Stock, Pete A.

From: Wood, Nicole [Nicole_Wood@LORD.COM]
Sent: Tuesday, August 25, 2009 2:18 PM
To: 'otfpv2010@development.ohio.gov'
Cc: Stock, Pete A.
Subject: 2010 OTFPVP LOI

Good afternoon, Mr. Stock:

Please accept my apologies for sending in the Appendix C documents. I misread the information in Section 1.3.3. Please advise if the information below satisfies the needs of the LOI.

Thank you for your consideration,
Nicole Wood

LORD Corporation
4644 Wadsworth Road
Dayton, OH 45414

Contact: Nicole Wood
Phone: 919 468 5979 x6327
Email: nicole.wood@lord.com

Project Title: Development and Coordination of a Jettable, Highly-Conductive Flexible Ink

Estimated Grant Funds Requested: $1MM

No known collaborators

To improve the efficiency of flexible solar cells and reduce the overall cost structure, we are developing a jettable, highly-conductive ink that can be applied to flexible surfaces.

PVP 401

2010 OTFPVP LOI

Lead Applicant Name:	Crown Battery Manufacturing Company, Inc.
Address:	1445 Majestic Drive Fremont, Ohio 43420
Phone Number:	(419) 334-7181
Contact Person:	Hal Hawk, President and CEO
Contact e-mail address:	hhawk@crownbattery.com
Project Title:	Optimized One Megawatt Energy Storage System for The University of Toledo Scott Campus Solar Array
Estimated Grant Funding Request:	$750,000
Known Collaborators:	The University of Toledo, Toledo, Ohio Juice Technologies, Columbus, Ohio Energystics Technologies Holdings, Sylvania, Ohio

PVP402

Project Summary

Crown Battery Manufacturing Company proposes a project to supply one megawatt of electric storage in support of the 1.2 megawatt solar array that is being built at The University of Toledo Campus of Energy and Innovation at Scott Park. Crown will build a system that uses battery and storage technologies that will be utilized for direct power usage on the campus and research into solar energy storage by the university.

Crown will collaborate with the University of Toledo Engineering Department Battery Research Team to develop a storage solution for the solar array that can be installed by 2011. From the initial installation there would be research on overall solar energy storage and specific system improvements that result from the efforts of members of both staffs. This project will result in solar energy powering the campus by 2011 and provide a platform for onsite research for world class solar energy storage solutions.

A second collaborator on this project is Juice Technologies. Juice Technologies is the consulting firm that The University of Toledo has contracted to assist in the transformation of the Scott Park campus to transition to the Campus of Energy and Innovation. Juice Technologies will help to facilitate in the execution of the storage system as an integrated solution that supports all the efforts of the University of Toledo and the objectives of the Energy and Innovation Campus.

It is our intention to work with Emerson Network Power in order to provide the control system for the project. Emerson is a world class manufacturer of energy controls with a very significant footprint in solar energy systems. Emerson Network Power is based in Columbus, Ohio.

Because of their cost per energy unit stored, recyclability, reliability, safety and availability; lead acid batteries are held to be an enabling technology for solar energy. Crown Battery would provide an advanced form of lead acid battery for this project. The third collaborator on the project is Energystics Technologies Holdings Inc. of Sylvania, Ohio. Energystics has been working with Crown and helped to develop a significantly higher output battery through improvements in plate, paste & process. The resulting advanced form of lead acid battery would be used in this project.

The funds from this grant will be used to help fund the building of the storage system for the solar array at The University of Toledo's Campus of Energy and Innovation at Scott Park. The benefit of the project will be renewable energy powering The University of Toledo plus knowledge and products created through research completed in support of the creation and maintenance of the project.

PVP 402

focus

August 25, 2009

Ohio Third Frontier
Photovoltaics Program

Project Title: "Low-Cost Low-Concentration Photovoltaic System"
Estimated Grant Funds: $6M
Known Collaborators: EFOI, OSU, Replex Plastics

To whom it may concern:

We at Energy Focus, Inc (EFOI) are pleased to submit a letter of intent in response to your FY 2010 solicitation. Energy Focus, Inc. is a technology oriented company producing innovative energy efficient products. We are a small business and have several successes in Federal Government funding. We have competed for and won Small Business Innovative Research awards from the Department of Energy, the Defense Advanced Research Projects Agency (DARPA) and the US Army. Additionally, built relationships within other agencies such as Naval Sea Systems Command (NAVSEA) where we sold products developed through the government funded projects. We will be submitting a proposal entitled, "Low-Cost Low-Concentration Photovoltaic System." The following is an overview of the proposal:

Summary

A low concentration (2x - 10x) Photovoltaic System will be developed and manufactured in Ohio. The system will take advantage of the low-accuracy pointing requirement of low optical concentration but still achieve high efficiency by employing III-V junctions manufactured on low-cost silicon substrates. The optical design work and system integration will be performed by the project lead, EFOI. The low-cost concentrator fabrication and supporting design structures will be created by Replex Plastics. The advanced low-cost III-V devices on Silicon substrates will be developed at the Ohio State University (OSU) Institute for Materials Research. The Team will employ the advanced facilities and staff of the OSU Nanotech West microfabrication center to help with the development of advanced, durable, optical thin-film coatings. We anticipate requesting $6M in grant funding for this effort.

