficiency and the theoretical maximum. These goals jointly support the missions of the DOE Office of Energy Efficiency and Renewable Energy's (EERE) Solar Energy Technologies Program (SETP) and the NSF Electrical, Communications and Cyber Systems (ECCS) Division.

BACKGROUND

The mission of the SETP[2] is to accelerate the research, development and large-scale deployment of solar technologies in the United States and to ensure that solar power is a viable and economic source for the nation's power needs. SETP is charged with leading DOE's SunShot Initiative to reduce the total costs (including installer margin) of solar energy systems by about 75 percent before the end of the decade. .[3] The PV subprogram supports the SunShot initiative by identifying and implementing approaches to reduce the total cost of installed PV systems through a program of applied research and development in PV materials, devices, and manufacturing technologies.

ECCS supports NSF's mission of research and education with activities that address fundamental research issues underlying device and component technologies, energy, power, controls, computation, networking, communications and cyber technologies. ECCS supports the integration and networking of intelligent systems principles at the nano, micro and macro scales for a variety of application domains in healthcare, homeland security, disaster mitigation, energy, power, telecommunications, environment, transportation, manufacturing, and other systems-related areas. Within ECCS, the EPAS (Energy, Power and Adaptive Systems) Program's mission is to support early stage research and development for energy collection, conversion and interfacing to the electric grid.

The DOE estimates that a $1 per watt installed PV solar energy system – equivalent to 5–6¢/kilowatt hour (kWh) – would make solar energy competitive with the wholesale rate of

[1] $1 per watt cost target represents the total installed cost, including installer margin, without subsidy.
[2] http://www1.eere.energy.gov/solar/
[3] http://www1.eere.energy.gov/solar/sunshot/

electricity without additional subsidies, nearly everywhere in the United States. This target represents a significantly more challenging goal than current "Business As Usual" projections of reaching $2.20 per watt for utility scale systems by 2016 and would enable large scale deployment of solar without subsidies. To reach this goal, PV module costs are anticipated to need to reach $0.50 per watt, balance of systems (BOS) costs would need to reach $0.40 per watt, and power electronics cost would need to reach $0.10 per watt.

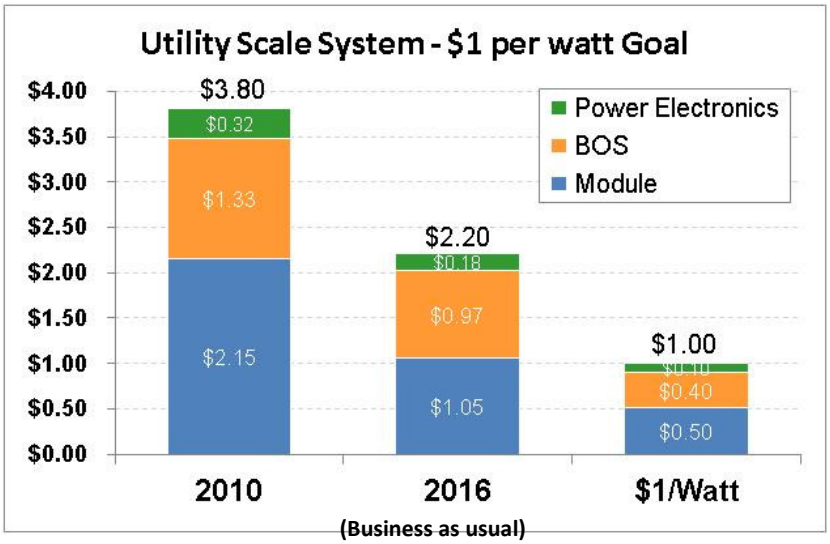

Figure 1: Approximate costs for utility scale PV systems in 2010 (not including land costs) and current projections of a "Business as Usual" scenario are presented for 2016. With the SunShot program, the DOE will work with industry, academia, and the National Laboratories to innovate towards $1/$W_{DC}$ installed systems.

Pursuing the $1 per watt goal puts the United States in a scientific and technical race with other nations to develop, commercialize, and scale-up new PV technologies. On February 4, 2011, Department of Energy Secretary Steven Chu formally announced the "SunShot" initiative to pursue the goal of reducing PV system costs by 75% or approximately $1/$W_{DC}$ for utility scale systems.

Through this FOA, ECCS and SETP intend to jointly pursue foundational research into PV cell and sub-cell technology to support the SunShot initiative. Foundational research is defined as research to advance the underlying scientific understanding of solar device physics and photovoltaic technologies that enables technical solutions to be developed to overcome significant barriers to decreased cost and increased cell and module efficiency and reliability. The goal of this collaboration between the ECCS and SETP is to leverage SETP's commercialization mission and ECCS' fundamental research and education mission, providing a more relevant and coordinated set of applied research projects than if each agency developed projects independently of the other.

For the purposes of planning, the $1 per watt goal has been broken down into $0.50 per watt for modules, $0.10 per watt for power electronics, and $0.40 per watt for installation and remaining balance of system (BOS) costs. Achieving the $0.50 per watt module cost requires an increase in the solar-to-electric conversion efficiency of PV cells, bringing cells closer to theoretical maximum conversion efficiencies, while decreasing cell manufacturing costs and maintaining the 30+ year lifetime performance of current cell technology. Figure 2 below shows the current typical production modules, laboratory cells, and theoretical maximum conversion efficiencies for a variety of PV technologies. To address the barriers to achieving lower cost, higher efficiency PV cells, a solid technical approach needs to be taken on a foundational science level.

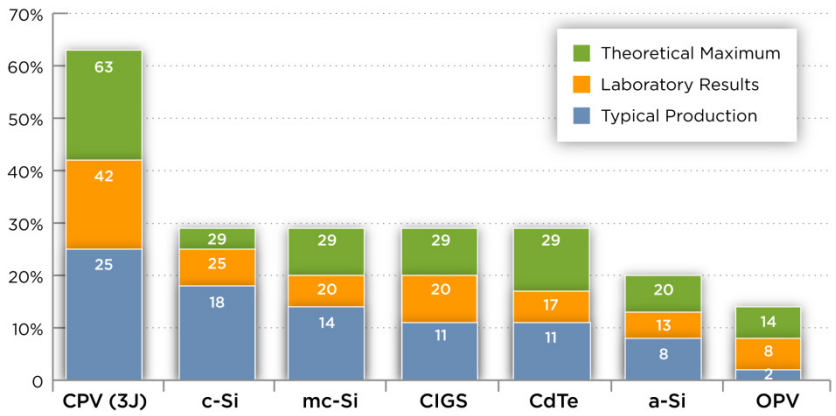

Figure 2: Gaps in efficiency between best laboratory results and theoretical limits and between production and best laboratory results provide opportunities for improvement. (Theoretical based on Shockley-Queisser limit and bandgap of semiconductor. Laboratory results are based on NREL verified cells.)

Foundational research is intended to accelerate the development process for innovations relevant to current PV technologies, in order for the U.S. to establish and maintain commercial leadership in these technologies as they continue to evolve and advance down their cost curves. F-PACE, therefore, represents a key component of SETP's Research, Development, Demonstration, and Deployment portfolio as shown in the figure below. It serves as the foundational block of applied science that feeds into proofs of concept for new innovations and their subsequent development and commercialization. Such foundational PV science will be broadly applicable to the PV industry and research community, and it will provide the scientific insight needed to achieve $0.50 per watt modules based on current commercial and near-commercial PV technologies. It is the logical and critical first step toward creating new components and/or processes and transitioning them into fully mature, production-scale systems by the end of the decade.

Technology Readiness Levels (TRLs) provide one method for describing this pipeline and the transition of new technologies from basic science, to applied research and development, to device and system integration, and eventually to commercialization and deployment. SETP's definition of TRLs from 1-9 are summarized in Appendix E. The F-PACE program is designed to rapidly take currently mature, recently-commercialized, or near-commercial module technologies, located at the end of this pipeline, and improve them with new cell or sub-cell technology R&D occurring at the beginning of this pipeline. The application of new enabling cell and sub-cell technologies creates the potential to significantly improve future PV systems, using processes that are otherwise at or near manufacturing-ready. Under this program, applicants will need to draw clearly the connection between barriers to higher cell efficiency and

the proposed research into a cell or cell sub-component. In other words, researchers are expected to take a novel technology at TRL's 3-4 ("analytical and experimental critical function and/or characteristic proof of concept", or "component and/or system validation in laboratory environment") and advance them one or more TRL levels, by applying an improved scientific and technical understanding.

In addition, applicants will need to describe a viable pathway for future development and integration of the proposed technology in higher efficiency, lower cost PV systems after the success of their project. It will also be crucial for applicants to discuss how their research will ultimately contribute to an economically competitive technology for solar energy conversion in the United States.

SCOPE OF ANNOUNCEMENT

Under this FOA, the DOE SETP program and the NSF ECCS program are requesting applications for research to overcome barriers to lower cost, higher cell efficiencies, and/or increased reliability in photovoltaics made of commercial or near-commercial absorber materials. Applications are sought for Research and Development projects for research, evaluation, verification, and/or testing. This funding opportunity will fill the currently unfulfilled need for a significant federal funding program to acquire and apply foundational knowledge of commercial and near-commercial semiconductors that are specifically used in PV.

In this context, commercial PV is defined as PV technology that can currently be purchased on the open market for use in large-scale, grid-tied electricity generation. Near-commercial is defined as PV technology that is already in pilot production and is anticipated to be in volume production within the next 2 years, with that pilot production directly leading to full PV manufacturing available for purchase on the open market for use in large-scale, grid-tied electricity generation by 2013 (See Figure 3).

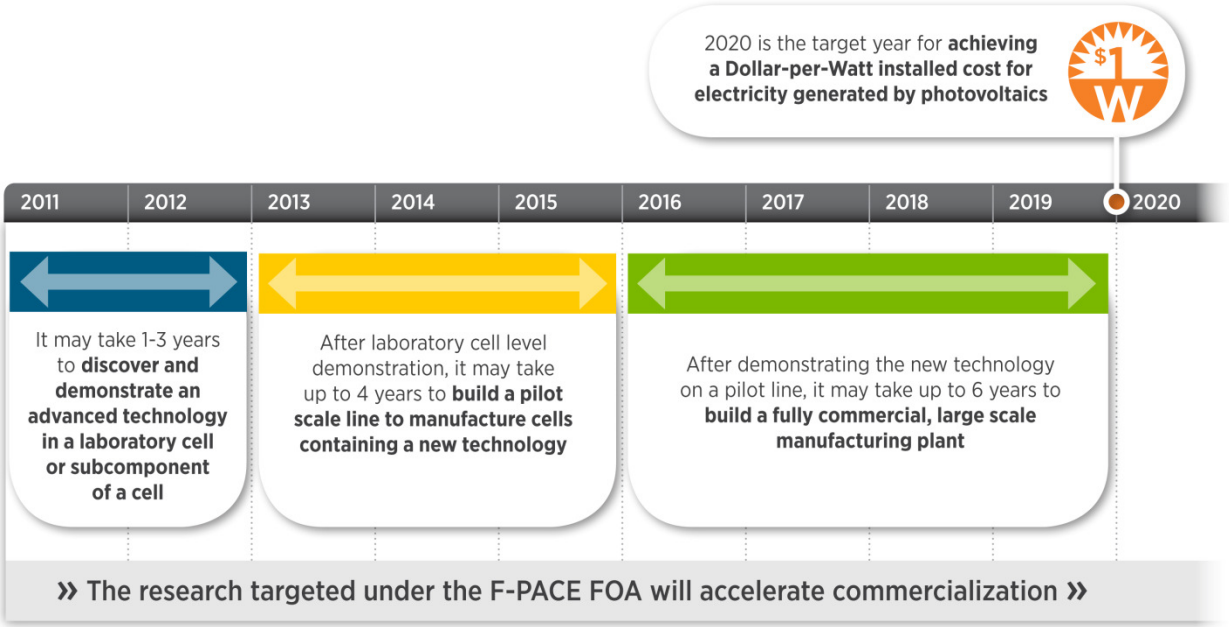

Figure 3: Timeline for earliest stage science targeted under F-PACE to arrive at full commercialization

Overcoming Performance Barriers

Successful applicants will describe the cost, efficiency, and/or reliability barrier(s) being addressed and the expected approach to overcoming the barrier(s). See Appendix D of this FOA, Barrier Analysis Tables, for a thorough collection of cost and efficiency barriers in *commercial* semiconductor-based photovoltaics. This analysis provides an initial technical framework and assessment of key barriers to advancing PV cost, reliability, and performance for the $1 per watt system goals for Single Crystal/Multi-Crystal Silicon (c/mc Si), Copper Indium Gallium Di-Selenide (CIGS), Cadmium Telluride (CdTe), Multi-Junction Gallium Arsenide (III-V). The list of technologies there is also not meant to be exhaustive. There are other relevant semiconductors and the list is meant to only provide a framework for discussion. It should be noted that the proposed approach to addressing a barrier does not have to match the "pathways" detailed in Appendix D. DOE and NSF acknowledge that applicants may have other ideas of how to overcome a given barrier than what is listed in this analysis. However, it is indicative of the technical level of detail that respondents must provide.

Successful applications for addressing cost, efficiency, and/or reliability barriers in *near-commercial* semiconductors should follow an analogous approach: identify the barrier(s) to achieving lower cost, higher PV conversion efficiencies, and/or higher reliability that the proposal will address, and describe what advances in research will be made to decrease cost, increase the performance (addressing the balance among J_{SC}, V_{OC}, and Fill Factor), and/or increase the reliability of photovoltaic devices while a maintaining 30+ year lifetime.

Addressing Broad Industry Needs

Successful applicants will also provide a convincing case for a high level of interest from industry in their research, and the ease with which the proposed advance could be adopted and transitioned to the marketplace within 1–3 years after completion of the project. Although foundational research on PV science is less likely to be done within the private sector, the results of this research are expected to be of interest to industry as a knowledge base from which to develop proprietary technologies. Therefore, the foundational research resulting from funding under this FOA will also have a publishing requirement, making the research available to anyone in the PV industry that is experiencing difficulties overcoming barriers to low cost, high efficiency, and increased reliability and thereby benefitting the entire U.S. PV industry. ***Projects supported under this FOA will promptly and openly publish results in high-impact-factor, peer-reviewed journals, either during the course of the project or within 1-2 years after completion.***

Three Application Topics

There will be three topics to which an application may be submitted under this FOA:

- **Topic 1: Foundational Research on PV Sub-cell Materials and Processes**
- **Topic 2: Foundational PV Cell Research**
- **Topic 3: Barrier Focus Teams**

The application process includes two phases: a concept paper phase and a final application phase. Applicants will be notified following the concept paper phase as to whether they are encouraged to submit a full application.

For the purposes of this FOA, and in the following topic descriptions, the following definitions will apply:

Subcell: a layer or combination of layers within a cell. May not be electrically active and is not yet integrated into a full Device or Laboratory Cell. Measurements of relevant figures of merit such as minority carrier lifetime or surface recombination velocity are possible, but efficiency measurements are not. Representative of TRL 3.

Device: an electrically active unit that may not possess all of the characteristic layers and parts of a Laboratory Cell. Measurements of quantum efficiency are possible. Most likely less than 1x1cm. Representative of TRL 4.

Laboratory Cell: an independent electrical unit consisting of the integrated active material and layer stack that is made in a laboratory, but possible to make in a manufacturing environment. The materials in the layer stack include substrates that are required for the active layers' creation and any electrically conducting parts. Measurements of efficiency are possible. Most likely at least 1x1cm. Representative of TRL 5.

Production Cell: an independent electrical unit consisting of the integrated active material and layer stack that is produced in full scale photovoltaic manufacturing. The materials in the layer stack include substrates that are required for the active layers' creation and any electrically conducting parts. Most likely at least 15x15cm. Representative of TRL 6.

Topic 1: Foundational Research on PV Sub-cell Materials and Processes

Under **Topic 1**, the goal is to fund research to produce scientific advances in the materials science and device and process physics of PV at the **subcell level** to overcome cost, efficiency, and/or reliability barriers. The approach to research under this topic is to fund universities, national laboratories, or companies to solve industry-relevant problems, resulting in increased cell efficiency, and lower cell cost, and/or increase cell reliability. Proposed research to this topic should be at an initial technology readiness level (TRL) of either 3 ("Analytical and experimental critical function and/or characteristic proof of concept") or 4 ("Component and/or system validation in laboratory environment") at the time of the proposal, and it should advance at least one TRL level by the conclusion of the project (i.e. go from a 3 to a 4, or from a 4 to a 5). TRL definitions specific to PV applications can be found in Appendix E.

A few specific (but not prescriptive), examples of proposed research for Topic 1 include the following:

- Investigation of defects at grain boundaries that will lead to longer minority carrier lifetimes.
- Defining the role(s) of sodium on CIGS cell performance; for example, cell quality during liquid-assisted growth is improved by the formation of low-melting Na_xSe_y but the mechanism not well understood
- Defining the role of Cu doping in CdTe and developing methods to control Cu to reduce

Shockley-Read-Hall carrier recombination at the junction.

Applications submitted to Topic 1 must:

1.) Identify performance metrics that define the critical parameters relevant to the success of the project, and identify target values for these metrics.
2.) Specify physical specimens that will provide an entrance baseline and an exit deliverable, on which the performance metrics will be measured and independently verified by a 3rd party.
3.) Describe how the targeted improvements in the performance metric are connected to a reduction in the cost per watt or Levelized Cost of Energy (LCOE) compared to the state-of-the-art in a PV device. (Example: a project for improvements to TCOs for Cd Te should describe how improvements in the identified metrics will lead to a cost reduction compared to the industry leader's state of the art cells and modules, and should estimate the magnitude of the cost reduction)

In order to fulfill #1 and #2 of this requirement, filling out the following table is encouraged:

	Physical Specimen Description	**Current State of the Art**	**Baseline Value**	**Target Value**
Metric 1				
Metric 2				
Metric x				

Topic 2: Foundational PV Cell Research

Under **Topic 2**, the goal is to fund **cell level** foundational research that will close the gaps between theoretical, laboratory, and production efficiency limits, overcome cost barriers, and/or overcome reliability barriers. The approach to research under this topic is to fund universities, national laboratories, or companies to conduct cell level research to solve industry-relevant problems, resulting in increased cell efficiency, lower cell cost, and/or increase cell reliability. Proposed research to this topic should be at an initial TRL of 4 ("Component and/or system validation in laboratory environment") at the time of the proposal, entering with a cell or device functioning at >10% efficiency (AM1.5), and the research should advance at least one TRL level by the conclusion of the project (i.e. go from a 4 to a 5). It is expected that a fully functional cell or device, demonstrating a measured and significant improvement in efficiency relative to the state of the art, will be a final deliverable for the project. Though world record cell performance is not the specific aim of the program, it is expected that during the process of foundational scientific discovery, higher efficiency cells will be result.

A few specific (but not prescriptive) examples of potential research for Topic 2 include the following:

- Improved understanding of material uniformity and doping control during deposition in CdTe, demonstrated in a cell with increased efficiency relative to the current record CdTe cell.
- Exploring lower cost options for CIGS absorber materials; for example increasing the

ratio of gallium (lower cost) to indium (higher cost), while maintaining the cell efficiencies of the current record CIGS cell.

Applications submitted to Topic 2 must:

1.) Identify performance metrics that define the critical parameters relevant to the success of the project, and identify target values for these metrics.
2.) Specify physical specimens that will provide an entrance baseline and an exit deliverable, including but not limited a cell or device functioning at >10% efficiency (AM1.5), on which the performance metrics (including but not limited to efficiency) will be measured and independently verified by a 3rd party.
3.) Describe how the targeted improvements in the performance metric are connected to a reduction in the cost per watt or Levelized Cost of Energy (LCOE) compared to the state-of-the-art in a PV device. (Example: a project for improvements to TCOs for Cd Te should describe how improvements in the identified metrics will lead to a cost reduction compared to the industry leader's state of the art cells and modules, and should estimate the magnitude of the cost reduction)

In order to fulfill #1 and #2 of this requirement, filling out the following table is encouraged:

	Physical Specimen Description	**Current State of the Art**	**Baseline Value**	**Target Value**
Metric 1: Efficiency	Details of cell or device functioning at >10% efficiency (AM1.5)		Specific value of >10% efficiency	
Metric 2				
Metric x				

Topic 3: Barrier Focus Teams

Under **Topic 3**, the goal is to fund subcell level or cell level foundational research addressing cost, efficiency, and/or reliability barriers (including the gaps between theoretical, laboratory, and production efficiency limits). The approach in this topic differs from the first two, however. Under this topic, **synergistic teams** of 3-5 PIs from universities, national labs, and/or companies will be funded to conduct integrated research to solve industry-relevant problems resulting in increased cell efficiency and/or reliability and lower cell cost. These teams are intended to be teams of leading researchers sharply focused on solving and overcoming critical barriers to improved performance and reduced cost in PV technologies. The teams must draw from a minimum of two institutions, and must include at least one PI with expertise in photovoltaic cells and devices. They also could potentially leverage international collaborations. A good rule of thumb for assembling a Barrier Focus Team is that team composition should be determined by

the barrier(s) being addressed, instead of vice-versa (with the choice of barrier(s) determined by who is on the team). Applications to this topic will have an extra requirement to include an explanation of why a team approach to solving a barrier or barriers will produce greater results than funding separate, individual researchers. Proposed research to this topic should be at an initial TRL of 3 ("Analytical and experimental critical function and/or characteristic proof of concept"), or 4 ("Component and/or system validation in laboratory environment") at the time of the proposal, and it should advance at least one TRL level by the conclusion of the project (i.e. go from a 3 to a 4, or from a 4 to a 5).

A few specific (but not prescriptive) examples of potential research for Topic 3 might include the following:

- Multiple PIs using different methods to improve TCOs for CdTe to identify the best approach; for example exploring replacements for SnO_2F, with some PIs focusing on Cd_2SnO_4 , some working with Zn_2SnO_4 , and some determining the best way to deposit the TCO, using either d.c. or r.f. sputtering, or reactive sputtering from metal-alloy targets.
- Multiple PIs collaborating to make a high efficiency CdTe device by attacking multiple barriers at once: improving TCOs, increasing minority carrier lifetime, decreasing contact resistance.

Applications submitted to Topic 3 must:

1.) Identify performance metrics that define the critical parameters relevant to the success of the project, and identify target values for these metrics.
2.) Specify physical specimens that will provide an entrance baseline and an exit deliverable, on which the performance metrics will be measured and independently verified by a 3rd party.
3.) Describe how the targeted improvements in the performance metric are connected to a reduction in the cost per watt or Levelized Cost of Energy (LCOE) compared to the state-of-the-art in a PV device. (Example: a project for improvements to TCOs for Cd Te should describe how improvements in the identified metrics will lead to a cost reduction compared to First Solar state of the art cells and modules, and should estimate the magnitude of the cost reduction)

In order to fulfill #1 and #2 of this requirement, filling out the following table is encouraged:

	Physical Specimen Description	**Current State of the Art**	**Baseline Value**	**Target Value**
Metric 1				
Metric 2				
Metric x				

Special Requirements:

- Entities that apply for multiple awards must demonstrate that all work for each

application can be completed as a standalone effort. There must be a single prime recipient identified in each application.

- **Applicants must indicate the Topic to which they are applying in their full application narrative. Applicants may submit applications to multiple Topics; however, separate applications must be submitted for each Topic.** If your organization is submitting more than one Application to different topic areas, you must identify an application number and the Topic Area Number at the end of each file name (e.g., Company-1-Topic1).
- **Topic 3 only:** The Barrier Focus Team must consist of at least 3-5 PIs from at least 2 institutions, and at least one of the PIs must have PV cell expertise. "Institutions" can be separate universities, companies, or national labs. Different departments or divisions within a university, company, or national lab are not considered different institutions.

SECTION II – AWARD INFORMATION

A. Type of Award Instrument

DOE anticipates awarding both grants and cooperative agreements under this program announcement. If it is determined that a cooperative agreement is the appropriate award instrument, the nature of the Federal involvement will be included in a special award condition.

B. Estimated Funding, Estimated Number of Awards and Maximum Award Size

Approximately $39,000,000 (DOE and NSF funding) is expected to be available for new awards under this announcement subject to annual appropriations.

Topic 1 (Sub-cell)	Topic 2 (Cell level)	Topic 3 (Barrier Focus Teams)
Award Duration (years)		
3		
Max Award Award (Total $ per Award)		
$1.5M ($1M Average)	$1.5M	$8M ($6M Average)
Estimated Annual Federal Funding ($)		
~$3M, (~9 Awards)	~$4M, (~8 Awards)	~$4-6M (~2-4 awards)
Objective		
Scientific advances in materials, device, and process research	Cell level foundational research closing the gaps between theoretical , lab, and production efficiency limits	Teams with very high level of focus on overcoming barriers to improved performance

C. Period of Performance

DOE and NSF DOE anticipate making awards that will run up to three years pending annual appropriations. Each project will be divided into three budget periods. The first budget period will cover a period of one year. Continuation to the next, one-year budget period, will be contingent upon satisfactory performance of the first budget period and subject to annual appropriations. Finally, a third budget year may be allowed contingent upon satisfactory performance of the previous budget period and subject to annual appropriations.

D. Type of Application

DOE and NSF will accept only new applications under this announcement (i.e., applications for renewals of existing DOE or NSF funded projects will not be considered).

SECTION III - ELIGIBILITY INFORMATION

Applicants must submit a Concept Paper by the due date to be eligible to submit a Full Application.

A. Eligible Applicants

An eligible applicant is 1) a legal entity established pursuant to United States Federal or State laws, with operations in the United States or its Territories or; 2) a foreign legal entity having a place of business in the United States or its Territories. An eligible entity must be able to demonstrate that its use of DOE funds will be in the economic interests of the United States, including, for example; creation of domestic manufacturing capability; use of American products, materials or labor; payment of United States taxes; or United States technological advancements.

Eligible applicants include but are not limited to: (1) institutions of higher education; (2) National Laboratories; (3) nonprofit and for-profit private entities; (4) State and local governments; (5) consortia of entities (1) through (4). If applying as a consortium, one member of the consortium that is an established legal entity and must be designated as the lead applicant.

Entities that do not meet this eligibility criteria are not eligible to apply as the prime applicant. However, entities not meeting this criteria are allowed as subrecipients to an eligible applicant provided that, in aggregate, not more than 20% of the total estimated DOE and NSF funding is provided to entities that do not meet the eligibility criteria and those entities must provide at least 20% cost sharing of their portion of the total project cost.

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 or to be a subrecipient to an eligible applicant.

B. Cost Sharing

The cost share must be at least 20% of the total allowable costs for research and development projects (i.e., the sum of the Government share, including FFRDC contractor costs if applicable, and the recipient share of allowable costs equals the total allowable cost of the project) and must come from non-Federal sources unless otherwise allowed by law (see Appendix C-1 and Appendix C-2 for additional information).

As an example, the minimum Applicant cost share requirement for a hypothetical project with a Total Project Cost of $1,875,000 and a 20% cost share requirement would be:

Applicant share, 20%	$375,000
DOE share, 80%	$1,500,000
Total Project Cost:	$1,875,000

Please note that the required minimum Applicant cost share percentage is **not** based on the DOE and NSF share but, rather, is based on the Total Project Cost.

Topic 1 Only:

In accordance with the Cost Share Waiver granted by the Under Secretary for EERE on April 7, 2011, Recipients and sub-recipients that are Non-profit organizations (as defined in 10 CFR 600.3), Institutions of Higher Education, U.S. National Laboratories, or U.S. Federally Funded Research and Development Centers (FFRDC) funded under this FOA are eligible for a waiver of the cost share requirement.

Recipients and sub-recipients not eligible for the cost share waiver as defined above must provide at least 20% of that Recipient or sub-recipient's allowable project costs (i.e., the sum of the Government share and the recipient share of allowable costs equals the allowable cost of the project) which must come from non-Federal sources unless otherwise allowed by law (see also Appendix C-1 entitled "Cost Share Information When Cost Share Waiver Applies" and Appendix C-2 entitled "Cost Share Information When Cost Share Waiver Does NOT Apply").

Summary by Topic:

	Recipient or Sub-Recipient Type	**Cost Share Requirement**
Topic 1	**Non-profit organizations, Institutions of Higher Education, U.S. National Laboratories, FFRDC**	**0%**
	All other entities	**20%**
Topic 2	**All applicants**	**20%**
Topic 3	**All applicants**	**20%**

By accepting federal funds under this award, the Prime Recipient agrees to be responsible for any sub-recipient cost share if the sub-recipient does not meet its cost share requirements.

Cost sharing above the minimum required and the likelihood of technology to be commercialized as evidenced by industry participation and/or industry cost share may be considered during selection (see Section V.A.3)

C. Other Eligibility Requirements

Federally Funded Research and Development Center (FFRDC) Contractors:
A DOE National Laboratory Contractor is eligible for funding as a prime applicant or a subcontractor on another entity's application if its cognizant contracting officer provides written authorization and this authorization is submitted with the application. If a DOE National Laboratory Contractor is selected for award, the proposed work will be authorized under the DOE work authorization process and performed under the laboratory's Management and Operating (M&O) contract. The following wording is acceptable for the authorization:

> "Authorization is granted for the _____ Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or

complementary to the missions of the laboratory, and will not adversely impact execution of the assigned DOE programs at the laboratory."

A Non-DOE FFRDC is eligible for funding as a prime applicant or a subcontractor on another entity's application. If a non-DOE FFRDC is selected for award, the proposed work will be authorized through an Interagency Agreement. The Federal agency sponsoring the FFRDC contractor must authorize in writing the use of the FFRDC contractor on the proposed project and this authorization must be submitted with the application. The use of a FFRDC contractor must be consistent with the contractor's FFRDC's authority under its award. The following wording is acceptable for this authorization:

"Authorization is granted for the _____ Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complementary to the missions of the laboratory, and will not adversely impact execution of assigned programs at the laboratory. THIS LABORATORY IS AUTHORIZED TO PERFORM THE WORK PROPOSED IN THE APPLICATION SUBMITTED UNDER DOE FUNDING OPPORTUNITY ANNOUNCEMENT # DE-FOA-0000492 BY THE FOLLOWING STATUTORY AUTHORITY [insert Statute name, citation, and section]_____."

Please be advised that those entities that form teams with National Laboratories in which the Laboratory is a Prime Recipient (i.e., lead participant) will be required to enter into subcontracts with the Laboratory. As such, the terms and conditions of the Management and Operating contract between the Laboratory and the Department of Energy will be in effect for any subcontracts, and not the traditional provisions associated with a financial assistance award. National Laboratories acting as Prime Recipients must make all applicable terms and conditions available to their subcontractors prior to submission of their applications. Any entities considering such teaming arrangements should request the Laboratory to provide the applicable terms and conditions prior to the Prime Recipient submitting a response to this FOA.

Value/Funding. The value of, and funding for, the FFRDC contractor portion of the work will not normally be included in the award to a successful applicant. Usually, DOE will fund a DOE FFRDC contractor through the DOE field work proposal system and other FFRDC contractors through an interagency agreement with the sponsoring agency.

Cost Share. The applicant's cost share requirement will be based on the total cost of the project, including the applicant's and the FFRDC contractor's portions of the effort.

Responsibility: The applicant, if successful, will be the responsible authority regarding the settlement and satisfaction of all contractual and administrative issues, including but not limited to, disputes and claims arising out of any agreement between the applicant and the FFRDC contractor.

SECTION IV – APPLICATION AND SUBMISSION INFORMATION

A. Address to Request Application Forms

The Application forms and/or instructions can be found on the EERE Exchange website at http://eere.energy.gov/financing/Exchange.

B. Letter of Intent and Concept Paper Application

- **Letter of Intent**

  A Letter of Intent is not required.

- **Concept Paper Application**

  Concept Papers are required and will be due on 5/9/2011 (see Section IV.C below for details).

C. Content and Form of Concept Papers

The application process will include two phases: a concept paper application phase and a full application phase. Following completion of the concept paper phase, applicants will be notified as to whether or not they are encouraged to submit a full application.

1. **SF-424 – Application for Federal Assistance**
   Complete all required fields in accordance with the instructions on the form. The list of certifications and assurances in Field 21 can be found at http://management.energy.gov/business_doe/business_forms.htm, under Certifications and Assurances. Note: The dates and dollar amounts on the SF 424 are for the complete project period and not just the first year, first phase or other subset of the project period.

2. **Concept Paper Narrative File (4-page limit)**
   The Concept Paper must not exceed 4 pages, including cover page, charts, graphs, maps, and photographs when printed using standard 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right), single spaced. EVALUATORS WILL REVIEW ONLY THE NUMBER OF PAGES SPECIFIED IN THE PRECEDING SENTENCE. The font must not be smaller than 11 point. Do not include any Internet addresses (URLs) that provide information necessary to review the application. See Section VIII.D for instructions on how to mark proprietary application information.

   The Concept Paper should provide a clear, concise statement of the specific objectives, primary approaches, and expected outcomes and impacts of the proposed project. It should address each of the Merit Review Criteria for Concept Papers listed in Section V.A.2 for the Topic under which the applicant is proposing a project. It must provide sufficient information that reviewers will be able to evaluate the technical merits of the preliminary application in accordance with these merit review criteria. The justification for the proposed project should include a clear statement of the importance of the project in terms of the utility of the outcomes and the target community of beneficiaries. For

multi-organizational or multi-investigator projects, briefly describe the roles and the work to be performed by each participant/investigator.

a. Bibliography and References (not included in the 4 page limit)
Provide a bibliography for any references cited. This section must include only bibliographic citations.

D. Content and Form of Final Full Application

Only Full Applications that are deemed compliant in the Concept Paper phase will be considered for selection. Full Application submissions are to be made via the EERE Exchange website at http://eere.energy.gov/financing/exchange.

You must complete the following application forms found on the EERE Exchange website at http://eere.energy.gov/financing/exchange, in accordance with the instructions.

	Required Document	Document Summary	Document Naming Convention
1	SF424 (PDF)	Application for Federal assistance	Control#_Institution_App424.pdf
2	SF-LLL (PDF) – Optional (include if applicable)	Disclosure of Lobbying Activities (if applicable)	Control#_Institution_SF-LLL.pdf
3	Project Narrative (PDF)	Technical application (can contain confidential information)	Control#_Institution_Technical.PDF (e.g. 206_9999_Corporation XYZ_Technical.pdf)
4	Summary for Public Release (PDF)	Public (nonconfidential) project summary in paragraph format	Control#_Institution_PublicSummary.PDF
5	Prime Recipient SF424 Research and Related (XLS)	High level budget spreadsheet	Control#_ Institution_SF424RR.xls Please submit file as a .XLS only (not .XLSX or other formats)
6	Prime Recipient Budget Justification (XLS)	Detailed budget spreadsheet	Control#_ Institution_BudgetJustification.XLS Please submit file as a .XLS only (not .XLSX or other formats)
7	Subrecipient SF424 Research and Related (XLS) – (if applicable)	High level budget Spreadsheet for all Subrecipients whose value is $100,000 or	Control#_ Institution_SubawardSF424RR.xls Please submit file as a .XLS only (not .XLSX or other formats)

		greater	
8	Subrecipient Budget Justification (XLS) – (if applicable)	Detailed budget spreadsheet for all Subrecipients whose value is $100,000 or greater	Control#_ Institution_SubrecipientBudgetJustification.XLS Please submit file as a .XLS only (not .XLSX or other formats)
9	Statement of Project Objectives (PDF)	Public (nonconfidential) concise (3-5 page) summary of project activities	Control#_Institution_SOPO.PDF
10	Summary Slide (PPT)	Project summary in PowerPoint format (should not contain proprietary or sensitive business information)	Control#_ Institution_Summary.ppt Please submit file as a .PPT only (not .PPTX or other formats)
11	NEPA Compliance Form (PDF)	Environmental compliance certification form	Control#_ Institution_Environmental.PDF

1. SF-424 – Application for Federal Assistance (Mandatory)
Complete all required fields in accordance with the instructions on the form. The list of certifications and assurances in Field 21 can be found at http://management.energy.gov/business_doe/business_forms.htm, under Certifications and Assurances. Note: The dates and dollar amounts on the SF 424 are for the complete project period and not just the first year, first phase or other subset of the project period. Save the information in a single file named "Control#_Institution_App424.pdf."

2. SF-LLL Disclosure of Lobbying Activities (Optional – Include As Applicable)
If applicable, complete the SF- LLL form. Applicability: If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the grant/cooperative agreement, you must complete and submit Standard Form - LLL, " Disclosure of Lobbying Activities."

3. Project Narrative (Mandatory)
The Project Narrative should be submitted in PDF format. Applicants should read and understand the Full Application evaluation criteria and keep the criteria in mind while preparing the application.

The project narrative must not exceed 15 pages, including cover page, table of contents, charts, graphs, maps, and photographs, when printed using standard 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right), single spaced. EVALUATORS WILL REVIEW ONLY THE NUMBER OF PAGES SPECIFIED IN THE PRECEDING SENTENCE. The font must not be smaller than 11 point. Do not include any Internet addresses (URLs) that provide information necessary to review the application. See Section VIII.D for instructions on how to mark proprietary application information. Save the information in a single file named "Control#_Institution_Technical.PDF" (e.g. 206_9999_CorpXYZ_Technical.pdf).

i. Cover Page:

The Preliminary Project Narrative cover page should indicate the name and type of organization, the announcement number, the project title, and both the technical and business points of contact for the applicant, denoting the names, titles, addresses, telephone and facsimile numbers, and electronic mail addresses. The cover page should also identify the names for all other participants (subrecipients). Finally, the cover page must specify which topic the applicant is applying to.

ii. Final Technical Proposal – Evaluation Criteria Discussion:

The Final Technical Proposal should provide a clear, concise statement of the specific objectives, primary approaches, and expected outcomes and impacts of the proposed project. **It should address each of the Merit Review Criteria for Final Applications listed in Section V.A.2.** for the Topic under which the applicant is proposing a project. It should also be structured in a logical manner consistent with the order of the criteria as listed. The Final Technical Proposal must provide sufficiently detailed scientific and technical information that reviewers will be able to evaluate the technical merits of the application in accordance with the merit review criteria. DOE WILL EVALUATE AND CONSIDER ONLY THOSE APPLICATIONS THAT ADDRESS SEPARATELY EACH OF THE MERIT REVIEW CRITERIA AND SUB-CRITERIA.

In order to help evaluate the application against the merit review criteria, the technical proposal should also include the following:

- Project Timetable and Milestones
  This table should outline as a function of time, year by year, all the important activities or phases of the project, include any activities planned beyond the project period. It should also include the key milestones and metrics for scientific success that are being proposed by the applicant.

(Successful applicants will use this project timetable to report progress.)

- Table of Participants and Roles
  Describe the roles and the work to be performed by each participant / investigator, and any business agreements between the applicant and participants.
- Facilities and Other Resources
  Identify the primary facilities (incl. office, laboratory, computer, etc.) to be used at each performance site listed, and, if appropriate, indicate their pertinent capabilities and capacities, their relative proximity, and their availability for the project. Describe only those resources that are directly applicable to the proposed work. Provide any information describing the other resources available to the project, such as machine and electronics shops.
- Primary Equipment
  List important items of equipment already available for this project, and if appropriate, note the location and pertinent capabilities of each. If you are proposing to acquire equipment, describe comparable equipment, if any, already at your organization and explain why it cannot be used.

The final application, including the final technical proposal, should be a stand-alone document. Merit reviewers for the final application may not have access to the concept paper application.

iii. Bibliography and References (not included in the 15-page limit)

Provide a bibliography for any references cited. This section must include only bibliographic citations.

iv. Resume File (not included in the 15-page limit)

Provide a resume for all key personnel proposed, including subrecipients and consultants. This should include (at a minimum) education and training, professional experience, and relevant publications. Each resume must not exceed 2 pages when printed on 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right), single spaced, with font not smaller than 11 point.

- Of the key personnel identified in this file, indicate the Principal Investigator(s) (PI).

- For Multiple Principal Investigators:
  The applicant, whether a single organization or team/partnership/consortium, must indicate if the project will include multiple PIs. The decision to use multiple PIs for a project is the sole responsibility of the applicant. If multiple PIs will be designated, the application must identify the Contact PI/Project Coordinator and provide a "Coordination and Management Plan" that describes the organization structure of the project as it pertains to the designation of multiple PIs. This plan should, at a minimum, include:

  - Process for making decisions on scientific/technical direction;
  - Publications;

- Intellectual property issues;
- Communication plans;
- Procedures for resolving conflicts; and
- PIs' roles and administrative, technical and scientific responsibilities for the project.

v. Letters of Commitment (if applicable). Not included in the 15-page limit

You must have a letter from each third party contributing cost share (i.e., a party other than the organization submitting the application) stating that the third party is committed to providing a specific minimum dollar amount of cost share. The letter should also identify the proposed cost sharing (e.g., cash, services, and/or property) to be contributed. Letters must be signed by the person authorized to commit the expenditure of funds by the entity. Letters of Commitment from parties participating in the project, exclusive of vendors, who will not be contributing cost share, but will be integral to the success of the project should be included as well.

vi. Authorization for non-DOE or DOE FFRDCs (if applicable. Not included in the 15-page limit)

See Section III.C. Other Eligibility Requirements.

4. Summary for Public Release (Mandatory) (1 page)

Provide a concise summary of the proposed research and development. The description should be understandable by technically literate but non-specialist readers. The summary should not contain proprietary or confidential business information. Save the information in a single file named "Control#_Institution_PublicSummary.PDF."

5. Prime Recipient SF 424 Research and Related (SF 424R&R) (Mandatory)

You must provide a separate budget (SF 424R&R) for each year of support requested and a cumulative budget for the total project period. Use the SF 424R&R Excel, "Budget Information Non-Construction Programs" form. You may request funds under any of the Object Class Categories as long as the item and amount are necessary to perform the proposed work, meet all the criteria for allowability under the applicable Federal cost principles, and are not prohibited by the funding restrictions in this announcement. Save the information in a single file named "Control#_ Institution_SF424RR.xls."

6. Prime Recipient Budget Justification File (Mandatory)

You must justify the costs proposed in each Object Class Category/Cost Classification category. This includes identifying:

- Key persons and personnel categories and the estimated costs for each person or category, amounts of time (e.g., hours or % of time) to be expended, the composite base pay rate, total direct personnel compensation and identify the rate basis (e.g., actual salary, labor distribution report, technical estimate, state civil service rates, etc.);
- Provide a list of equipment and cost of each item providing a basis of cost such as vendor quotes, catalog prices, prior invoices, etc., and briefly justifying its need as it applies to the Statement of Project Objectives;
- Identify proposed subrecipient/consultant work and cost of each subrecipient/consultant;
- Describe purpose of proposed travel, number of travelers, and number of travel days;
- List general categories of supplies and amount for each category providing a basis of cost such as vendor quotes, catalog prices, prior invoices, etc., and briefly justifying the need

for the supplies as they apply to the Statement of Project Objectives; and provide any other information you wish to support your budget;

- Provide the name of your cognizant/oversight agency, if you have one, and the name and phone number of the individual responsible for negotiating your indirect rates; and
- Indentify all sources of cost share including third parties and identify (1) the name of the organization; (2) the proposed dollar amount to be provided; (3) the amount as a percentage of the total project cost; and (4) the proposed type of cost share – cash, services, or property.

