PMC-EF2a
(2.0.6.02)

U.S. DEPARTMENT OF ENERGY
EERE PROJECT MANAGEMENT CENTER
NEPA DETERMINATION

RECIPIENT: Caelux Corporation **STATE:** CA

PROJECT TITLE : Low-cost, Flexible, Microstructured Solar Cells – Caelux Corporation; NREL Tracking No. 011-022

Funding Opportunity Announcement Number	Procurement Instrument Number	NEPA Control Number	CID Number
		NREL-11-022	GO10337

Based on my review of the information concerning the proposed action, as NEPA Compliance Officer (authorized under DOE Order 451.1A), I have made the following determination:

CX, EA, EIS APPENDIX AND NUMBER:
Description:

A9 Information gathering (including, but not limited to, literature surveys, inventories, audits), data analysis (including computer modeling), document preparation (such as conceptual design or feasibility studies, analytical energy supply and demand studies), and dissemination (including, but not limited to, document mailings, publication, and distribution; and classroom training and informational programs), but not including site characterization or environmental monitoring.

A11 Technical advice and planning assistance to international, national, state, and local organizations.

B3.6 Siting, construction (or modification), operation, and decommissioning of facilities for indoor bench-scale research projects and conventional laboratory operations (for example, preparation of chemical standards and sample analysis); small-scale research and development projects; and small-scale pilot projects (generally less than two years) conducted to verify a concept before demonstration actions. Construction (or modification) will be within or contiguous to an already developed area (where active utilities and currently used roads are readily accessible).

Rational for determination:

The Photovoltaic (PV) Technology Incubator project represents a significant component of the U.S. Department of Energy (DOE) business strategy of partnering with U.S. industry to accelerate the commercialization of photovoltaic system research and development (R&D) to meet aggressive cost and installed capacity goals. This specific partnership leverages technical capabilities and resources within the National Renewable Energy Lab (NREL) and other DOE laboratories/facilities to enhance and support areas of expertise within a small business in order to accelerate the development of the small business's technology. This early-stage assistance in crossing the technological barriers to commercialization also provides a better level of understanding and development on which the investment community can base decisions. Additionally, it will have multiple benefits for the country including reaching cost parity with baseload energy rates, increasing solar PV market share, boosting domestic solar manufacturing, and reducing greenhouse gas emissions.

The proposed subcontract would be for work in the 12-month, Tier 1, PV Technology Incubator. The subcontractor (Caelux) would develop a flexible thin film solar manufacturing process and design that minimizes the amount of semiconducting material used. This has the potential to improve device efficiency, while dramatically reducing PV production costs. The objective of this project would be to research and develop solar cells made from silicon microwire arrays. Process technologies would be developed to enable bench-scale production of prototype materials and solar cells that would be furnished to NREL for testing and verification of project milestones.

Work would be conducted in three tasks over the 12 month period:
• Task 1 – Cell performance research and development to test efficiencies in comparison to wafer-based multicrystalline Si solar cells
• Task 2 – Wafer reprocessing using scalable processing steps to grow a multitude of wire-array solar cells
• Task 3 – Scaled growth to commercially relevant device areas, utilizing scalable reactor technologies

PHASE I – ONSITE OPERATIONS AT EXISTING CALTECH FACILITIES
Caelux would conduct its initial operations, material characterization, and cell testing on the campus of the California Institute of Technology (Caltech) in Pasadena, California, using existing laboratories and bench scale equipment. The proposed work would utilize labs located within the following buildings: Watson, Steele, and Noyes (a map has been uploaded to the PMC database). These operations would not require upgrading or modification of facilities, or the use of chemicals or procedures not already in use at Caltech. All efforts would be performed at the bench/prototype scale, and would not include high-volume commercial production of a product. All operations would be performed indoors, and work would be completed using industry standard methods and protocols, and in accordance with all federal, state, and local regulations. Work is expected to occur from mid 2011 through mid 2012.

Caltech has extensive safety protocols in place to cover the diverse range of research performed in its labs. Caltech facilities employ alarms, gas cabinets, interlocks, and scrubbers for handling hazardous gasses and gaseous waste. Fume hoods are used for handling all hazardous chemicals. All labs are equipped with standard personal protective equipment including gloves, aprons, goggles, and masks, as well as specific equipment for unique hazards. Each lab has emergency provisions including showers, eye wash stations, chemical first aid, auxiliary lighting, etc. These procedures are administered by the Safety Office (http://safety.caltech.edu/), which provides campus-wide manuals, consultation, training, evaluations, inspections, protective equipment, waste management, incident response, and other safety services. Furthermore, each campus division mandates specific safety training, protocols, and protective equipment relating to the hazards encountered its labs. Caelux would utilize facilities in the division of Chemistry & Chemical Engineering (CCE) and Engineering & Applied Sciences (EAS). Finally, the safety of each lab is overseen by a Safety Officer, a lab employee appointed by the Safety Office, who provides and enforces the specific safety protocols for each user/process/equipment. Caelux employees using Caltech facilities would comply with all protocols and training requirements.
Potential gaseous waste streams would include gaseous hydrochloric acid and un-reacted gaseous precursors (silicon tetrachloride, dilute phosphine, dilute boron trichloride, ammonia, or silane). These gaseous waste streams would be processed through gas abatement systems (i.e., a sodium-hydroxide liquid gas scrubber system, a dry bed absorber system, or a burn box/scrubber system) to prevent the release of hazardous gases into the environment. When saturated, brine solution would be collected and stored for pick-up by a licensed hazardous waste collection/disposal service; or gas collection cartridges would be shipped to the manufacturer for processing/refilling; or automated, ventilated gas cabinets would be used to prevent inadvertent release of source gasses to the environment.