We look forward to working with your organization.

Sincerely,

Laszlo Takacs

Laszlo Takacs
Energy Focus, Inc
Director or Research and Development
440-715-1288
ltakacs@efoi.com

PVP 403

32000 Aurora Road Solon, Ohio 44139
Tel (800) 327-7877 Fax (440) 715-1014

THIRD MILLENNIUM METALS, LLC

110 E. EMMITT AVENUE, WAVERLY, OHIO 45690

August 26, 2009

OTFPVP2010@development.ohio.gov

The Ohio Department of Development
Technology and Innovation Division
77 South High Street, 25th Floor
Columbus, OH 43215

Re: "2010 OTFPVP2010 LOI"

Dear Administration,

This letter signifies the intent of TMM to submit a proposal for the above referenced RFP.

The lead applicant will be:

Third Millennium Metals, LLC
Jason Shugart, President
110 E. Emmitt Avenue
Waverly, Ohio 45690
Tel: 740-947-7277
Email: jshugart@tmmetals.com

Project Title: "Corrosion resistant copper for photovoltaic panel production"

Estimated Grant funds: $2,000,000 ($1,000,000.00 capital)

Known Collaborators: University of Toledo
North Central Campus for Emerging Technologies

Project summary: Third Millennium Metals, LLC (TMM) has developed a new process to introduce carbon into copper in quantities not previously understood to make a Copper Nanocarbon Metal (NCM) material. The Cu NCM shows enhanced corrosion resistance and excellent oxidation resistance. The University of Toledo is currently studying the oxidation resistance of the NCMs to replace the gold currently used in photovoltaics production. TMM intends to build a pilot production plant in Findlay, Ohio to produce NCMs for the photovoltaic market. TMM intends to collaborate with a yet to be determined photovoltaic manufacturer.

Best regards,

/s/ *Louis A. Luedtke*

Louis A Luedtke, CEO
Third Millennium Metals, LLC

PVP 404

Low Cost, Mass Producible Concentrated PV Design

Lead Applicant: GreenField Solar Corp.

Address:
7881 Root Rd
North Ridgeville, OH 44039

Telephone: 216-535-9200

Contact Person: Mico Perales
Email address: mico.perales@greenfieldsolar.com

Project Title: Low Cost, Mass Producible Concentrated PV Design

Est. Grant Funds Requested: $1,000,000

Known Collaborators:

- The Edison Materials Technology Center (EMTEC)
- Center for Photovoltaics Innovation and Commercialization (PVIC) in conjunction with Ohio State and University of Toledo

PVP 405

Low Cost, Mass Producible Concentrated PV Design

Summary of Proposed Project

GreenField Solar Corp (GreenField), Ohio's only producer of concentrated photovoltaic (CPV) solar energy systems, which produce electricity as well as thermal energy for the utility scale market, is submitting this proposal for consideration. Our unique CPV system, the StarGen™ 100, incorporates our proprietary high performance PhotoVolt™ solar cells, and has achieved proven technical viability and market acceptance. GreenField is positioned to significantly enhance Ohio's growing portfolio of companies within the solar energy industry, and completion of this proposal will align our product's costs with mass market acceptance. We are in the process of deploying StarGen™ 100 test and demonstration units across Ohio, including NASA, the City of Mentor, Duke Energy, and AEP. While these projects have demonstrated the viability of our technology, they are a first generation design, and we must now reduce the system costs to meet mass-market pricing requirements. Our Third Frontier project proposes a cost and manufacturability redesign effort of our StarGen™ system, with the goal to reduce total installed system price to $3.00 per peak watt, which would establish global price leadership. In addition, we seek to identify qualified Ohio based manufacturing companies that cost effectively produce component parts that will be assembled into the next generation StarGen™ CPV system, establishing a strong supply chain within the State, which leverages Ohio's legacy of strength in traditional manufacturing.

Once our cost reduction effort is complete, we will demonstrate the performance of the next generation StarGen™ system at committed end user sites. Over the course of the project, we will monitor and measure performance, gathering data critical to selling the systems into the utility-scale and large commercial mass market. Finally, we will secure global product certification, so that at the completion of our two year Third Frontier project, our systems will have achieved: (a) our target price point, (b) and the field validation and system certification required to sell product into the global solar energy market.

Together with our collaborators, we will design, deploy, validate, and certify our next generation StarGen™ systems, introducing the product as a fully commercialized product, while establishing a vibrant Ohio supply chain, strengthening the Ohio economy.

