

PMC-ND

(1.08.09.13)

U.S. DEPARTMENT OF ENERGY
OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY
NEPA DETERMINATION

**RECIPIENT:** Washington State University**STATE:** WA

PROJECT TITLE Developing a low cost, high volume and scalable manufacturing technology for undoped and heavily p-type doped CdTe feedstock materials

Funding Opportunity Announcement Number	Procurement Instrument Number	NEPA Control Number	CID Number
DE-FOA-0001387	DE-EE-0007537	GFO-0007537-001	

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, analysis, and dissemination** Information gathering (including, but not limited to, literature surveys, inventories, site visits, and audits), data analysis (including, but not limited to, computer modeling), document preparation (including, but not limited to, conceptual design, feasibility studies, and analytical energy supply and demand studies), and information dissemination (including, but not limited to, document publication and distribution, and classroom training and informational programs), but not including site characterization or environmental monitoring. (See also B3.1 of appendix B to this subpart.)
- B3.6 Small-scale research and development, laboratory operations, and pilot projects** Siting, construction, modification, operation, and decommissioning of facilities for smallscale research and development projects; conventional laboratory operations (such as preparation of chemical standards and sample analysis); and small-scale pilot projects (generally less than 2 years) frequently conducted to verify a concept before demonstration actions, provided that construction or modification would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible). Not included in this category are demonstration actions, meaning actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment.

Rationale for determination:

The U.S. Department of Energy (DOE) is proposing to provide funding to Washington State University (WSU) to develop a CdTe synthesis and growth process that yields improved semi-conductor crystals for the solar industry. The proposed project would use cadmium and telluride for the crystal material, which would be alloyed with controlled concentrations of phosphorus ("p-type doping"). After purity and defect characterization, the better crystals would be used to fabricate solar cells and evaluated for efficiency at the National Renewable Energy Laboratory (NREL).

The proposed activities during Year 1 would include growth of CdTe:P semiconductor crystals in existing Modified Vertical Bridgman (MVB) furnaces at WSU in Pullman WA, followed by characterization of the materials using thermoelectric effect spectroscopy (TEES), resistivity and hole density (Hall/CV), infrared microscopy (IR), X-ray fluorescence (XRF), and Glow Discharge Mass Spectrometry (GDMS). Chemical analyses would be undertaken at WSU. MVB grown feedstock would be used to fabricate thin films at WSU and NREL, and materials with the best electronic properties would be used to fabricate solar cells at NREL. Additionally, in preparation for activities that would take place during Years 2 and 3, the proposed project would involve reconfiguration of existing High Pressure Bridgman (HPB) furnaces both at WSU and at the dedicated research facility of subrecipient Nious Technologies, Inc. in Wexford PA.

The proposed activities during Years 2 and 3 would involve HPB growth in the upgraded furnaces with the intention of ultimately scaling up boule size from 1.5 to >15 kg, in addition to increasing the doping density. The HPB grown material would be subject to purity and defect characterization (TEES, Hall, CV, IR, XRF) and provided to NREL for device fabrication and characterization. It is expected that after transitioning from MVB to HPB several growth iterations would be necessary to control and obtain desired stoichiometry before scaling up the doped boule size. The end product would be large crystals of CdTe (up to 8 inches in diameter) used to deposit polycrystalline devices in a traditional superstrate structure by closed spaced sublimation (CSS) and vapour transfer deposition (VTD) at NREL.

The facilities in which crystal growth and solar cell research would occur are purpose-built for the type of activities being proposed. Although existing furnaces at WSU and Nious would require upgrades for the HPB feedstock growth proposed by this project, no change in the use or mission of these facilities would arise out of this effort, no ground disturbing activities would occur, and no new permits, licenses, or authorizations would be required to perform project activities. Further, growth furnaces only emit heat (no ambient air emissions).

The proposed project would involve the handling and disposal of cadmium and telluride plus doping elements. This is standard for crystal growth facilities at WSU, which operate under WSU Environmental Services review and compliance. Nious Technologies, Inc. is a private company with a record of successful crystal growth and safety, and would use an approved hazardous waste contractor. Minor amounts of electrical contact materials and substrate materials common in solar cells would be used at NREL and disposed of per their established laboratory procedures.

Any work proposed to be conducted at a DOE laboratory may be subject to additional NEPA review by the cognizant DOE NEPA Compliance Officer for the specific DOE laboratory prior to initiating such work. Further, any work conducted at a DOE laboratory must meet the laboratory's health and safety requirements.

Based on the review of the proposal, DOE has determined the proposal fits within the class of action(s) and the integral elements of 10 CFR 1021 subpart B outlined in the DOE categorical exclusion(s) selected above. DOE has also determined that: (1) there are no extraordinary circumstances (as defined by 10 CFR 1021.410(2)) related to the proposal that may affect the significance of the environmental effects of the proposal; (2) the proposal has not been segmented to meet the definition of a categorical exclusion; and (3) the proposal is not connected to other actions with potentially significant impacts, related to other proposals with cumulatively significant actions, or an improper interim action. This proposal is categorically excluded from further NEPA review.

NEPA PROVISION

DOE has made a final NEPA determination for this award

Insert the following language in the award:

If the Recipient intends to make changes to the scope or objective of this project, the Recipient is required to contact the Project Officer, identified in Block 15 of the Assistance Agreement before proceeding. The Recipient must receive notification of approval from the DOE Contracting Officer prior to commencing with work beyond that currently approved. If the Recipient moves forward with activities that are not authorized for Federal funding by the DOE Contracting Officer in advance of a final NEPA decision, the Recipient is doing so at risk of not receiving Federal funding and such costs may not be recognized as allowable cost share.

Insert the following language in the award:

You are required to:

Any work proposed to be conducted at a DOE laboratory may be subject to additional NEPA review by the cognizant DOE NEPA Compliance Officer for the specific DOE laboratory prior to initiating such work. Further, any work conducted at a DOE laboratory must meet the laboratory's health and safety requirements.

Note to Specialist :

Solar Energy Technologies Office

This NEPA determination requires a tailored NEPA provision.

Review completed by Whitney Doss on 08/01/2016.

SIGNATURE OF THIS MEMORANDUM CONSTITUTES A RECORD OF THIS DECISION.

NEPA Compliance Officer Signature:

Electronically
Signed By: Kristin Kerwin

NEPA Compliance Officer

Date: 8/1/2016

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:

Field Office Manager

Date: