SAI PV INCUBATOR

Net Conference
March 17, 2008

- Will begin at 9:40 MT for adequate login

- For audio, please dial, 1-888-566-0007,
  Participant Pass code: 9856378
  Conference #: PG9281305

SAI PV INCUBATOR

Basic Information for Conference

- Please do not include your company name in your question
- Please do not include proprietary data or business sensitive information in your question
- In order to provide the most accurate information possible, NREL may elect not to provide a response to a question during the net conference, but will respond to the question as part of the LOI amendment, which will be posted at the following website for all interested parties to review:

www.nrel.gov/business_opportunuties/solicitations_rfps.html

Photovoltaics R&D: DOE Funding Opportunities

PHASES	Material & Device Concepts	Device & Process Proof of Concept	Component Prototype & Pilot Scale Production	System Development & Manufacturing	
SOLICITATION	Solar Energy Utilization	Future Generation PV Devices & Processes	PV Component / System Incubator	University Product & Process Development Support	Technology Pathway Partnerships
FUNDING SOURCE	DOE/O/S, BES	DOE / SETP	DOE / SETP	DOE / SETP	DOE / SETP
DESCRIPTION	New materials and pathways for solar to electric conversion	Novel devices or processes with potentially significant performance or cost advantages	Prototype PV components or systems produced at pilot-scale with demonstrated cost, reliability, or performance advantages	Universities perform targeted materials science and process engineering research in support of industry-led teams developing new PV systems for commercialization in 2010-2015.	PV systems and components ready for mass production delivering energy at target costs
PROJECT LIFECYCLE	3 years	3 years	1.5 years w/ 9 mo. On/Off Ramp	3 Years	3 years
ANNUAL FUNDING LEVEL	$0.3 - 1.5 Million	≤ $300K	$1 - 2 Million	Up to $300,000/year	$2 - 7 Million
TEAM LEADS	Universities or Laboratories*	Businesses or Universities*	U.S. Commercial Entity	Universities	U.S. Commercial Entity
ELIGIBLE PARTICIPANTS	All	All	Universities / Laboratories*	Universities	Universities / Laboratories
ENTRANCE CRITERION	Basic science properties conceived/simulated	Materials synthesized; properties observed	Coupon-scale PV cell; process demonstrated in lab; proof of concept demo	Identification of manufacturing process or component improvements possible through targeted research investigations.	Prototype components; pilot production demo; business case established
EXIT CRITERION	Materials synthesized; properties observed	Coupon-scale PV cell; process demonstrated in lab; proof of concept demo	Prototype components; pilot production demo; business case established	Incorporation of research results into commercial manufacturing operations or product designs.	Commercial PV systems and subsystems; scaled production demonstrated >25MW
TOPICS	• Single-crystal, polycrystalline, amorphous, and nanostructured inorganic and organic materials • Electronic structure • Single or multiple junction solar cells	• New devices and structures using materials such as thin-film silicon, microcrystalline/amorphous silicon, polycrystalline metal chalcogenides and oxides, nanocrystalline materials, biomimetic concepts, organic materials, photoelectrochemical cells, dye-sensitized materials, materials with low-dimensionsal quantum structures • Very-high efficiency epitaxial solar cells or other concepts	• Modules: multiple technologies (including CPV) seeking efficient material use, better performance, or improved manufacturing • BOS Components: higher reliability inverters, CPV trackers, rapid installation features, storage systems • Systems: controls and smart monitoring, integration of components, factory diagnostics	Identifying and developing: • Fabrication processes to improve material properties during manufacture • Improved solar cell materials • Innovative device designs to improve solar cell efficiency • Simpler, lower cost manufacturing processes • New electrical contacting techniques for improved efficiency and reliability • Diagnostic techniques to identify properties and quality of solar cells materials during manufacturing • Improved materials utilization processes • Understanding of chemistry between encapsulants and solar cell materials • Providing careful long-term field testing of modules and systems in support of product improvement	• Partnerships with U.S. industry for projects that focus on development, testing, demonstration, validation, and interconnection of new PV components, systems, and manufacturing equipment • Technology improvements in PV system and component design, integration, and installation will be a focus • Cost reductions, performance enhancements, and reliability improvements are sought for all aspects of PV systems

NOTE: The NREL and SNL teams that are part of the SETP program will continue to provide technical support for these activities through the SETP but will not be direct participants