PVP 405

Ohio Third Frontier Photovoltaic Program Letter of Intent

August 25, 2009

Lead Applicant:

Joseph Edghill
Leading Edge Coating Solutions *
208 Glenhurst Court
Gahanna, OH 43230
614-562-2170
Jedghill@ledgecs.com
www.ledgecs.com

*Please note: a new corporation will be formed around this project. It will likely be called Centurus Innovations, LLC.

Project Title: Thin-film PVDF for Photovoltaics

Estimated Grant Funds being requested: $1 million

Collaborators:

1. Joseph Edghill, founder of Leading Edge Coating Solutions, holds a Bachelor of Chemical Engineering degree from City College of New York and an M.B.A. from Capital University, Columbus Ohio. He has worked at Procter & Gamble, and has been employed in the specialty chemicals and coatings industries since 1982. Before starting Leading Edge Coating Solutions in 2007 he worked for 10 years in technical sales at Stahl USA, a manufacturer of polyurethane resins and finishes, serving a variety of flexible-substrate markets. Mr. Edghill will be the project lead and will handle sales, marketing and general management.

2. Hugh Barrett, the President of Stratford Labs International, is a consultant, inventor and entrepreneur specializing in research and development of specialty coatings, polymers, resins and adhesives for the flexible vinyl and other industries. Prior to starting SLI in 1999 he worked at Polyplastex International where he served as the FAA's Designated Engineering Representative responsible for flammability testing. Prior to that he served as Plant Manager for the Proto Corporation where he developed extensive expertise in film and sheet extrusion. Mr. Barrett will be responsible for all technical activities.

3. Paul Roe holds a B.S. in chemistry from Bradley University. He is currently employed as Technical Director at CMI Automotive Inc, Elkhart, IN. He has worked at Polyplastex, Columbus Coated Fabrics, Sandusky Vinyl, Duracote Corporation, Uniroyal Engineered Products in a variety of technical roles. He is an accomplished expert on laminating, coating and the manufacture of all kinds of specialty PVC-coated textiles for automotive and commercial applications. He holds two patents and has co-authored three publications. Paul has collaborated with Hugh Barrett on a variety of successful projects. He will carry both sales and technical responsibilities.

4. Richard Fetter currently serves as acting provost at Butler University, Indianapolis, IN. He is a partner and treasurer of Morral Chemical Company. He is a CPA and holds an MBA in marketing and finance and a PhD in Marketing from Indiana University. He has also served as Associate Professor and Dean of the College of Business at Butler University, Indianapolis IN. Dr. Fetter also owns an equity share of Tillery Capital Inc., a private equity firm, and has consulted with Ashland Chemical,

PVP 406

Eli Lilly and Conner Prairie. He will provide equity funding for the venture and serve in a business consulting role.

Project Summary:

PVDF, polyvinylidene fluoride, is a non-reactive thermoplastic fluoropolymer that is supplied in dry form under various trade names: KYNAR® or HYLAR®. PVDF is a specialty fluoropolymer that is typically used in applications requiring the highest purity, strength, and resistance to solvents, acids, bases and heat and low smoke generation during a fire. Compared to other fluoropolymers, PVDF has a relatively low melting point of around 177°C, a low density (1.78) and lower cost. It is available as piping products, sheet, tubing, films, plate and as a wire insulator. It can be injected, molded or welded and is commonly used in the chemical, semiconductor, medical and defense industries, as well as in lithium ion batteries (also a potential target market). Fine powdered grades of PVDF are also used as the principal ingredient of high-end paints for metals and other rigid architectural surfaces. These paints have extremely good gloss and color retention, and they are in use on many prominent buildings around the world as well as on commercial and residential metal roofing. PVDF is the polymer of choice for 50-year architectural panels where it is usually baked or fused onto the metallic substrate. Other characteristics of PVDF finishes are outstanding resistance to humidity, color change, chalking, gloss shift and chemical attack.

Tedlar ® (PVF) is a similar fluoropolymer to PVDF which is produced by DuPont and is widely used in solar panels as back and front-sheet films. The photovoltaic market will continue to grow because of the spiraling demand for clean energy and DuPont has initiated capacity increases for Tedlar ® to meet this anticipated demand. PVDF films are a viable substitute for Tedlar ® for photovoltaic applications.

Our search for a Tedlar ® replacement film began fifteen years ago when we performed extensive studies on how to manufacture PVDF films by a blown-film extrusion process. We managed to produce films as thin as 0.2 mils but the process proved technically unworkable and the project was abandoned. Building on this experience, our team has recently developed a process for producing PVDF film that can run on commercially available PVC plastisol coating lines and which will afford us the flexibility to produce pure or composite PVDF films that will compete successfully with Tedlar ®.