Further instructions for providing a budget justification to support the SF424R&R can be found at http://eere.energy.gov/financing/Exchange.

Save the budget justification information in a single file named "Control#_ Institution_BudgetJustification.xls."

7. Subrecipient SF 424 Research and Related (SF 424R&R) – (if applicable)

You must also provide a separate budget (i.e., budget for each year and a cumulative budget) for each subrecipient, including DOE/NNSA Federally Funded Research and Development Center (FFRDC) Contractors, that is expected to perform work estimated to be more than $100,000 or 50% of the total work effort (whichever is less). You may request funds under any of the Object Class Categories as long as the item and amount are necessary to perform the proposed work, meet all the criteria for allowability under the applicable Federal cost principles, and are not prohibited by the funding restrictions in this announcement. Save the information in a single file named "Control#_ Institution_Subrecpient SF424RR.xls."

8. Subrecipient Award Budget Justification (if applicable)

Each subrecipient, including DOE/NNSA Federally Funded Research and Development Center (FFRDC) Contractors, that is expected to perform work estimated to be more than $100,000 or 50% of the total work effort (whichever is less) is also required to submit a subrecipient budget justification. Please see the Section IV.D.6 above for details required for the Subrecipient Award Budget Justification file. Save the budget justification information in a single file named "Control#_ Institution_SubrecipientBudgetJustification.xls."

9. Statement of Project Objectives (SOPO) (Mandatory)

The Statement of Project Objectives should be provided. The SOPO must address how the project objectives will be met. It must contain a clear, concise description of all activities to be completed during the project performance and follow the requirements in the template. This file is essentially a condensed version of the Technical Proposal and all information contained in this document should also be provided in the Technical Proposal. The SOPO may be released to the public by DOE, in whole or in part, at any time. Therefore, it is required that it shall not contain proprietary or confidential business information. Save the SOPO in a single file named "Control#_Institution_SOPO.PDF."

10. Summary Slide (Mandatory)

A Project Summary in Power Point format should be provided using the template provided. All information must fit on a single slide. The Summary Slide may be released to the public by DOE, in whole or in part, at any time. Therefore, it is required that it shall not contain proprietary or confidential business information. Save the Summary Slide as Control#_ Institution_Summary.ppt. Please submit file as a .PPT only (not PPTX or other formats).

11. NEPA Compliance Form (Mandatory)

National Environmental Policy Act (NEPA) compliance certification form should be provided. Save the NEPA Compliance Form as "Control#_ Institution_Environmental.PDF."

E. Submissions from Applicants Selected for Negotiation of Award

If selected for award, DOE reserves the right to request additional or clarifying information for any reason deemed necessary, including, but not limited to:

- Indirect cost information
- Other budget information
- Environmental Research and Development Questionnaire

F. Submission Dates and Times

1. Concept Paper Application Due Date

Concept Paper applications must be received by 5/9/2011, no later than 11:59 PM Eastern Time. You are encouraged to transmit your application well before the deadline. All **APPLICATIONS SUBMISSIONS MUST BE MADE VIA THE EERE EXCHANGE AT http://eere.energy.gov/financing/exchange. APPLICATIONS RECEIVED AFTER THE NOTED DEADLINES OR BY ANY OTHER MEANS WILL NOT BE REVIEWED OR CONSIDERED FOR AWARD.**

2. Full Applications

Following the Concept Paper application phase, applicants will receive a notice as to whether or not they are encouraged to submit a full application. It is expected that these letters will be sent by 5/23/2011.

3. Final Full Application Due Date

Final applications must be received by 6/30/2011, no later than 11:59 PM Eastern Time. You are encouraged to transmit your application well before the deadline. **APPLICATIONS SUBMISSIONS MUST BE MADE VIA THE EERE EXCHANGE AT http://eere.energy.gov/financing/exchange. APPLICATIONS RECEIVED AFTER THE NOTED DEADLINES OR BY ANY OTHER MEANS WILL NOT BE REVIEWED OR CONSIDERED FOR AWARD.**

G. Intergovernmental Review

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

H. Funding Restrictions

Cost Principles**.** Costs must be allowable in accordance with the applicable Federal cost principles referenced in 10 CFR Part 600. The cost principles for commercial organization are in FAR Part 31.

Pre-award Costs**.** Recipients may charge to an award resulting from this announcement pre-award costs that were incurred within the ninety (90) calendar day period immediately

preceding the effective date of the award, and no earlier than the selection date of final applications, if the costs are allowable in accordance with the applicable Federal cost principles referenced in 10 CFR part 600. Recipients must obtain the prior approval of the contracting officer for any pre-award costs that are for periods greater than this 90 day calendar period. Pre-award costs are incurred at the applicant's risk. DOE is under no obligation to reimburse such costs if for any reason the applicant does not receive an award or if the award is made for a lesser amount than the applicant expected.

If recipients are State or Local Governments, they may not incur pre-award costs prior to award, without prior approval of the DOE contracting officer.

I. Submission and Registration Requirements

1. Where to Submit

CONCEPT PAPER AND FULL APPLICATIONS MUST BE SUBMITTED THROUGH THE EERE EXCHANGE SYSTEM (http://eere.energy.gov/financing/exchange) TO BE CONSIDERED FOR AWARD UNDER THIS ANNOUNCEMENT. Applications submitted by any other means will not be accepted. You cannot submit an application unless you are registered.

2. Registration Process Requirements

There are several one-time actions the applicant should complete. The applicant should:

- Register through the EERE Exchange at http://eere.energy.gov/financing/Exchange
- Obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number at http://fedgov.dnb.com/webform
- Register with the Central Contractor Registry (CCR) at https://www.ccr.gov/
- Register in FedConnect at https://www.fedconnect.net/; use "Register as a Vendor" link. To create an organization account, your organization's CCR MPIN is required; obtain the MPIN from your organization's Electronic Business Point of Contact. Refer to the FedConnect Quick Start guide at the website

Besides the Exchange registration system, which does not have a delay, these registration requirements could take several weeks to process and are necessary in order for a potential applicant to receive an award under this announcement. Therefore, although not required in order to submit an application, all potential applicants lacking a DUNS number or not yet registered with CCR should complete them as soon as possible.

EERE Web-Based Submission Information

All Application submissions are to be made via the EERE Exchange at http://eere.energy.gov/financing/exchange. To gain access to the EERE Exchange, the applicant must first register and create an account on the main EERE Exchange site. This account will then allow the user to register for any open EERE FOAs that are currently in Exchange. It is recommended that each organization or business unit, whether acting as a team or a single entity, utilize one account as the appropriate contact information for each submission.

The applicant will receive an automated response when the Concept Paper or Full Application is received; this will serve as a confirmation of EERE receipt – please do not reply to the automated response. The applicant will have the opportunity to re-submit a revised Concept Paper or Full Application for any reason as long as the relevant submission is submitted by the

specified deadline. A "User Guide" for the EERE Exchange can be found at http://eere.energy.gov/financing/exchange/Manuals.aspx after logging in to the system.

3. Electronic Authorization of Applications and Award Documents

Submission of an application and supplemental information under this announcement through electronic systems used by the Department of Energy constitutes the authorized representative's approval and electronic signature.

Submission of award documents, including modifications, through electronic systems used by the Department of Energy, including FedConnect, constitutes the authorized representative's approval and acceptance of the terms and conditions of the award. Award acknowledgement via FedConnect constitutes the authorized representative's electronic signature.

SECTION V - APPLICATION REVIEW INFORMATION

A. Criteria

1. Initial Review Criteria

Prior to a comprehensive merit evaluation, DOE will perform an initial review of the Concept Papers and Full Applications to determine that (1) the applicant is eligible for an award; (2) the information required by the announcement has been submitted; (3) the minimum required cost share has been proposed; (4) all mandatory requirements are satisfied; and (5) the proposed project is responsive to the objectives of the funding opportunity announcement. If an application fails to meet these requirements, it may be deemed non-responsive and eliminated from full further review.

2. Merit Review Criteria

The following merit review evaluation criteria will be used in the comprehensive evaluation of applications.

For each Concept Paper application, the criterion is either a Go/No Go or will be scored on a +/0/- scale. By definition, if a concept paper application does not meet the requirement for a "Go" decision in the Go/No Go criterion, the concept paper application will not be allowed to proceed further. The applications deemed compliant to the Concept Paper phase will be allowed to submit a Full Application.

For each full application criterion for final applicants, the weighting (out of a total of 100%) is indicated to show the relative importance.

Merit Review Criteria for Concept Papers

Topic 1: Foundational Research on PV Sub-Cell Materials and Processes

- **Criterion 1: The proposed innovation significantly enables $0.50** per watt **modules (Score on scale of +/0/-)**
    - Extent to which the applicant provides a convincing pathway for how the proposed scientific research can enable commercial and near commercial semiconductor-based PV systems with module costs of $0.50 per watt, lifetimes greater than 25 years, and sufficiently high efficiencies to enable low balance of system costs.

- **Criterion 2: The research potentially will lead to a significant absolute increase in efficiency of the targeted type of PV (+/0/-)**
    - In light of the existing body of knowledge regarding the targeted conversion technology and its relative PV commercial maturity, the degree to which the proposed research exhibits a groundbreaking expansion of knowledge enabling revolutionary improvements to absolute efficiency.

- **Criterion 3: The research is physically possible based on scientific theory (Go/No-Go)**
    - The research proposed must be viable, i.e., must not obviously violate the Laws of Thermodynamics or other well-established scientific theories.

- **Criterion 4: The research area's primary focus is the conversion of sunlight to electrons (Go/No-Go)**
    - Photovoltaic technology is the primary area of interest under this funding opportunity, NOT other solar technologies (e.g. concentrating solar thermal technologies, thermophotovoltaics, solar water heating, fuel production with solar energy, space-based solar).

- **Criterion 5: The research will produce prompt publications in peer reviewed journals (Go/No-Go)**
    - Concept Paper application must include a commitment to publish on the research conducted as soon as possible (meaning during the project or within 1-2 years after project completion) and include a list of targeted journals.

Topic 2: Foundational PV Cell Research

- **Criterion 1: The proposed innovation significantly enables $0.50** per watt **modules (Score on scale of +/0/-)**
    - Extent to which the applicant provides a convincing pathway for how the proposed scientific research can enable commercial and near commercial semiconductor-based PV systems with module costs of $0.50 per watt, lifetimes greater than 25 years, and sufficiently high efficiencies to enable low balance of system costs.

- **Criterion 2: The research potentially will lead to a significant absolute increase in efficiency of the targeted type of PV (+/0/-)**
    - In light of the existing body of knowledge regarding the targeted conversion technology and its relative PV commercial maturity, the degree to which the proposed research exhibits a groundbreaking expansion of knowledge enabling revolutionary improvements to absolute efficiency.

- **Criterion 3: The research is physically possible based on scientific theory (Go/No-Go)**
    - The research proposed must be viable, i.e., must not obviously violate the Laws of Thermodynamics or other well-established scientific theories.

- **Criterion 4: The research area's primary focus is the conversion of sunlight to electrons (Go/No-Go)**
    - Photovoltaic technology is the primary area of interest under this funding opportunity, NOT other solar technologies (e.g. concentrating solar thermal technologies, thermophotovoltaics, solar water heating, fuel production with solar energy, space-based solar).

- **Criterion 5: The research will produce prompt publications in peer reviewed journals (Go/No-Go)**
    - Concept Paper must include a commitment to publish on the research conducted as soon as possible (meaning during the project or within 1-2 years after project completion) and include a list of targeted journals.

- **Criterion 6: The research builds upon a cell that has demonstrated >10% efficiency (Go/No-Go)**
    - Concept Paper must include a description of the >10% efficient PV device the applicants have already fabricated as a baseline for the proposed research, including relevant technical data (e.g., IV curve with documented efficiency and area of measurement), device layer stack, and area of the device.

Topic 3: Barrier Focus Teams

- **Criterion 1: The proposed innovation significantly enables $0.50** per watt **modules (Score on scale of +/0/-)**
    - Extent to which the applicant provides a convincing pathway for how the proposed scientific research can enable commercial and near commercial semiconductor-based PV systems with module costs of $0.50 per watt, lifetimes greater than 25 years, and sufficiently high efficiencies to enable low balance of system costs.

- **Criterion 2: The research potentially will produce a significant absolute increase in efficiency of the targeted type of PV (+/0/-)**
    - In light of the existing body of knowledge regarding the targeted conversion technology and its relative PV commercial maturity, the degree to which the proposed research exhibits a groundbreaking expansion of knowledge enabling revolutionary improvements to absolute efficiency.

- **Criterion 3: The research team is highly integrated and demonstrates significant synergy (Score on scale of +/0/-)**

- Strength of argument for why greater results will be achieved from the Barrier Focus Team than from funding separate, individual researchers to pursue the proposed research.
- Degree to which the proposed team is the best possible team to find solutions to the barriers chosen.

- **Criterion 4: The research is physically possible based on scientific theory (Go/No-Go)**
  - The research proposed must be viable, i.e,. must not obviously violate the Laws of Thermodynamics or other well-established scientific theories.

- **Criterion 5: The research area's primary focus is the conversion of sunlight to electrons (Go/No-Go)**
  - Photovoltaic technology is the primary area of interest under this funding opportunity, NOT other solar technologies (e.g. concentrating solar thermal technologies, thermophotovoltaics, solar water heating, fuel production with solar energy, space-based solar).

- **Criterion 6: The research will produce prompt publications in peer reviewed journals (Go/No-Go)**
  - Concept Paper must include a commitment to publish on the research conducted as soon as possible (meaning during the project or within 1-2 years after project completion) and include a list of targeted journals.

Merit Review Criteria for Full Applications (All Topics)

Criterion 1: Foundational Scientific Advancement Toward $0.50 per watt **Module Goal (*Intellectual Merit – What is the Goal, and What is the Broader Impact of the Work*)** (Weight: 35%)

1.1. **Scientific merit**

1.1.1. Degree to which proposed research will advance the public scientific knowledge base in photovoltaic science and provide valuable public information to solve industry problems.

1.1.2. Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious, including relevant data and discussion of prior work in the literature that support the viability of the research.

1.1.3. Extent to which the application specifically and convincingly demonstrates how the proposed research will enable improvements in the factors affecting the efficiency, cost, and/or reliability of photovoltaic devices – including the balance among J_{SC}, V_{OC}, and Fill Factor.

1.2. **Level of criticality for enabling $1** per watt **installed system cost targets**

1.2.1 Extent to which the proposed research is critically required for advancing the state of the art to meet $0.50 per watt modules in the targeted technology, including a convincing pathway for enabling commercial and near commercial semiconductor-based PV systems with module costs of $0.50 per watt, lifetimes greater than 25 years, and sufficiently high efficiency to enable low balance of system costs.

1.2.2 Level of interest from the PV industry in the research and the ease with which the proposed advances could be adopted and brought to market within 1-3 years, as demonstrated through such proof as letters of support from industry.

Criterion 2: Technical Approach (*Intellectual Merit – How will the work be accomplished*) (Weight: 35%)

2.1. **Research approach and work plan**

2.1.1 Degree to which the fundamental approach and critical path have been clearly described and thoughtfully considered.

2.1.2 Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed work plan will succeed in meeting the project goals.

2.2 **Identification of technical risks**

2.2.1 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.

2.3 **Baseline, metrics, and deliverables**

2.3.1 Relative to a clearly defined experimental baseline (specifically a >10% efficient cell for Topic 2), the strength of the quantifiable metrics, milestones, and mid-point deliverables defined in the application, such that meaningful

interim progress will be made.

2.3.2 Extent to which quantitative metrics for a relevant final deliverable are clearly defined for measurement, in order to demonstrate the feasibility and applicability of the research for further development in commercial or near-commercial PV cells. Extent to which the targeted improvements' connection to cost reduction compared to the state of the art in a PV device has been clearly identified. For Topic 2, the final deliverable must include a functioning cell demonstrating a specified improvement in efficiency relative to the experimental baseline.

2.4 **Synergy of team (Topic 3 only)**

2.4.1 Degree of synergy within the Barrier Focus Team: why greater results will be achieved by the team than by funding separate, individual researchers to pursue the same area of research. Likelihood that the end deliverable will be more substantial because of the synergy of the team.

2.4.2 Clarity with which the Barrier Focus Team has chosen and articulated the barriers they will overcome and has defined technical success, with success being more substantial than a sum of individual efforts

2.4.3 Degree to which the proposed team is the best possible team to find solutions to the barriers chosen.

Criterion 3: Technical Capability of the Responder/Team (*Intellectual Merit – Who will perform the work*)

(Weight: 15%)

3.1 **Team qualifications and capability**

3.1.1 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.

3.1.2 Qualifications, relevant expertise, and time commitment of the PIs.

3.2 **Facilities and equipment**

3.2.1 Adequacy (quality, availability, and appropriateness) of existing and proposed facilities and equipment to accommodate the proposed project.

Criterion 4: Commitment to Education and Open Access of Results (*Broader Impact)* (Weight: 15%)

4.1 **Educational component**

4.1.1 Degree to which substantial education and participation of graduate students and post-doctoral fellows are intrinsic to the proposed research.

4.2 **Publication**

4.2.1 Likelihood that the research will result in prompt publication of results in high-impact-factor, peer-reviewed journals, during the project or within 1-2 years after project completion.

3. Other Selection Factors

The selection official may consider the following program policy factors in the selection process:

- Extent to which the individual projects or portfolio of research produces the optimum collaboration with NSF
- Breadth and significance of potential impact of research and DOE and NSF funds
- Diversity and complementariness of technologies, approaches, and methods (contribution to portfolio diversity)
- Diversity and geographic distribution of institutions and organizations
- Diversity of career stages among PIs, including the inclusion of early-career investigators
- Level of cost-share above the minimum required and leveraging of additional resources
- Impact of DOE funds on the project measured by project's increased likelihood of achieving programmatic objectives
- Likelihood of technology to be commercialized as evidenced by industry participation and/or industry cost share.

B. Review and Selection Process

1. Merit Review

Applications that pass the initial review will be subject to a merit review in accordance with the guidance provided in the "Department of Energy Merit Review Guide for Financial Assistance". This guide is available at: http://www.management.energy.gov/documents/meritrev.pdf.

It is very important that those documents, Project Abstract and Project Narrative file, that will be used during the Merit Review Process do not contain any Personally Identifiable Information as described in Appendix B.

After passing the initial review, concept paper applications will undergo a merit review process where they are evaluated according to the Merit Review Criteria for concept paper applications listed in Section V.A.2 above by distinguished independent reviewers and a Federal Merit Review Committee. Concept paper applicants will be notified by letter of the results of the concept paper application merit review and will be encouraged or discouraged to submit a final application.

Final applications will be evaluated, scored, and ranked according to the Merit Review Criteria for Full Applications listed in Part V.A.2 above by distinguished independent reviewers. A Federal Merit Review Committee will then rank the applications and make recommendations to the Selection Official as to whether or not each application is determined to have sufficient merit to be considered for funding based exclusively on the strengths and weaknesses of the full application.

2. Pre-Selection Clarification

The Contracting Officer may contact Applicants if he/she determines that pre-selection clarification is necessary and appropriate. The Contracting Officer has exclusive authority to make this determination. The Contracting Officer may contact one, multiple, or no Applicants at his/her discretion. The Contracting Officer will convey any questions or requests for clarification to the Applicant and set a deadline for responses. All responses must be sent to the Contracting Officer by the given deadline.

3. Selection

The Selection Official may consider the merit review recommendation, program policy factors, and the amount of funds available.

4. Discussions and Award

The Government may enter into discussions with a selected applicant fo````r any reason deemed necessary, including, but not limited to: (1) the budget is not appropriate or reasonable for the requirement; (2) only a portion of the application is selected for award; (3) the Government needs additional information to determine that the recipient is capable of complying with the requirements in 10 CFR part 600; and/or (4) special terms and conditions are required. Failure to resolve satisfactorily the issues identified by the Government will preclude award to the applicant.

C. Anticipated Notice of Selection and Award Dates

DOE anticipates notifying applicants selected for negotiation of award by August 2011and making awards by the end of September 2011.

SECTION VI - AWARD ADMINISTRATION INFORMATION

A. Award Notices

1. Notice of Selection and Debriefings

DOE will notify applicants selected for negotiation award. This notice of selection is not an authorization to begin performance. (See Section IV.G with respect to the allowability of pre-award costs.)

Organizations whose applications have not been selected will be advised as promptly as possible. For applicants who do not pass the initial review, this notice will consist of the findings of the initial review as determined by DOE/Golden Field Office. For applicants who go forward to the comprehensive review, but are not selected for negotiation of award, this notice will consist of the consensus strengths and weaknesses as determined by the Merit Review Committee and will constitute the debriefing.

2. Notice of Award

A Financial Assistance Award or Assistance Agreement issued by the DOE Contracting Officer is the authorizing award document. It normally includes, either as an attachment or by reference: (1) Special Terms and Conditions; (2) Applicable program regulations, if any; (3) Application as approved by DOE; (4) DOE assistance regulations at 10 CFR part 600; (5) National Policy Assurances To Be Incorporated As Award Terms; (6) Statement of Project Objectives; (7) Budget Summary; and (8) Federal Assistance Reporting Checklist, which identifies the reporting requirements.

For grants and cooperative agreements made to universities, non-profits and other entities subject to OMB Circular A-110, the Award also includes the Research Terms and Conditions and the DOE Agency Specific Requirements located at: http://www.nsf.gov/bfa/dias/policy/rtc/index.jsp.

B. Administrative and National Policy Requirements

1. Administrative Requirements

The administrative requirements for DOE grants and cooperative agreements are contained in 10 CFR part 600 (See: http://ecfr.gpoaccess.gov). Grants and cooperative agreements made to universities, non-profits and other entities subject to OMB Circular A-110 are subject to the Research Terms and Conditions located on the National Science Foundation web site at: http://www.nsf.bfa/dias/policy/rtc/index.jsp.

DUNS and CCR Requirements

Additional administrative requirements for DOE grants and cooperative agreements are contained in 2 CFR, Part 25 (See: http://ecfr.gpoaccess.gov). Prime awardees must keep their data at CCR current. Subawardees at all tiers must obtain DUNS numbers and provide the DUNS to the prime awardee before the subaward can be issued.

Subaward and Executive Reporting

Additional administrative requirements necessary for DOE grants and cooperative agreements to comply with the Federal Funding and Transparency Act of 2006 (FFATA) are contained in 2 CFR, Part 170. (See: http://ecfr.gpoaccess.gov). Prime awardees must register with the new FSRS database and report the required data on their first tier subawardees. Prime awardees must report the executive compensation for their own executives as part of their registration profile in the CCR.

2. **Special Terms and Conditions and National Policy Requirements**
   The DOE Special Terms and Conditions for Use in Most Grants and Cooperative Agreements are located at
   http://management.energy.gov/business_doe/business_forms.htm
   http://www.management.energy.gov/documents/specialtermsandcondition308.pdf.

   The National Policy Assurances To Be Incorporated As Award Terms are located at
   http://management.energy.gov/business_doe/business_forms.htm
   http://management.energy.gov/business_doe/1374.htm.

3. **Intellectual Property Provisions**
   The standard DOE financial assistance intellectual property provisions applicable to the various types of recipients are located at
   http://www.gc.doe.gov/financial_assistance_awards.htm.

4. **Statement of Substantial Involvement**
   Either a grant or cooperative agreement may be awarded under this announcement. If the award is a cooperative agreement, DOE will negotiate a Statement of Substantial Involvement prior to award.

C. Reporting

Reporting requirements are identified on the Federal Assistance Reporting Checklist, DOE F 4600.2, attached to the award agreement. For a sample Checklist, see
http://management.energy.gov/documents/DOEF46002PolicyVersion.pdf.

Specific reporting requirements for all awards resulting from this announcement will include:

- Quarterly Technical and Final Progress Reports
- Quarterly and Final Federal Financial Reports
- Annual presentations at the DOE Program's Annual Solar Energy Technologies Merit Review and Peer Evaluation Meeting (typically in Washington, D.C.)
- Annual submissions to the DOE Program's Annual Solar Energy Technologies Progress Report
- Provide an integrated device, component or system validation in a laboratory environment

SECTION VII - QUESTIONS/AGENCY CONTACTS

A. Questions

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

Questions related to the Funding Opportunity Announcement should be submitted to: F-PACE@go.doe.gov

All questions and answers related to this FOA will be posted at: http://eere.energy.gov/financing/exchange. DOE will try to respond to a question within 3 business days, unless a similar question and answer have already been posted on the website.

SECTION VIII - OTHER INFORMATION

A. Amendments

Notices of any amendments to this announcement will be posted on the EERE Exchange web site. When you create an application record you are then registered to receive notifications of changes. This notice will be delivered by e-mail to the address listed in your application record.

B. Government Right to Reject or Negotiate

DOE reserves the right, without qualification, to reject any or all applications received in response to this announcement and to select any application, in whole or in part, as a basis for negotiation and/or award.

C. Commitment of Public Funds

The Contracting Officer is the only individual who can make awards or commit the Government to the expenditure of public funds. A commitment by other than the Contracting Officer, either explicit or implied, is invalid.

D. Proprietary Application Information

Patentable ideas, trade secrets, proprietary or confidential commercial or financial information, disclosure of which may harm the applicant, should be included in an application only when such information is necessary to convey an understanding of the proposed project. The use and disclosure of such data may be restricted, provided the applicant includes the following legend on the first page of the project narrative and specifies the pages of the application which are to be restricted:

"The data contained in pages _____ of this application have been submitted in confidence and contain trade secrets or proprietary information, and such data shall be used or disclosed only for evaluation purposes, provided that if this applicant receives an award as a result of or in connection with the submission of this application, DOE shall have the right to use or disclose the data herein to the extent provided in the award. This restriction does not limit the government's right to use or disclose data obtained without restriction from any source, including the applicant."

To protect such data, each line or paragraph on the pages containing such data must be specifically identified and marked with a legend similar to the following:

"The following contains proprietary information that (name of applicant) requests not be released to persons outside the Government, except for purposes of review and evaluation."

E. Evaluation and Administration by Non-Federal Personnel

In conducting the merit review evaluation, the Government may seek the advice of qualified non-Federal personnel as reviewers. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The applicant, by submitting its application, consents to the use of non-Federal reviewers/administrators. Non-Federal

reviewers must sign conflict of interest and non-disclosure agreements prior to reviewing an application. Non-Federal personnel conducting administrative activities must sign a non-disclosure agreement.

F. Intellectual Property Developed under this Program

Patent Rights. The government will have certain statutory rights in an invention that is conceived or first actually reduced to practice under a DOE award. 42 U.S.C. 5908 provides that title to such inventions vests in the United States, except where 35 U.S.C. 202 provides otherwise for nonprofit organizations or small business firms. However, the Secretary of Energy may waive all or any part of the rights of the United States subject to certain conditions. (See "Notice of Right to Request Patent Waiver" in paragraph G below.)

Rights in Technical Data. Normally, the government has unlimited rights in technical data created under a DOE agreement. Delivery or third party licensing of proprietary software or data developed solely at private expense will not normally be required except as specifically negotiated in a particular agreement to satisfy DOE's own needs or to insure the commercialization of technology developed under a DOE agreement.

G. Notice of Right to Request Patent Waiver

Applicants may request a waiver of all or any part of the rights of the United States in inventions conceived or first actually reduced to practice in performance of an agreement as a result of this announcement, in advance of or within 30 days after the effective date of the award. Even if such advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver of the rights of the United States in identified inventions, i.e., individual inventions conceived or first actually reduced to practice in performance of the award. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784. For example see http://www.gc.doe.gov/documents/patwaivclau.pdf.

A waiver shall only be granted if it is determined that the waiver would best serve the United States and the general public. This determination shall be made according to the considerations set forth at 10 CFR 784.4 including a commitment by the recipient to agree to U.S. manufacturing or other activities that would benefit the U.S. economy.

Domestic small businesses and domestic nonprofit organizations will receive the patent rights clause at 37 CFR 401.14, i.e., the implementation of the Bayh-Dole Act. This clause permits domestic small business and domestic nonprofit organizations to retain title to subject inventions. Therefore, small businesses and nonprofit organizations do not need to request a waiver.

H. Notice Regarding Eligible/Ineligible Activities

Eligible activities under this program include those which describe and promote the understanding of scientific and technical aspects of specific energy technologies, but not those which encourage or support political activities such as the collection and dissemination of information related to potential, planned or pending legislation.

I. Notice of Right to Conduct a Review of Financial Capability

DOE reserves the right to conduct an independent third party review of financial capability for applicants that are selected for negotiation of award (including personal credit information of principal(s) of a small business if there is insufficient information to determine financial capability of the organization).

J. Notice of Potential Disclosure under Freedom of Information Act

Applicants should be advised that identifying information regarding all applicants, including applicant names and/or points of contact, may be subject to public disclosure under the Freedom of Information Act, whether or not such applicants are selected for negotiation of award.

REFERENCE MATERIAL

Appendix A – Definitions

"Amendment" means a revision to a Funding Opportunity Announcement

"**Applicant**" means the legal entity or individual signing the Application. This entity or individual may be one organization or a single entity representing a group of organizations (such as a Consortium) that has chosen to submit a single Application in response to a Funding Opportunity Announcement.

"**Application**" means the documentation submitted in response to a Funding Opportunity Announcement.

"Authorized Organization Representative (AOR)" is the person with assigned privileges who is authorized to submit grant applications through Grants.gov on behalf of an organization. The privileges are assigned by the organization's E-Business Point of Contact designated in the CCR.

"**Award**" means the written documentation executed by a DOE Contracting Officer, after an Applicant is selected, which contains the negotiated terms and conditions for providing Financial Assistance to the Applicant. A Financial Assistance Award may be either a Grant or a Cooperative Agreement.

"**Budget**" means the cost expenditure plan submitted in the Application, including both the DOE contribution and the Applicant Cost Share.

"Central Contractor Registration (CCR)" is the primary database which collects, validates, stores and disseminates data in support of agency missions. Funding Opportunity Announcements which require application submission through FedConnect or Grants.gov require that the organization first be registered in the CCR at http://www.grants.gov/CCRRegister.

"**Consortium (plural consortia)**" means the group of organizations or individuals that have chosen to submit a single Application in response to a Funding Opportunity Announcement.

"**Contracting Officer**" means the DOE official authorized to execute Awards on behalf of DOE and who is responsible for the business management and non-program aspects of the Financial Assistance process.

"**Cooperative Agreement**" means a Financial Assistance instrument used by DOE to transfer money or property when the principal purpose of the transaction is to accomplish a public purpose of support or stimulation authorized by Federal statute, and Substantial Involvement (see definition below) is anticipated between DOE and the Applicant during the performance of the contemplated activity.

"**Cost Sharing**" means the respective share of Total Project Costs to be contributed by the Applicant and by DOE. The percentage of Applicant Cost Share is to be applied to the Total Project Cost (i.e., the sum of Applicant plus DOE Cost Shares) rather than to the DOE contribution alone.

"Credential Provider" is an organization that validates the electronic identity of an individual through electronic credentials, PINS, and passwords for Grants.gov and FedConnect. Funding Opportunity Announcements which require application submission through Grants.gov require that the individual applying on behalf of an organization first be registered with the Credential Provider at https://apply.grants.gov/OrcRegister.

"Data Universal Numbering System (DUNS) Number" is a unique nine-character identification number issued by Dun and Bradstreet (D&B). Organizations must have a DUNS number prior to registering in the CCR. Call 1-866-705-5711 to receive one free of charge. http://www.grants.gov/applicants/request_duns_number.jsp

"E-Business Point of Contact (POC)" is the individual who is designated as the Electronic Business Point of Contact in the CCR registration. This person is the sole authority of the organization with the capability of designating or revoking an individual's ability to conduct CCR transactions.

"E-Find" is a Grants.gov webpage where you can search for Federal Funding Opportunities in FedGrants. http://www.grants.gov/search/searchHome.do

"**Financial Assistance**" means the transfer of money or property to an Applicant or Participant to accomplish a public purpose of support authorized by Federal statute through Grants or Cooperative Agreements and sub-awards. For DOE, it does not include direct loans, loan guarantees, price guarantees, purchase agreements, Cooperative Research and Development Agreements (CRADAs), or any other type of financial incentive instrument.

"FedConnect" is where federal agencies post opportunities and make awards via the web. Any Applicant can view public postings without registering. However, registered users have numerous added benefits including the ability to electronically submit Applications / Responses to the government directly through this site. https://www.fedconnect.net/FedConnect/

"Federally Funded Research and Development Center (FFRDC)" means a research laboratory as defined by Federal Acquisition Regulation 35.017.

"Funding Opportunity Announcement (FOA)" is a publicly available document by which a Federal agency makes known its intentions to award discretionary grants or cooperative agreements, usually as a result of competition for funds. Funding opportunity announcements may be known as program announcements, notices of funding availability, solicitations, or other names depending on the agency and type of program.

"Grant" means a Financial Assistance instrument used by DOE to transfer money or property when the principal purpose of the transaction is to accomplish a public purpose of support or stimulation authorized by Federal statute, and no Substantial Involvement is anticipated between DOE and the Applicant during the performance of the contemplated activity.

"Grants.gov" is the "storefront" web portal which allows organizations to electronically find grant opportunities from all Federal grant-making agencies. Grants.gov is THE single access point for over 900 grant programs offered by the 26 Federal grant-making agencies. http://www.grants.gov

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

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

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

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

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

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

"Proposal" is the term used to describe the documentation submitted in response to a Funding Opportunity Announcement. Also see Application.

"Recipient" means the organization, individual, or other entity that receives a Financial Assistance Award from DOE, is financially accountable for the use of any DOE funds or property provided for the performance of the Project, and is legally responsible for carrying out the terms and condition of the award.

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

"Selection Official" means the DOE official designated to select Applications for negotiation toward Award under a subject Funding Opportunity Announcement.

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

"Technology Investment Agreement (TIA)" is a type of assistance instrument used to support

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

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

"Tribal Energy Resource Development Organization or Group" means an "organization" of two or more entities, at least one of which is an Indian Tribe (see "Indian Tribe" above) that has the written consent of the governing bodies of all Indian Tribes participating in the organization to apply for a grant or loan, or other assistance under 25 U.S.C. § 3503.

Appendix B – Personally Identifiable Information

In responding to this Announcement, Applicants must ensure that Protected Personally Identifiable Information (PII) is not included in the following documents: Project Abstract, Project Narrative, Biographical Sketches, Budget or Budget Justification. These documents will be used by the Merit Review Committee in the review process to evaluate each application. PII is defined by the Office of Management and Budget (OMB) and DOE as:

> Any information about an individual maintained by an agency, including but not limited to, education, financial transactions, medical history, and criminal or employment history and information that can be used to distinguish or trace an individual's identity, such as their name, social security number, date and place of birth, mother's maiden name, biometric records, etc., including any other personal information that is linked or linkable to an individual.

This definition of PII can be further defined as: (1) Public PII and (2) Protected PII.

a. **Public PII:** PII found in public sources such as telephone books, public websites, business cards, university listing, etc. Public PII includes first and last name, address, work telephone number, email address, home telephone number, and general education credentials.

b. **Protected PII:** PII that requires enhanced protection. This information includes data that if compromised could cause harm to an individual such as identity theft.

Listed below are examples of Protected PII that Applicants must not include in the files listed above to be evaluated by the Merit Review Committee.

- Social Security Numbers in any form
- Place of Birth associated with an individual
- Date of Birth associated with an individual
- Mother's maiden name associated with an individual
- Biometric record associated with an individual
- Fingerprint
- Iris scan
- DNA
- Medical history information associated with an individual
- Medical conditions, including history of disease
- Metric information, e.g. weight, height, blood pressure
- Criminal history associated with an individual
- Employment history and other employment information associated with an individual
- Ratings
- Disciplinary actions
- Performance elements and standards (or work expectations) are PII when they are so intertwined with performance appraisals that their disclosure would reveal an individual's performance appraisal
- Financial information associated with an individual
- Credit card numbers

- Bank account numbers
- Security clearance history or related information (not including actual clearances held)

Listed below are examples of Public PII that Applicants may include in the files listed above to be evaluated by the Merit Review Committee:

- Phone numbers (work, home, cell)
- Street addresses (work and personal)
- Email addresses (work and personal)
- Digital pictures
- Medical information included in a health or safety report
- Employment information that is not PII even when associated with a name
- Resumes, unless they include a Social Security Number
- Present and past position titles and occupational series
- Present and past grades
- Present and past annual salary rates (including performance awards or bonuses, incentive awards, merit pay amount, Meritorious or Distinguished Executive Ranks, and allowances and differentials)
- Present and past duty stations and organization of assignment (includes room and phone numbers, organization designations, work email address, or other identifying information regarding buildings, room numbers, or places of employment)
- Position descriptions, identification of job elements, and those performance standards (but not actual performance appraisals) that the release of which would not interfere with law enforcement programs or severely inhibit agency effectiveness
- Security clearances held
- Written biographies (e.g. to be used in a program describing a speaker)
- Academic credentials
- Schools attended
- Major or area of study
- Personal information stored by individuals about themselves on their assigned workstation or laptop unless it contains a Social Security Number

Appendix C-1 – Cost Share Information When Cost Share Waiver Applies

Cost Sharing or Cost Matching

The terms "cost sharing" and "cost matching" are often used synonymously. Even the DOE Financial Assistance Regulations, 10 CFR Part 600, use both of the terms in the titles specific to regulations applicable to cost sharing. DOE almost always uses the term "cost sharing," as it conveys the concept that **non-federal share is calculated as a percentage of the Total Project Cost.** An exception is the State Energy Program Regulation, 10 CFR Part 420.12, State Matching Contribution. Here "cost matching" for the non-federal share is calculated as a percentage of the federal funds only, rather than the Total Project Cost.

Cost Share Waiver (Topic 1 Only. See Section III.B.)

Section 988 of the Energy Policy Act of 2005 establishes Department-wide cost sharing requirements for most research, development, demonstration, and commercial application activities. The cost sharing requirements generally require a 20 percent cost share for research and development and a 50 percent cost share for demonstration and commercial application activities. Recipients and Sub-Recipients that are Non-profit organizations (as defined in 10 CFR 600.3), Institutions of Higher Education, U.S. National Laboratories, or U.S. Federally Funded Research and Development Centers (FFRDCs) funded under this FOA are eligible for a waiver of cost share requirements.

Recipients and Sub-Recipients not eligible for the cost share waiver as defined above must provide at least 20% of that Recipient's or Sub-Recipient's allowable project costs (i.e. the sum of the Government share and the Recipient or Sub-Recipients share of allowable costs equals the allowable project cost) which must come from non-Federal sources unless otherwise allowed by law. Each Non-Eligible Sub-Recipient is responsible for their respective cost share requirement regardless of tier or level.

Cost sharing above the minimum level required and cost sharing at least commensurate with the maturity of the technology is strongly encouraged and may be considered by the Selection Official in making his/her selection (see Section V.A.3).

How Cost Sharing Is Calculated

As stated above, cost sharing is calculated as a percentage of the Total Project Cost. Following are examples of how to calculate cost sharing amounts for a project with $2,000,000 in federal funds.

Example 1: Eligible Prime Recipient without Sub-Recipients

Total Federal Share: $2,000,000
Eligible Prime Recipient cost share requirement: 0%
Total Project Costs: $2,000,000
Total cost share: $0

Example 2: Eligible Prime Recipient with Eligible Sub-Recipient

Total Federal Share: $2,000,000
Eligible Prime Recipient total federal share: $1,000,000
Eligible Prime Recipient cost share requirement: 0%
Total Eligible Prime Recipient project costs: $1,000,000
Eligible Sub-Recipient total federal share: $1,000,000
Eligible Sub-Recipient cost share requirement: 0%
Total Eligible Sub-Recipient project costs: $1,000,000
Total project cost: $1,000,000 + $1,000,000 = $2,000,000
Total cost share: $0

Example 3: Eligible Prime Recipient with Non-Eligible Sub-Recipient

Total Federal Share: $2,000,000
Eligible Prime Recipient total federal share: $1,000,000
Eligible Prime Recipient cost share requirement: 0%
Total Eligible Prime Recipient project costs: $1,000,000
Total Non-Eligible Sub-Recipient federal share: $1,000,000
Non-Eligible Sub-Recipient cost share requirement: 20% of total Sub-Recipient project cost
Total Sub-Recipient project costs: $1,000,000 divided by 80% = $1,250,000
Total project costs: $1,000,000 Prime + $1,250,000 Sub = $2,250,000
Total cost share: $2,250,000 total project costs - $2,000,000 federal share = $250,000 cost share

Example 4: Non-Eligible Prime Recipient without Sub-Recipients

Total Federal Share: $2,000,000
Non-Eligible Prime Recipient cost share requirement: 20% of total Prime Recipient project costs
Total Project Costs: $2,000,000 divided by 80% = $2,500,000
Total cost share: $2,500,000 total project costs - $2,000,000 federal share = $500,000 cost share

Example 5: Non-Eligible Prime Recipient with Eligible Sub-Recipient

Federal Share: $2,000,000
Non-Eligible Prime Recipient total federal share: $1,000,000
Non-eligible Prime Recipient cost share requirement: 20% of total Prime Recipient project costs
Total Prime Recipient project costs: $1,000,000 divided by 80% = $1,250,000
Eligible Sub-Recipient total federal share: $1,000,000
Eligible Sub-Recipient cost share requirement: 0%
Total Eligible Sub-Recipient project costs: $1,000,000
Total project cost: $1,250,000 Prime + $1,000,000 Sub = $2,250,000
Total cost share: $2,250,000 total project costs - $2,000,000 federal share = $250,000 cost share

Example 6: Non-Eligible Prime Recipient with Non-Eligible Sub-Recipient

Total Federal Share: $2,000,000
Non-Eligible Prime Recipient total federal share: $1,000,000

Non-Eligible Prime Recipient cost share requirement: 20% of total Prime Recipient costs
Total Prime Recipient project costs: $1,000,000 divided by 80% = $1,250,000
Non-Eligible Sub-Recipient total federal share: $1,000,000
Non-Eligible Sub-Recipient cost share requirement: 20% of total Sub-Recipient project costs
Total Sub-Recipient project costs: $1,000,000 divided by 80% = $1,250,000
Total project cost: $1,250,000 Prime + $1,250,000 Sub = $2,500,000
Total cost share: $2,500,000 total project costs - $2,000,000 federal share = $500,000 cost share ($250,000 Prime + $250,000 Sub)

What Qualifies For Cost Sharing

While it is not possible to explain what specifically qualifies for cost sharing in one or even a couple of sentences, in general, if a cost is allowable under the cost principles applicable to the organization incurring the cost and is eligible for reimbursement under a DOE grant or cooperative agreement, then it is allowable as cost share. Conversely, if the cost is not allowable under the cost principles and not eligible for reimbursement, then it is not allowable as cost share. In addition, costs may not be counted as cost share if they are paid by the Federal Government under another award unless authorized by Federal statute to be used for cost sharing.

The rules associated with what is allowable as cost share are specific to the type of organization that is receiving funds under the grant or cooperative agreement, though are generally the same for all types of entities. The specific rules applicable to:

- Institutions of Higher Education, Hospitals, and Other Nonprofit Organizations are found at 10 CFR600.123;
- State and Local Governments are found at 10 CFR600.224;
- For-profit Organizations are found at 10 CFR600.313.

In addition to the regulations referenced above, other factors may also come into play such as timing of donations and length of the project period. For example, the value of ten years of donated maintenance on a project that has a project period of five years would not be fully allowable as cost share. Only the value for the five years of donated maintenance that corresponds to the project period is allowable and may be counted as cost share.

Additionally, DOE generally does not allow pre-award costs for either cost share or reimbursement when these costs precede the signing of the appropriation bill that funds the award. In the case of a competitive award, DOE generally does not allow pre-award costs prior to the signing of the Selection Statement by the DOE Selection Official.

Following is a link to the DOE Financial Assistance Regulations. You can click on the specific section for each Code of Federal Regulations reference mentioned above.

DOE Financial Assistance Regulations:
http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=98a996164312e8dcf0df9c22912852b0&rgn=div5&view=text&node=10:4.0.1.3.9&idno=10

As stated above, the rules associated with what is allowable cost share are generally the same for all types of organizations. Following are the rules found to be common, but again, the specifics are contained in the regulations and cost principles specific to the type of entity:

(A) *Acceptable contributions.* All contributions, including cash contributions and third party in-kind contributions, must be accepted as part of the recipient's cost sharing if such contributions meet all of the following criteria:

(1) They are verifiable from the recipient's records.

(2) They are not included as contributions for any other federally-assisted project or program.

(3) They are necessary and reasonable for proper and efficient accomplishment of project or program objectives.

(4) They are allowable under the cost principles applicable to the type of entity incurring the cost as follows:

(a) *For-profit organizations.* Allowability of costs incurred by for-profit organizations and those nonprofit organizations listed in Attachment C to OMB Circular A–122 is determined in accordance with the for-profit costs principles in 48 CFR Part 31 in the Federal Acquisition Regulation, except that patent prosecution costs are not allowable unless specifically authorized in the award document.

(b) *Other types of organizations.* Allowability of costs incurred by other types of organizations that may be Sub-Recipients under a prime award is determined as follows:

(i) *Institutions of higher education.* Allowability is determined in accordance with 2 CFR 220

(ii) *Other nonprofit organizations.* Allowability is determined in accordance with 2 CFR 230

(iii) *Hospitals.* Allowability is determined in accordance with the provisions of 45 CFR Part 74, Appendix E, Principles for Determining Costs Applicable to Research and Development Under Grants and Contracts with Hospitals

(iv) *Governmental organizations.* Allowability for State, local, or federally recognized Indian tribal government is determined in accordance with 2 CFR 225

(5) They are not paid by the Federal Government under another award unless authorized by Federal statute to be used for cost sharing or matching.

(6) They are provided for in the approved budget.

(B) *Valuing and documenting contributions*

(1) *Valuing recipient's property or services of recipient's employees.* Values are established in accordance with the applicable cost principles, which mean that amounts chargeable to the project are determined on the basis of costs incurred. For real property or equipment used on the project, the cost principles authorize depreciation or use charges. The full value of the item may be applied when the item will be consumed in the performance of the award or fully depreciated by the end of the award. In cases where the full value of a donated capital asset is to be applied as cost sharing or matching, that full value must be the lesser or the following:

(a) The certified value of the remaining life of the property recorded in the recipient's accounting records at the time of donation; or
(b) The current fair market value. If there is sufficient justification, the contracting officer may approve the use of the current fair market value of the donated property, even if it exceeds the certified value at the time of donation to the project. The contracting officer may accept the use of any reasonable basis for determining the fair market value of the property.

(2) *Valuing services of others' employees.* If an employer other than the recipient furnishes the services of an employee, those services are valued at the employee's regular rate of pay, provided these services are for the same skill level for which the employee is normally paid.

(3) *Valuing volunteer services.* Volunteer services furnished by professional and technical personnel, consultants, and other skilled and unskilled labor may be counted as cost sharing or matching if the service is an integral and necessary part of an approved project or program. Rates for volunteer services must be consistent with those paid for similar work in the recipient's organization. In those markets in which the required skills are not found in the recipient organization, rates must be consistent with those paid for similar work in the labor market in which the recipient competes for the kind of services involved. In either case, paid fringe benefits that are reasonable, allowable, and allocable may be included in the valuation.

(4) *Valuing property donated by third parties.*

(a) Donated supplies may include such items as office supplies or laboratory supplies. Value assessed to donated supplies included in the cost sharing or matching share must be reasonable and must not exceed the fair market value of the property at the time of the donation.

(b) Normally only depreciation or use charges for equipment and buildings may be applied. However, the fair rental charges for land and the full value of equipment or other capital assets may be allowed, when they will be consumed in the performance of the award or fully depreciated by the end of the award, provided that the contracting officer has approved the charges. When use charges are applied, values must be determined in accordance with the usual accounting policies of the recipient, with the following qualifications:

(i) The value of donated space must not exceed the fair rental value of comparable space as established by an independent appraisal of comparable space and facilities in a privately-owned building in the same locality.

(ii) The value of loaned equipment must not exceed its fair rental value.

(5) *Documentation.* The following requirements pertain to the recipient's supporting records for in-kind contributions from third parties:

(a) Volunteer services must be documented and, to the extent feasible, supported by the same methods used by the recipient for its own employees.

(b) The basis for determining the valuation for personal services and property must be documented.

Appendix C-2 – Cost Share Information When Cost Share Waiver Does NOT Apply

Cost Sharing or Cost Matching

The terms "cost sharing" and "cost matching" are often used synonymously. Even the DOE Financial Assistance Regulations, 10 CFR Part 600, use both of the terms in the titles specific to regulations applicable to cost sharing. DOE almost always uses the term "cost sharing," as it conveys the concept that **non-federal share is calculated as a percentage of the Total Project Cost.** An exception is the State Energy Program Regulation, 10 CFR Part 420.12, State Matching Contribution. Here "cost matching" for the non-federal share is calculated as a percentage of the federal funds only, rather than the Total Project Cost.

How Cost Sharing is Calculated

As stated above, cost sharing is calculated as a percentage of the Total Project Cost. Following is an example of how to calculate cost sharing amounts for a project with $1,000,000 in federal funds with a minimum 20% non-federal cost sharing requirement:

Formula: Federal share ($) divided by Federal share (%) = Total Project Cost
Example: $1,000,000 divided by 80% = $1,250,000

Formula: Total Project Cost ($) minus Federal share ($) = Non-federal share ($)
Example: $1,250,000 minus $1,000,000 = $250,000

Formula: Non-federal share ($) divided by Total Project Cost ($) = Non-federal share (%)
Example: $250,000 divided by $1,250,000 = 20%

See the sample cost share calculation for a blended cost share percentage below. **Keep in mind that FFRDC funding is DOE funding.**

What Qualifies For Cost Sharing

While it is not possible to explain what specifically qualifies for cost sharing in one or even a couple of sentences, in general, if a cost is allowable under the cost principles applicable to the organization incurring the cost and is eligible for reimbursement under a DOE grant or cooperative agreement, then it is allowable as cost share. Conversely, if the cost is not allowable under the cost principles and not eligible for reimbursement, then it is not allowable as cost share. In addition, costs may not be counted as cost share if they are paid by the Federal Government under another award unless authorized by Federal statute to be used for cost sharing.

The rules associated with what is allowable as cost share are specific to the type of organization that is receiving funds under the grant or cooperative agreement, though are generally the same for all types of entities. The specific rules applicable to:

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- State and Local Governments are found at 10 CFR600.224;

- For-profit Organizations are found at 10 CFR600.313.

In addition to the regulations referenced above, other factors may also come into play such as timing of donations and length of the project period. For example, the value of ten years of donated maintenance on a project that has a project period of five years would not be fully allowable as cost share. Only the value for the five years of donated maintenance that corresponds to the project period is allowable and may be counted as cost share.

Additionally, DOE generally does not allow pre-award costs for either cost share or reimbursement when these costs precede the signing of the appropriation bill that funds the award. In the case of a competitive award, DOE generally does not allow pre-award costs prior to the signing of the Selection Statement by the DOE Selection Official.

Following is a link to the DOE Financial Assistance Regulations. You can click on the specific section for each Code of Federal Regulations reference mentioned above.

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http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=98a996164312e8dcf0df9c22912852b0&rgn=div5&view=text&node=10:4.0.1.3.9&idno=10

As stated above, the rules associated with what is allowable cost share are generally the same for all types of organizations. Following are the rules found to be common, but again, the specifics are contained in the regulations and cost principles specific to the type of entity:

(A) *Acceptable contributions.* All contributions, including cash contributions and third party in-kind contributions, must be accepted as part of the recipient's cost sharing if such contributions meet all of the following criteria:

(1) They are verifiable from the recipient's records.

(2) They are not included as contributions for any other federally-assisted project or program.

(3) They are necessary and reasonable for proper and efficient accomplishment of project or program objectives.

(4) They are allowable under the cost principles applicable to the type of entity incurring the cost as follows:

(a) *For-profit organizations.* Allowability of costs incurred by for-profit organizations and those nonprofit organizations listed in Attachment C to OMB Circular A–122 is determined in accordance with the for-profit costs principles in 48 CFR Part 31 in the Federal Acquisition Regulation, except that patent prosecution costs are not allowable unless specifically authorized in the award document.

(b) *Other types of organizations.* Allowability of costs incurred by other types of organizations that may be subrecipients under a prime award is determined as

follows:

(i) *Institutions of higher education.* Allowability is determined in accordance with 2 CFR 220

(ii) *Other nonprofit organizations.* Allowability is determined in accordance with 2 CFR 230

(iii) *Hospitals.* Allowability is determined in accordance with the provisions of 45 CFR Part 74, Appendix E, Principles for Determining Costs Applicable to Research and Development Under Grants and Contracts with Hospitals

(iv) *Governmental organizations.* Allowability for State, local, or federally recognized Indian tribal government is determined in accordance with 2 CFR 225

(5) They are not paid by the Federal Government under another award unless authorized by Federal statute to be used for cost sharing or matching.

(6) They are provided for in the approved budget.

(B) *Valuing and documenting contributions*

(1) *Valuing recipient's property or services of recipient's employees.* Values are established in accordance with the applicable cost principles, which mean that amounts chargeable to the project are determined on the basis of costs incurred. For real property or equipment used on the project, the cost principles authorize depreciation or use charges. The full value of the item may be applied when the item will be consumed in the performance of the award or fully depreciated by the end of the award. In cases where the full value of a donated capital asset is to be applied as cost sharing or matching, that full value must be the lesser or the following:

(a) The certified value of the remaining life of the property recorded in the recipient's accounting records at the time of donation; or
(b) The current fair market value. If there is sufficient justification, the contracting officer may approve the use of the current fair market value of the donated property, even if it exceeds the certified value at the time of donation to the project. The contracting officer may accept the use of any reasonable basis for determining the fair market value of the property.

(2) *Valuing services of others' employees.* If an employer other than the recipient furnishes the services of an employee, those services are valued at the employee's regular rate of pay, provided these services are for the same skill level for which the employee is normally paid.

(3) *Valuing volunteer services.* Volunteer services furnished by professional and technical personnel, consultants, and other skilled and unskilled labor may be counted as cost sharing or matching if the service is an integral and necessary part of an approved project or program. Rates for volunteer services must be consistent with those paid for

similar work in the recipient's organization. In those markets in which the required skills are not found in the recipient organization, rates must be consistent with those paid for similar work in the labor market in which the recipient competes for the kind of services involved. In either case, paid fringe benefits that are reasonable, allowable, and allocable may be included in the valuation.

(4) *Valuing property donated by third parties.*

(a) Donated supplies may include such items as office supplies or laboratory supplies. Value assessed to donated supplies included in the cost sharing or matching share must be reasonable and must not exceed the fair market value of the property at the time of the donation.

(b) Normally only depreciation or use charges for equipment and buildings may be applied. However, the fair rental charges for land and the full value of equipment or other capital assets may be allowed, when they will be consumed in the performance of the award or fully depreciated by the end of the award, provided that the contracting officer has approved the charges. When use charges are applied, values must be determined in accordance with the usual accounting policies of the recipient, with the following qualifications:

(i) The value of donated space must not exceed the fair rental value of comparable space as established by an independent appraisal of comparable space and facilities in a privately-owned building in the same locality.

(ii) The value of loaned equipment must not exceed its fair rental value.

(5) *Documentation.* The following requirements pertain to the recipient's supporting records for in-kind contributions from third parties:

(a) Volunteer services must be documented and, to the extent feasible, supported by the same methods used by the recipient for its own employees.

(b) The basis for determining the valuation for personal services and property must be documented.