Any waste products (e.g., HCl condensation, scale formation) would be collected, segregated by waste class, stored, and disposed in accordance with established policies and procedures. Non-hazardous liquid effluent will be discharged to the sanitary sewer system if permissible by state and local regulations. Chemicals would be handled, stored, and disposed in accordance with OSHA requirements, environmental regulations, and other applicable federal, state, and local code. A list of anticipated chemicals, amount to be used, and amount to be stored is provided on the R&D Laboratories Questionnaire (uploaded to the PMC database). The same procedures would apply to work performed both at Caltech as well as any off-campus work (See Phase II below).

All hazardous chemical waste would be collected, separated by hazard class, stored (with secondary containment enclosures), and disposed of through a licensed hazardous waste pick-up/disposal service (Clean Harbors). Caltech maintains permits as necessary for the operation of a research university within the city of Pasadena. Its EPA identification number for the handling of hazardous waste is CAD009584210. The proposed work would not introduce new processes, equipment, or chemicals to the Caltech labs; thus, no new permits would be necessary at Caltech.

PHASE II – OFFSITE OPERATIONS AT OFF-CAMPUS LEASED SPACE
As efforts would progress to consider larger-area solar cells and to use higher-volume process technologies (e.g., larger reactors), lab/office space would be leased near Caltech to house and operate the larger equipment. While this location has not yet been selected, nearby locations currently under consideration range from 3,000–10,000 square feet, and are located in technology parks amongst suites of companies conducting similar-scale research and development. Scaled Si wire-array growth and processing would be done at the selected location. Employees and business operations would also be based at this off-campus location.

Upon leasing an off-campus location, Caelux would establish its own corporate safety policies, based primarily on the relevant portions of Caltech safety policy, and would publish its safety policies for employee access. A specific employee would perform duties of the Safety Officer, including training and audits. OSHA standards would be followed. All proper laboratory safety equipment would be installed (if not already present) at the leased off-campus location.

Permits may be necessary if an off-campus facility is established, but specific permit requirements are not known at this point. Gas abatement technologies would be used for any reactor(s) that may be installed at Caelux's proposed off-campus facility, to ensure that (a) no airborne hazardous materials are released into the environment, and (b) no captured hazardous waste is disposed of onsite. Caelux would use a licensed hazardous waste hauler and an offsite properly permitted disposal facility.

This proposed project would result minimal increases of hazardous waste generation, hazardous material utilization, and de minimis air emissions. Based on the information above, this Phase I of the proposed action would qualify for Categorical Exclusions A9, A11, and B3.6. DOE does not authorize federal funds for the off-campus lease acquisition, equipment procurement, facility infrastructure modification, or laboratory operation (Phase II) until a subsequent NEPA determination is made for the proposed off-campus leased space. The contractor must submit the proper documentation once a specific off-campus property is proposed.

NEPA PROVISION

DOE has made a conditional NEPA determination for this award, and funding for certain tasks under this award is contingent upon the final NEPA determination.

Insert the following language in the award:

You are restricted from taking any action using federal funds, which would have an adverse affect on the environment or limit the choice of reasonable alternatives prior to DOE/NNSA providing either a NEPA clearance or a final NEPA decision regarding the project.

Prohibited actions include:
All proposed Phase II activities are prohibited including off-campus lease acquisition, equipment procurement, facility infrastructure modification, and off-campus laboratory operation until a subsequent NEPA determination is made for the proposed off-campus leased lab space.
This restriction does not preclude you from:
All proposed Phase I activities at Caltech utilizing existing laboratories, equipment, and processes described above.
If you move forward with activities that are not authorized for federal funding by the DOE Contracting Officer in advance of the final NEPA decision, you are doing so at risk of not receiving federal funding and such costs may not be recognized as allowable cost share.

Note to Specialist :

EF2a prepared by Rob Smith on 05/09/2011.

SIGNATURE OF THIS MEMORANDUM CONSTITUTES A RECORD OF THIS DECISION.

NEPA Compliance Officer Signature: Lori Plummer / Lori Plummer Date: 5/11/2011
NEPA Compliance Officer

FIELD OFFICE MANAGER DETERMINATION

☐ Field Office Manager review required

NCO REQUESTS THE FIELD OFFICE MANAGER REVIEW FOR THE FOLLOWING REASON:

☐ Proposed action fits within a categorical exclusion but involves a high profile or controversial issue that warrants Field Office Manager's attention.
☐ Proposed action falls within an EA or EIS category and therefore requires Field Office Manager's review and determination.

BASED ON MY REVIEW I CONCUR WITH THE DETERMINATION OF THE NCO :

Field Office Manager's Signature: _____ Date: _____
Field Office Manager