The goal of this project is to launch and build a venture to produce PVDF thin-films (2.0 mils or less) targeted to the photovoltaic segment where the market potential is excellent and growing.

Following is a summary of the key elements of this venture:

- We are starting a review of the patentability of the process.
- We are starting to capitalize the pilot phase of the project which will demonstrate our capability to produce films at pilot plant and full commercial widths. A toll manufacturer has already been indentified to assist in this phase which we estimate will take about six months.
- During this pilot phase we will also be seeking collaborators to assist in refining our product entries and marketing strategy.
- Once we scale up the process we will have the option of outsourcing the manufacturing to our toll partner or building or acquiring our own production facility. This will considerably speed up our time to market. We believe it is realistic to be selling products into the PV and other segments within a year.
- We believe our technical team has the know how to be much more than a "me-too" entry in this segment but to be an innovator in PVDF-composite films.
- It is important to note that several other markets for PVDF thin films already exist, but photovoltaic represents the most promising segment. We estimate DuPont ® will sell $250 to $500 million of Tedlar ® in 2010 into the PV segment alone, and this segment is expected to grow at a rate of 50 percent over the next several years. With a conservative market share

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estimate of 10 percent it is realistic to project potential revenues of $25 to $50 million within five years.

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Ohio Third Frontier Photovoltaics Program

2010 Request for Proposals

Application Information Page

Letter of Intent (LOI) Notification Number (Issued by ODOD)			**LOI #: OTFPVP 10-_____**	
This Application:	☐ Does ☒ Does Not	include information considered a "trade secret" under Ohio Revised Code Section 1333.61 (D)		
Lead Applicant Name	**GLOVON & CLOVON ENGINEERING CONSULTING, LLC.**			
Lead Applicant Address	**10979 Reed Hartman Highway, Suite 331D**			
	City:	**Cincinnati**	**Ohio County:**	Hamilton
	State:	**Ohio**	**Zip Code:**	**45242**
Project Title:	Critical Load Modular Solar System Manufacturing Plant in Ohio			
State Funds:	OTFRDF$	Wright$	Total$	**Cost Share:** $1,000.000
Is the Lead Applicant the lead in any other proposal submitted under this RFP?			☐ Yes	☒ No
If yes, provide the Other Project Title/LOI #:				

Uche Agomuo — President & CEO

Typed Name of Authorizing Agent — Title of Authorizing Agent

August 24, 2009

Signature — Date

For ODOD Use Only

Date Received — Proposal ID #

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Ohio Third Frontier Photovoltaics Program
Lead Applicant Contact Information

Authorizing Agent	Name	Uche Agomuo		
	Title	President & CEO		
	Organization	Glovon & Clovon Engineering Consulting, LLC.		
	Address	10979 Reed Hartman Highway, Suite 331D		
	City, State, Zip	Cincinnati, Ohio, 45242		
	Telephone	513-745-0186	Fax	513-201-3020
	E-Mail	uagomuo@gncenger.com		
Project Director	Name	Uche Agomuo		
	Title	President & CEO		
	Organization	Glovon & Clovon Engineering Consulting, LLC.		
	Address	10979 Reed Hartman Highway, Suite 331D		
	City, State, Zip	Cincinnati, Ohio, 45242		
	Telephone	513-745-0186	Fax	513-201-3020
	E-Mail	uagomuo@gncenger.com		
Fiscal Agent	Name	Steve Taylor		
	Title	Sr. VP Engineering		
	Organization	Glovon & Clovon Engineering Consulting, LLC.		
	Address	10979 Reed Hartman Highway, Suite 331D		
	City, State, Zip	Cincinnati, Ohio, 45242		
	Telephone	513-382-0100	Fax	513-201-3020
	E-Mail	staylor@gncengr.com		
Grant Administrator	Name	Uche Agomuo		
	Title	President & CEO		
	Organization	Glovon & Clovon Engineering Consulting, LLC.		
	Address	10979 Reed Hartman Highway, Suite 331D		
	City, State, Zip	Cincinnati, Ohio, 45242		
	Telephone	513-745-0186	Fax	513-201-3020
	E-Mail	uagomuo@gncenger.com		

Authorizing Agent – the individual authorized by the Lead Applicant to accept the terms and conditions of an award of Grant Funds.
Project Director – the individual authorized by the Lead Applicant to direct the Project for which the Grant Funds have been awarded.
Fiscal Agent – the individual authorized by the Lead Applicant to sign Grant-related financial documents, *e.g.*, Requests for Payment, Grant financial reports, *etc.*

PVP407

Ohio Third Frontier Photovoltaics Program
Collaborator Information

Attach additional forms as needed.