Appendix D – Barriers Analysis Tables

Table D-1: Cost Drivers and Pathways to Cost Reduction

Technology	Drivers	Cost Reduction Potential	Technical Risk	Pathways
sc/mc-Si	Wafers	High	Medium	Thinner or kerfless wafers, continuous CZ, or epitaxial film approaches
	Contact Materials (Ag and Al paste)	High	Low	New pastes and/or deposition methods with lower cost Earth abundant materials
	Capital costs (batch processing)	Low	High	Alternative to conventional CZ, possibly epitaxial
	Quality Control (hot spots, shunts)	Low	Low	In-situ, in-line, high-throughput metrology
CIGS	Materials cost and availability (Indium, selenium, cadmium)	High	Medium	Thinner layers or replacement with Earth abundant and benign materials (e.g., CZTS, ZnS, …)
	Transparent Conductors	High	Low	ITO alternative materials and/or deposition methodologies
	Glass and/or Encapsulants	Medium	Medium	Flexible low-cost front and backsheets with low WVTR (i.e., ultrabarriers, glass replacement)
	Operational costs of selenization ovens	Medium	Medium	Eliminate batch selenization, alternative deposition methodologies (e.g., atmospheric deposition).
	Large scale spatial uniformity and improved throughput with same or lower cost of capital	High	Medium	Improved In-situ metrology, thermal control, and elimination of chemical bath CdS
CdTe	Glass cost, thermal properties, and transparency	High	Medium	Alternative superstrate approach that provides low Fe glass transparency (currently \$8.5 /m^2 vs \$2.5/m^2 for soda lime) or alternative substrate approach.
	Transparent Conductive Oxides/Buffer Layers	High	Medium	Develop TCO with high conductivity, transparency, environmental stability (i.e, AZO, FTZrO, ...)
	In-line step processing for better throughput	Medium	Low	Continuous, all dry processing, substrate approach (roll-to-roll)
	Film uniformity with same or lower cost of capital	Low	Medium	In-line metrology and target development
	Active material cost and availability (Cd, Te, ...)	Low	High	Thinner layers or replace with earth abundant earth benign materials
III-V Multi-Junction	High cost of single crystal substrates (GaAs, Ge)	High	Medium	Metamorphic growth on Si, direct deposition on foil, lift-off and regrowth/substrate reuse
	Cost and abundance of contact Materials (Au, Pd, …)	Low	High	New pastes and/or deposition methods with lower cost earth abundant materials
	Precursors (TMGa, TMZn, …)	Low	High	Lower cost and less toxic precursors and processing chemicals
	Conventional Organo-Metallic Vapor Phase Epitaxy (OMVPE)	Low	High	LPCVD, high rate MBE, or continuous roll-to-roll fabrication

Table D-2: Efficiency Opportunities

Technology		Short Circuit Current (mA/cm^2)	Open Circuit Voltage (volts/cell)	Fill Factor	Efficiency (percent)
sc/mc-Si	Practical Potential	43.3	0.75	0.83	27
	Best laboratory cell	42.7	0.71	0.83	25
	Best commercial cells	38.5	0.72	0.8	22
	Typical commercial cells	36	0.63	0.78	18
CIGS	Practical Potential+	30.0 - 39.0	0.75 - 0.95	0.83	25
	Best laboratory cell	35.4	0.74	0.78	20.3
	Commercial cells*	30 (32.5)	0.60 (0.69)	0.70 (0.73)	13 (16.3)
CdTe	Practical Potential	29.5	1.1	0.81	21
	Best laboratory cell	25.7	0.84	0.78	17
	Commercial cells*	19 (21)	0.8 (0.84)	0.70 (0.76)	11(13.5)
III-V Mult-Junction	Practical Potential (@1000 suns)	3J IMM: 14.4	3.5	90	45
		4J IMM: 13.2	4.2	90	50
		5J IMM: 10.6	5.6	90	53
	Best laboratory cell (3J)†	14.7	3.19	88.7	41.6
		14.1	3.45	87.1	42.3
	Commercial cells (3J)^	13.9	3.17	87.1	39

+ Ranges reflect variation in bandgap (i.e., Ga/In ratio)
* Values in parentheses are from hero modules
† 41.6% is for standard commercial design; 42.3% for backside metamorphic design
^ http://spectrolab.com/DataSheets/PV/CPV/C3MJ%20CDO%20Products%2020100810.pdf

Table D-3: Pathways to increase Short Circuit Current Density from commercial to best lab cell

Technology	Action	Potential Current Increase (mA/cm^2)	Technical Risk	Pathways
sc/mc-Si*	Reduce the front metal shadow loss by reducing line widths	0.8	Low	Costs vs. performance and throughput associated with new techniques such as ink-jet or IBC
	Enhancement of red response via improved back surface field	1-2	Medium	New process and learning curve (e.g., point back contact, passivation RSV < 1000)
	Novel surface texturing for better light trapping	1-2	Medium	Cost vs. performance improvement over current pyramidal texturing
	Selective emitter to enhance blue response	0.6	Low	Additional processing step and costs associated with selective emitter
CIGS	Reduce CdS window layer thickness	1.5	Medium	Develop 20 nm thick continuous CdS layer without shunting.
	Larger band gap junction partner	2.5	Medium	Replace CdS (e.g. 2.5 eV) with wide bandgap emitter (i.e., ZnS (3.1 eV))
	Improved TCO	1.5	Medium	Develop TCO with high conductivity, transparency, environmental stability (i.e., a-InZnO)
	Improved monolithic integration	1	Low	Reduce line width of laser/mechanical scribing
	Minimize reflection off CIG surface	1.5	Medium	Develop a suitable low cost anti-reflection coating
CdTe	Higher transparency glass superstrate	1.5	Low	Develop low cost low iron glass
	Improved transparent conducting material	1.5	Medium	Develop new materials with comparable costs (e.g., use Cd_2SnO_4 - at high T - instead of SnO_2F)
	Reduce CdS absorption	4	High	Thin CdS by reducing absorber surface roughness, and Cu control or Cu free design, or substrate approach
	Reduce edge "dead zone"	1	Low	Improve laser scribing without shunting
III-V Multi-Junction	Improve current matching to the solar spectrum	3 (Ge - 3J)	Low	Adjusting band gaps while maintaining high materials quality for non-lattice-matched junctions
	Decrease minority carrier recombination at absorber back surface	0.5	Medium	Improved the back surface field using different materials or alternative composition gradients
	Improve top cell emitter transparency	0.5	Medium	Alternative wide bandgap emitter materials (i.e., AlInGaP, graded InGaP, AlInP, AlGaAs, II-VI:III-V alloys)

* The values listed are for crystalline Si. The actions also apply to mc-Si but the magnitude of these improvements will be proportionally less.

Table D-4: Pathways to increase Open Circuit Voltage from commercial to best lab cell

Technology	Action	Potential Voltage Increase (V)	Technical Risk	Pathways
sc/mc-Si*	Improve crystalline quality of Si wafer	0.03	Low	Reduce impurities or lower defect density
	Improve surface and bulk passivation	0.1	Medium	Reduce SRV while maintain costs of ALD or dielectric deposition
	Apply heterojunction	0.1	Low	Modify current manufacturing lines to allow for heterojunction deposition
CIGS	Improve the absorber carrier lifetime and concentration	0.05	Medium	Implement in-situ quality control at minimal additional cost
	Increase the Ga/In ratio in CIGS by a factor of 2 to 3	0.1	Medium	Increase CIGS deposition temperature via higher temperature glass substrates or alternative stable substrates.
CdTe	Reduce Shockley-Read-Hall carrier recombination at junction	0.1	High	Doping control during deposition, material uniformity, Cu doping concentration
	Improve bulk material minority carrier lifetime	0.1	Medium	Increasing grain size, crystallinity, and grain boundary passivation via deposition rate, temperature control, and chemical processing
	Control intermixing of CdTe/CdS at junction	0.1	High	Optimize processing to improve interface alloying (i.e., substrate approach)
III-V Multi-Junction	Replace 0.7 eV Ge junction of standard design with 1 eV junction	0.3	Medium	Integrating 1-eV materials into structure: either metamorphic or new materials such as GaInNAs
	Increase high concentration performance (>1000 suns)	0.1	Low	Improve grid designs and reduce contact series resistance
	Expand the spectral response of the receivers	0.6	Low	Develop 4J cell designs using high- and low-bandgap materials with suitable tunnel junctions

* The values listed are for crystalline Si. The actions also apply to mc-Si but the magnitude of these improvements will be proportionally less.

Table D-5: Pathways to increase fill factor from commercial to best lab cell

Technology	Action	Potential FF Increase	Technical Risk	Pathways
sc-Si*	Improve front metal grid conductivity by electroplating	0.05	Medium	Develop electroplating methodologies which solve adhesion problems
	Improve paste conductivity	0.05	Low	Developing the new pastes (i.e., NiCuAg)
	Heavily doped bus bar and finger region at front	0.05	Low	Use of selective emitter
CIGS	Reduce contact resistance	0.07	Low	Improved TCO and contact grid combination
	Reduce parasitic leakage current	0.1	Low	Improve the density, phase, and crystallinity of the absorber
CdTe	Improve transparent conductive material	0.1	Medium	Develop material with high conductivity, transparency, environmental stability (i.e, AZO, FTZrO, ...)
	Improved back contact	0.1	Low	Controlling Cu diffusion and carrier lifetime in absorber, reduce contact resistance
	Improved cell contacting and interconnects	0.1	Low	Improved metallization (i.e., materials, deposition methodologies)
III-V Multi-Junction	Improve the CPV receiver robustness to non-uniform illumination	0.2	High	Improved lateral conductivity of tunnel junctions and better diffusion barriers
	Decrease the top cell contact resistance	0.3	Low	Optimize the grid design and develop improved contact metallization/contact layer/emitter combination for the top cell

* The values listed are for crystalline Si. The actions also apply to mc-Si but the magnitude of these improvements will be proportionally less.

Appendix E – Technology Readiness Level (TRL) Definitions

Table E-1: Technology Readiness Levels (TRLs)

TRL	Definition	Description - and Relevance
1	Basic principles observed and reported	This is the lowest level of technology readiness. *Scientific research begins to be translated into applied R&D*. Examples might include paper studies of a technology's basic properties or experimental work that consists mainly of observations of the physical world. Supporting Information includes published research or other references that identify the principles that underlie the technology. A specific example in PV might be the observation of increased light absorbtion in silicon nano-tubes or observation of Multiple Exciton Generation. *Intersection of BES and applied research.*
2	Technology concept and/or application formulated	Once basic principles are observed, *practical applications can be invented*. Applications are speculative, and there may be no proof or detailed analysis to support the assumptions. Examples are still limited to analytic studies. Supporting information includes publications or other references that outline the application being considered and that provide analysis to support the concept. The step up from TRL 1 to TRL 2 *moves the ideas from basic to applied research*. Most of the work is analytical or paper studies with the emphasis on understanding the science better. Experimental work is designed to corroborate the basic scientific observations made during TRL 1 work. An example in PV might be analytical models of a new thin film with very low absorption coefficient that could serve as an enhanced Anti-Reflective coating, or in a multi-layer anti-reflective coating.
3	Analytical and experimental critical function and/or characteristic proof of concept	Active research and development (R&D) is initiated. This includes *analytical studies and laboratory-scale studies to physically validate the analytical predictions* of separate elements of the technology. Examples include components that are not yet integrated. Supporting information includes results of laboratory tests performed to measure parameters of interest and comparison to analytical predictions for critical subsystems. At TRL 3 the work has moved beyond the paper phase to experimental work that verifies that the concept works as expected. Components of the technology are validated, but there is no strong attempt to integrate the components into a complete system. Modeling and simulation may be used to complement physical experiments. Examples in PV would include deposition of thin films on bare substrates or films for optical measurement of devices and not necessarily actual PV devices.
4	Component and/or system validation in laboratory environment	The *basic technological components are integrated* to establish that the pieces will work together. This is relatively "low fidelity" compared with the eventual system. Examples include integration of ad hoc hardware in a laboratory and testing. Supporting information includes the results of the integrated experiments and estimates of how the experimental components and experimental test results differ from the expected system performance goals. TRL 4-6 represent the bridge from scientific research to engineering. TRL 4 is the first step in determining whether the individual components will work together as a system. The laboratory system will probably be a mix of on hand

		equipment and a few special purpose components that may require special handling, calibration, or alignment to get them to function. An example in PV might include the first attempts to fabricate a new PV device design in the laboratory. The concept is there but the details of the unit process steps are not yet worked out. The goal of TRL 4 should be the *narrowing of possible options in the complete system.*
5	Laboratory scale, similar system validation in relevant environment	The basic technological *components are integrated* so that the system configuration is similar to (matches) the final application in almost all respects. Supporting information includes results from the laboratory scale testing, analysis of the differences between the laboratory and eventual operating system/environment, and analysis of what the experimental results mean for the eventual operating system/environment. The major difference between TRL 4 and 5 is the increase in the fidelity of the system and environment to the actual application. The system tested is almost prototypical. An example in PV might be the fabrication of devices that closely matches or exceeds the expected efficiency targets but is fabricated in the lab manually with minimal automation as would be necessary in full scale production. *Scientific risk should be retired at the end of TRL 5*. Results presented should be statistically relevant.
6	Engineering/pilot-scale, similar (prototypical) system validation in relevant environment	*Engineering-scale* models or prototypes are tested in a relevant environment. This represents a major step up in a technology's demonstrated readiness. Examples include fabrication of the device on an engineering pilot line. Supporting information includes results from the engineering scale testing and analysis of the differences between the engineering scale, prototypical system/environment, and analysis of what the experimental results mean for the eventual operating system/environment. TRL 6 begins true engineering development of the technology as an operational system. The major difference between TRL 5 and 6 is the *step up from laboratory scale to engineering scale* and the determination of scaling factors that will enable design of the final system. For PV cell or module manufacturing, the system that is referred to is the manufacturing system and not the cell or module. The engineering pilot scale demonstration should be capable of performing all the functions that will be required of a full manufacturing system. The operating environment for the testing should closely represent the actual operating environment. Refinement of the cost model is expected at this stage based on new learnings from the pilot line. *The goal while in TRL 6 is to reduce engineering risk*. Results presented should be statistically relevant.
7	Full-scale, similar (prototypical) system demonstrated in relevant environment	This represents a major step up from TRL 6, requiring demonstration of an actual system prototype in a relevant environment. In the case of a new PV module, this will include a full scale pilot line capable of producing such modules. Examples include manufacturing the PV devices on a *manufacturing pilot line* with operations under primary control of manufacturing. Significant amount of automation is expected at the completion of this phase if the cost model for full scale ramp requires it. *24 hour production* (at least for a relevant duration) is expected to discover any unexpected issues that might occur during scale up and ramp. Supporting information includes results from the full-scale testing and analysis of the differences between the test environment, and

		analysis of what the experimental results mean for the eventual operating system/environment. Final design is virtually complete. The goal of this stage is to *retire engineering and manufacturing risk*. To credibly achieve this goal and exit TRL 7, scale is required as there are many significant engineering and manufacturing issues can surface during the transition between TRL 6 and 7.
8	Actual system completed and qualified through test and demonstration.	The *technology has been proven to work in its final form* and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include full scale volume manufacturing of commercial end product. *True manufacturing costs* will be determined and deltas to models will need to be highlighted and plans developed to address them. Product performance delta to plan needs to be highlighted and plans to *close the gap* will need to be developed.
9	Actual system operations	The technology is in its final form and operated under the full range of operating conditions. Examples include steady state 24/7 *manufacturing meeting cost, yield, and output targets*. Emphasis shifts toward statistical process control.