SAI PV Technology Incubator LOI Key Information

PHASE	Component Prototype & Pilot Scale Production
SOLICITATION	PV Component / System Incubator
FUNDING SOURCE	DOE / SETP
DESCRIPTION	Prototype PV components or systems produced at pilot-scale with demonstrated cost, reliability, or performance advantages
PROJECT LIFECYCLE	1.5 years with 9 mo. On/Off Ramp
ANNUAL FUNDING LEVEL	$1 - 2 Million
TEAM LEADS	U.S. Commercial Entity
ELIGIBLE PARTICIPANTS	Universities / Laboratories*
ENTRANCE CRITERION	Coupon-scale PV cell; process demonstrated in lab; proof of concept demo
EXIT CRITERION	Prototype components; pilot production demo; business case established
TOPICS	• **Modules:** multiple technologies (including CPV) seeking efficient material use, better performance, or improved manufacturing • **BOS Components:** higher reliability inverters, CPV trackers, rapid installation features, storage systems • **Systems:** controls and smart monitoring, integration of components, factory diagnostics

SAI PV Incubator

Funding Source: SETP, Photovoltaics Sub-Program

Opportunity Description:

Research and Development on PV cell and module prototypes with demonstrated functionality in either large-area cell/module form or, preferably, prototypes produced in pilot-scale operations. Address the barriers to entry, with emphasis on 2010 commercialization. Period of Performance for 18 months.

Entrance Criterion: Demonstrated process lab devices or modules. A successful demonstration for the entrance criterion is a quantifiable and verifiable baseline measurement.

Successful Exit Criterion: Prototype modules and >3 MW/YR pilot production demonstration.

NOTE on Entrance/Exit Criteria: companies may be more advanced than the cited entrance criterion, and may seek to be more advanced at the completion of their projects.

SAI PV Incubator: Topics

Topic Areas:

- Novel wafer-based silicon modules
- Polycrystalline thin films
- Film silicon on a foreign substrate
- High-efficiency cells, including multi-junction, and CPV module concepts
- Organic PV, DSSC's, or other polymer-based solar cells
- Low-X concentration CPV systems with limited or 1-axis tracking module designs
- Low-X Si modules, 3-10X

SAI PV Incubator: Mechanism

Letter of Interest (LOI) : Firm Fixed Price Awards: Price Participation

- Deliverables have dollar amount associated to each.

Flexible & Cyclical

- Period of Performance: 18-months
- Exit/entrance every 9-months
- Solicitation open with proposals due every 9-months

Price Participation: 20%

Small Businesses are responders
Small Businesses, Large Businesses, Non-Profits, and Universities can be lower-tier subcontractors.

Award amount: Anticipated NREL funding not to exceed $3.0 million/award over 18 months

Entrance Criteria: PV cell and module prototypes

Website: www.nrel.gov/business_opportunutues/solicitations_rfps.html

Qualitative Merit Criteria for Best Value Selection

- Quality and Relevance of the Proposed Technical Plan (50%)
- Technical Capability of the Responder/Team (20%)
- Quality and Relevance of the Proposed Business Strategy (30%)

LOI Response Requirements for Statement of Work

I. Background

Summary of the proposed project and how it relates and responds to the PV Technology Incubator solicitation's objectives

II. Objectives

Address the technology development pathway for the project over its 18 month duration, includes KPP's, TIO's and Stage Gates, with focus on the 2010 commercialization-plan.

III. Scope of Work – Technical/Task Descriptions

Identify specific activities in this section that are clearly linked to their impact on the identified TIOs and KPPs.

IV. Project Plan

Schedule for each task and subtask activity, as well as a proposed reporting schedule, review schedule, key technical decision point milestones and deliverables.

II. Objectives of SOW

Key Performance Parameters

Metric	Units	Comments
Levelized Cost of Energy (LCOE)	$/kWh	Principle metric that measures degree of competitiveness with conventionally produced electricity
Annual manufacturing capacity	MW/yr	MW of annual subsystem and/or component manufacturing capacity in a given year at the target LCOE cost level. Like LCOE, this is a driving metric for SAI.
Direct manufacturing cost	$/Wp	This is the direct manufacturing cost of a subsystem and/or component that includes materials, labor, equipment depreciation, facilities costs, etc.
PVcomponent performance factor(s)	Unit To Be Determined by Responder	This performance factor(s) should be selected by the TPP to represent the driving contribution to system-level performance that will be provided by the subsystem and/or component they are improving. For example, a module development project might select the "nameplate" rated power output for the module (Wp_{dc}). This factor can be calculated on a daily or annual basis, but daily calculations must be averaged over an operating year. This metric is based on performance only, and does not take into account cost or lifetime issues.
Mean Time Between Failure (MTBF)	Time (hrs)	Expressed as the "average" time between failures for a subsystem and/or component – i.e. the reciprocal of the failure rate in the special case when failure rate is constant.