Name	Lawrence W. Feist		
Title	Program Chair, Energy Efficiency & Renewable Energy Center for Innovation Technologies.		
Organization	Cincinnati State Technical & Community College		
Address	3520 Central Parkway		
City, State, Zip	Cincinnati, Ohio, 45223-2690		
Telephone	513-569-1428	Fax	513-569-4689
E-Mail	Larry.feist@cincinnatistate.edu		

Name			
Title			
Organization			
Address			
City, State, Zip			
Telephone		Fax	
E-Mail			

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E-Mail			

PVP407

Glovon & Clovon Engineering Consulting, LLC

"Evolving Engineering, Manufacturing & Energy solutions around the globe"

CRITICAL LOAD MODULAR SOLAR SYSTEM MANUFACTURING PLANT IN OHIO

Project Description:
Build a manufacturing plant in Southwest Ohio for a plug-n-play solar critical load module for various applications from commercial applications to residential, emergency power, backup power, developing countries, institutions, out doors, etc. This is a self contained, portable solar power unit with varying loads from 100 watts to 1mw depending on the application and load sizes.

Business Opportunity:
Innovating and portable electricity that is plug-n-play for emergency power during hurricane, or backup for homes, quick install for homes and institutions, developing countries, powering specific appliances. The major components will all be manufactured in Ohio and this will create employment for the local community.

Learning Plan:
We estimate a three to six months feasibility and design phase, including equipment, facilities, power and controls, prototypes and concepts, and to determine pipeline building potential.

Deliverables

a) A consumer-validated business model. An Options Analysis (equipment specification, number of SKUs, raw material suppliers, manufacturing process, manufacturing facility, warehousing, showrooms and total supply chain), with volume 'impacts' (validated with quantitative consumer research), attractive economics, and a saleable consumer proposition.

b) A time-phased plan with options to deliver on all project success measures on the fastest possible timing. Given the challenge for urgency and the need to create an attractive and sustainable business model with minimal investment, the project will identify plans for two phases.

Customers:

1. Residential customer
2. Commercial buildings and businesses
3. Utility companies
4. Government agencies
5. Developing country
6. Institutions

Uche Agomuo

10979 Reed Hartman Highway, Suite 331 D, Cincinnati, Ohio 45242

Phone: 513-745-0186

E-mail: uagomuo@gncengr.com

PVP 407

Letter of Intent
2010 Ohio Third Frontier Photovoltaic Program

Lead Applicant: Akron Polymer Systems, Inc.
2990 Gilchrist Rd. Akron, Ohio 44305
Phone: (330) 794-6359
Fax: (330) 794-6241

Contact Person: Dr. Matt Graham
mgraham@akronpolysys.com

Project Title: Polymeric Films for the Fabrication of Flexible Photovoltaic Panels

Estimated Grant Funds Requested: $750,000

Known Collaborators: The University of Akron
Prof. Miko Cakmak
Department of Polymer Engineering

PVP 408

Project Summary:

This Ohio OTFPVP project is to commercialize a flexible, transparent (> 85% from 400nm to 800nm), high glass transition temperature (Tg > 390°C), and high degradation temperature (T_d > 450°C) film that can be utilized as a substrate or superstrate for the fabrication of flexible photovoltaic devices. This project will involve Akron Polymer Systems (APS) and Prof. Miko Cakmak of The University of Akron Department of Polymer Engineering who have complementary areas of technical expertise.

The key issues to market acceptance of certain PV products are module cost, installation cost, system performance, reliability, and durability. For these reasons, commercial rooftops are the most frequent application of PVs because commercial customers have longer payback periods than residential customers, and per unit installation costs decrease with increasing installation size. Since many large commercial roofs cannot support heavy glass substrate based panels, lightweight and flexible products are particularly competitive. Additionally, flexible PVs can be produced in roll-to-roll manufacturing processes which allow for reduced production costs, radical design freedom and new applications for PVs. The development of a flexible, transparent, thermally stable film provides an opportunity for Ohio to have greater participation in the growing flexible PV market.

PV cells based on CdTe technology are fabricated in a superstrate configuration which requires the base layer be transparent and able to withstand high temperature processing (>390°C). For both flexibility and transparency, a polymer substrate is needed. It has proven difficult to obtain a polymer film with properties that sufficiently match the thermal and optical properties of glass plate. For example, polyethylene naphthalate (PEN) films are highly transparent and have a relatively low CTE (<20 ppm/°C). However, this material can only be processed below 180°C. Poly(cycloolefin) (COP) films have excellent transparency, high thermal stability (Tg> 300°C), but the thermal stability is still not sufficient and the CTE of these films is large (>70 ppm/°C) for PV applications. The outstanding thermal properties of polyimides make them natural candidates for substrates. Two commercial polyimide films, Kapton of Dupont Co (USA) and Upilex of Ube Co (Japan) have sufficiently high Tgs, but the films are dark orange, dramatically limiting the potential efficiency of the final cell. Using specifically designed monomers highly transparent polyimide films have been prepared, but to date no commercially available transparent film has been prepared with a sufficiently high Tg.

This project is aimed at commercializing a polymeric material that has been developed by APS which meets the optical and thermal property requirements necessary for use as a CdTe PV superstrate. The main focus will be the scale of and processing of these materials. Prof. Cakmak of The University of Akron has expertise in polymer film casting and the equipment necessary to understand the structure-processing relationships of these materials which will accelerate the processing scale-up of this product. The proposed technology commercialization activities include: (1) synthesis and processing scale-up (e.g., to construct the pilot-scale systems for the synthesis of the substrate material and develop the processing conditions); (2) market validation and expansion (e.g., to proactively conduct marketing activities in selected market sectors); (3) business development, marketing, and sales (e.g., film evaluation by potential customers, investors, and strategic partners); and (4) sourcing of base materials and components. Commercialization of this technology will leverage growth in the PV industry and the strength of the indigenous Ohio PV industry.

PVP408

Dear Ohio Department of Development;

This is the Letter of Intent (LOI) of Glasstech, Inc. to submit a proposal for 2010 Ohio Third Frontier Photovoltaics Program.

The required information of the LOI follows:

Lead Applicant's

- Name: Glasstech, Inc
- Address: 995 Fourth Street, Perrysburg Ohio, 43551
- Phone Number: 419-661-9500
- Contact Person: Kenneth H. Wetmore
- Contact e-mail: kwetmore@glasstech.com
- Proposed Project Title: Commercialization of a heat treating process to strengthen large, thinner glass substrates for Photovoltaic panels.
- Grant Funds Requested: $750,000 to $1,000,000
- Collaborators: Glasstech, Inc and Ohio suppliers to Glasstech

Glasstech has developed convection heating technology which is capable of heating various glass substrates, including normal soda lime, high light transmission low iron and Transparent Conductive Oxide (TCO) coated glass. The convection heating technology utilizes combusting fossil fuels as the primary heating source. The Photovoltaic (PV) Industry has expressed significant interest in an electrically based source and that the glass substrates become larger, up to 2.2 m by 2.6 m, thinner, as thin as 2.7 mm thickness and flatter than the current industry standard. Segments of the PV industry generate better scales of economy by increasing the surface area of their PV panel and by reducing the glass thickness which, in some cases, will allow more light to pass through the glass to the active layers of the PV panel and reduce weight. This is an important segment in the PV market and will assist in the expansion of PV in the US and worldwide.

Glasstech has developed small scale, proof of concept, test equipment which has demonstrated the capability of heating glass substrates with an electrically fueled convection heater and a new air tempering technology which is more energy efficient and capable of tempering thinner glass. The grant funds requested would allow Glasstech to commercialize these technologies by having a properly sized demonstration system in Perrysburg, Ohio capable of tempering these larger surface area, thinner thickness glass substrates for potential PV customers. Glasstech believes the grant would be carried over a two year program. By demonstrating the system to potential Glasstech customers in the solar industry and making sample glass parts for the solar applications, Glasstech will generate a significant number of system sales worldwide.

Glasstech has an extensive supply base within Ohio. Moving forward with this demonstration system will create and retain jobs in Ohio and each sale of a system by Glasstech will also create and retain jobs in Ohio.

PVP 409

A Letter of Intent
To the **Ohio Third Frontier Advanced Energy Program (OTFPVP),**

Lead Applicant: Xunlight 26 Solar, LLC
3145 Nebraska Avenue
Toledo, OH 43607
Ph: 419-469-8600; Fax: 419-469-8601
Contact Person: Dr. Alvin Compaan, Chief Technology Officer
acompaan@xunlight26.com; ph: 419-469-8662; fax: 419-469-8601
Proposed Project Title: *Monolithically Integrated, Flexible PV Modules*
Estimated Grant Funds to Be Requested: $1,000,000
Known Collaborating Organizations:

- Xunlight Corporation (Dr. Aarohi Vijh)
- The University of Toledo, including the Wright Center for Photovoltaics Innovation and Commercialization (Norman Stevens)

Project Summary

Xunlight 26 Solar will team with *Xunlight Corporation* for the joint development of monolithically integrated, flexible solar modules based primarily on thin-film cadmium telluride. On-line, monolithic integration of flexible PV cells into large-area, high voltage modules provides new market potential, and additional job creation opportunities, over existing rigid and flexible PV module products now in the market. This effort will leverage the existing capability for roll-to-roll deposition and manufacturing of large-area, flexible, thin-film solar cells that has been built with previous investments from Ohio's Third Frontier Program as well as from venture capital companies and other sources. In addition, this project will include collaboration with The University of Toledo's PV group and the Wright Center for PV Innovation and Commercialization that further leverages on-going and prior Third Frontier investments.

Xunlight is a leader in flexible and lightweight thin-film silicon photovoltaic (PV) modules with all manufacturing and R&D employment located in Toledo. Xunlight 26 Solar has teamed with Xunlight to bring to commercial scale, advances from University of Toledo scientists in the fabrication of thin-film CdTe cells on polymer substrates.