Objectives of SOW

Stage Gate Example

STAGE GATE REVIEW PLANNING SHEET

Incubator Company:

PI: **Ph:** **E-mail:**

Gate #	Planned Review Date	Criteria (Specific, Measurable, Achievable, Relevant, Timely)	Deliverable	Deliverable Date	How will achieving criteria be demonstrated?
1	9-months from project start	10%, 0.5 sq meter pre-production prototype modules	4 pre-production modules for test	8 months after start	Test results from T&E team
		Manufacturing line design with equipment ordered	Design Report	6 months after start	Report will document design and analysis of cost
		Module packaging design and prototype encapsulated pre-production models	4 pre-production encapsulated modules	5 months after start	Damp heat test
		Report on direct manufacturing cost at scale-up with substantiating equipment acquisition cost and process step times	Report	8 months after start	Report and substantiating documentation evaluated to assess direct mfg cost target achievement

EXAMPLE

Scope of Work – Technical/Project Plan

Technical Improvement Opportunities

TIOs		Metrics			
TIER 1 TIOs	TIER 2 TIOs	Performance Efficiency	Cost	O&M	Reliability
Modules	Module				
	Absorber				
	Cells and Contacts				
	Interconnects				
	Packaging				
	Manufacturing				
Inverter & BOS	Inverter				
	Inverter Software				
	Inverter Components/Design				
	Inverter Packaging/Manufacturing				
	Inverter Integration				
	Other BOS				
Systems Engineering & Integration	System Engr. & Integration				
	System Manufacturing/Assembly				
	Installation & Maintenance				
Deployment Facilitation					

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Responders will focus on Tier 2 (or lower) level TIOs for a single component of the MODULE Tier 1 TIO

Project Plan

Example of Task Plan and Milestones

\ Month Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Task 1	Δ	.....	■	.. .. .	... ..	... ..	.....	... ..	■									
Task 2	Δ	.....	... ..	.. .. .	■	... ..	.....	... ..	■	.....	.... .	.....	.....	.....	.....	.....	.....	■
Task 3									Δ	.....	.... .	.....	.....	■	.....	.....	.....	■
Task 4									Δ	.....	.... .	.....	.....	.....	.....	.....	.....	■
Quarterly Review			▲			▲						▲			▲			▲
Stage Gate Review									*									
Final Review																		♦

* 9-Month Stage Gate Review

■ Decision Point Milestone

▲ Quarterly Review of Milestone and Deliverable Status

Project Plan

Example of Deliverable Schedule

Deliverable	Due Date	% of Subcontract Price
*Task 1, D-1	3rd Month	9% of subcontract
*Task 1, D-2	9th Month	12% of subcontract
*Task 2, D-1	5th Month	14% of subcontract
*Task 2, D-2	9th Month	10% of subcontract
*Task 2, D-3	18th Month	8% of subcontract
*Task 3, D-1	14th Month	11% of subcontract
*Task 3, D-2	18th Month	15% of subcontract
*Task 4, D-1	18th Month	12% of subcontract
**Quarterly Review	3rd Month	1% of subcontract
**Quarterly Review	6th Month	1% of subcontract
**Stage Gate Review	9th Month	3% of subcontract
**Quarterly Review	12th Month	1% of subcontract
**Quarterly Review	15th Month	1% of subcontract
**Final Review	18th Month	2% of subcontract

*Price allocated to % of work effort associated with this deliverable.

**Total of these deliverables must not exceed 10% of the total subcontract

Schedule for Solicitation

- LOI released: March 3, 2008
- Technical Questions Due : March 24, 2008
- Responses due: April 18, 2008
- Responses reviewed: April 25-June 11, 2008
- Selections announced: August 1, 2008,
- Awards made: Late-August, 2008