PVP 410

SHADE

2600 Dorr Street, #1060
Toledo, OH 43606

August 25, 2009

Ohio Third Frontier Photovoltaics Program
The Ohio Department of Development
Technology and Innovation Division
77 South High Street, 25th Floor
Columbus, OH 43215
Attn: 2010 OTFPVP LOI

++ VIA ELECTRONIC MAIL ++

To Whom It May Concern:

This letter signifies the intention of ShadePlex, LLC, to apply for a grant from the Ohio Third Frontier Photovoltaics Program. Please find the required information below and on the following page.

Please do not hesitate to contact me at 734-368-0215 or brian@shadeplex.com with any questions.

Best regards,

Brian Tell

President

Lead Applicant:

ShadePlex, LLC, 2600 Dorr Street, #1060, Toledo, OH 43606

Phone: 248-270-3150

Lead Applicant Contact Person:

Brian Tell, President

Email: brian@shadeplex.com

Proposed Project Title: Bringing solar-electric fabrics for buildings and structures to market.

Estimated Grant Funds to be Requested: $770,000

Known Collaborators:

Applied Technologies, Inc.; The Lathrop Company; SSOE; The Seaman Corp.; Plug Smart; University of Toledo; Xunlight Corporation

PVP 411

SHADE

2600 Dorr Street, #1060
Toledo, OH 43606

Summary of the Proposed Project

ShadePlex is a Toledo-based, start-up firm located at the University of Toledo Clean and Alternative Energy Incubator. ShadePlex is developing durable fabric frames for high power, flexible, thin-film solar panels. Our proprietary, patent pending attachment technology is engineered to enable mounting of flexible solar panels on fabric parking canopies, sports domes, warehousing facilities, community centers, military and emergency relief tents, and commercial flat roofs.

As a client of Rocket Ventures, part of the Third Frontier Entrepreneurial Signature Program, and as a recipient of an Ignite! product development grant, we achieved proof-of-concept for our unique fabric-frame attachment technology in June 2009; we have been able to secure key parts of our supply-chain, which includes three Ohio-based companies – Xunlight Corporation (Toledo), the Seaman Corp. (Wooster), and Miller-Weldmaster (Navarre); and in September 2009, we will be installing two small prototype structures incorporating ShadePlex's technology, 1kW each in size, at the Maumee, Ohio location of The Lathrop Company.

ShadePlex is requesting $770,000 in OTF grant funds to support the transition from our current *Incubation* stage (in the OTF Technology Commercialization Framework) to the *Demonstration* and *Market Entry* stages. OTF funds will be used by ShadePlex and its collaborators to:

- Perform accelerated tests on our integrated PV-fabric products;
- Set up a pilot production line for commercial-scale demonstration projects;
- Design, engineer, and install two commercial-scale pilot projects between 35 and 50kW each, including PV-fabric shade structures for PHEV charging stations at the University of Toledo Scott Park Campus; and a warehouse flat roof installation at The Lathrop Company in Maumee, Ohio;
- Refine production processes for market-entry sales based on results of demo projects;
- Finalize specifications for the UL certification process and product warranty; and
- Market ShadePlex products and/or applications integrated with ShadePlex products to customers, utilizing the combined market channels of ShadePlex and its collaborators.

ShadePlex is bringing together a world-class team of Ohio-based collaborators to position our products for initial market entry in Q3 2010. Collaborators will include:

- *Applied Technologies, Inc. (Maumee)* – Leading provider of structural solutions for renewable energy applications. ATI recently launched a PV rack system that reduces installation costs by up to 50%. ATI will engineer structural systems for applications with ShadePlex products.
- *The Lathrop Company (Maumee)* – Part of Turner Construction, the largest general contractor and the largest builder of green buildings in the U.S. Lathrop is a committed end-user. They will house a 50kW flat roof demo project, and will provide construction management for both demo projects.
- *SSOE, Inc (Toledo)* – 11th largest Architecture and Engineering firm in the U.S.(BD+C, 2009), and ranked 3rd nationally among Green Industrial and Manufacturing Design Firms (ENR, 2009). SSOE is a committed end-user. They will provide architectural design, P.E. review, and system engineering for the two demo projects, as well as guide the build-out of ShadePlex's production facility.
- *The Seaman Corp. (Wooster)* – Leading U.S. manufacturer of high performance, PVC-coated roofing and structural fabrics. Seaman will provide fabrics, lab facilities for testing, and expertise on fabric engineering and installation.
- *Plug Smart (Cleveland, Columbus)* – Developer of innovative, portable charging devices for plug-in electric hybrid (PHEV) vehicles. Plug Smart is also project manager for the University of Toledo's 2MW Scott Park Campus project. Plug Smart will provide its charging devices for the PV-fabric/PHEV demo project at the University of Toledo.
- *University of Toledo* – 3rd largest public university in the state and a center of excellence for research and commercialization of photovoltaic technologies. The University is a committed end-user.
- *Xunlight Corporation (Toledo)* – Innovative manufacturer of high power, lightweight and flexible, thin-film PV panels. Xunlight will supply its new 330 and/or 110 watt panels for integration in ShadePlex products and installation in the two demo projects.

PVP411

Ohio Third Frontier Photovoltaics Program
Letter of Intent

Lead Applicant Name: Five Star Technologies, Inc.
Address: 6801 Brecksville Road, Suite 200
Independence, OH 44131 USA
Telephone: 1-877-513-3483
Contact Person: Gerry Weimann
Contact Email: gweimann@fivestartech.com

Research Commercialization Program Project Title: Commercialization of Specialty Electronic Inks for Advances in Photovoltaic Technology

Known Collaborators: The University of Toledo, Center for Photovoltaic Innovation and Commercialization

Grant Amount Requested: $1,000,000

Summary of Proposed Topic:

Five Star Technologies, Inc. (Five Star) is a manufacturer of specialty dispersions, inks and pastes for the electronics industry. The technology basis of the company is a unique, patented process that utilizes cavitation energy for the dispersion and deagglomeration of very fine powders. Cavitation processing results in more complete deagglomeration and more consistent dispersion of fine particles, enabling the creation of inks with improved rheological properties, superior fine line printability, easier densification and greater consistency when compared to conventionally produced inks.

Five Star is now applying this technology to commercialize a family of improved metallization inks that will enable the fabrication of more powerful photovoltaic devices. Solar cell manufacturers are actively seeking improved performance from specialty electronic inks currently used to screen print electrical contacts onto commercial silicon solar cells. Continuing solar cell performance improvements are the key drivers to make solar energy a significant future energy resource.

The improved inks enabled by Five Star's cavitation technology have demonstrated the performance necessary to advance solar cell performance. Inks created via Five Star's patented process technology and unique chemical formulations give solar cell manufacturers the ability to screen print much finer lines that fire denser than conventional inks and achieve more consistent emitter contact. When used as collector electrodes on the front side of a solar cell, the company's inks enable significant increases in solar cell performance, allowing solar cell fabricators to produce better products and earn higher margins. The level of performance obtainable with Five Star's inks is a significant, game-changing increase from the performance levels attained using today's conventional solar inks.

Five Star is investing significant venture capital resources into the development of the platform technology and its application into the solar energy arena. We are requesting Third Frontier funding to accelerate the development and commercialization of these important advances in photovoltaic technology.

Regards,
Gerard R. Weimann
President and CEO
Five Star Technologies, Inc.

PVP 412

EMTEC

The Center of Solutions

Ph. 937-259-1365
Fax 937-259-1303
1-888-55-EMTEC
www.emtec.org

3155 Research Blvd.
Dayton, OH 45420

- Alternative Energy Materials
- Supply Chain Development

- Core Technology
- New Product Development PDQ Center

- Business Development
- Materials Help Desk – RFH

- Bilateral Trade Support
- Foreign Company Attraction

- Air Force Research Lab
- SBIR Support

- Training
- Networking

- Business Assistance
- Capital Formation

The Edison Materials Technology Center

An Ohio Edison Technology Center

Ohio Department of Development

Letter of Intent to Submit a Proposal for the Third Frontier Program

Prospective Applicant's Name:	Edison Materials Technology Center
Applicant's Legal Structure:	501(c)3 non-profit
Organization's Address:	3155 Research Blvd. Suite 101 Dayton, OH 45420
Contact Person:	Jon VanDonkelaar
Phone Number:	937-253-0034
Email Address:	jvandonkelaar@emtec.org
Expected Collaborators:	Emerson Liebert The Ohio State University
Proposal Type:	Photovoltaics Program
Proposed Project Title:	**Cyber Controlled Integration of Smart Grid Technologies**
Estimate Dollars Requested:	$1,000,000 from Photovoltaics Program and $2,000,000 from Wright Capital Fund over three years

Liebert Corp. is a division of Emerson Network Power, a business unit of Emerson Electric (NYSE:EMR). Emerson is the global leader in enabling Business-Critical Continuity™. The company is the trusted source for adaptive and ultra-reliable solutions that enable and protect its customers' business-critical technology infrastructures. For more information on Liebert visit www.Liebert.com or visit www.emerson.com.

Founded in 1870, The Ohio State University is a world-class public research university and the leading comprehensive teaching and research institution in the state of Ohio. With more than 52,000 students enrolled at its main Columbus campus, 18 colleges and 170 majors, the university offers its students exceptional breadth and depth of opportunity in the liberal arts, the sciences and the professions. A national research powerhouse, the university ranks seventh among all public universities in research expenditures and a remarkable second place when it comes to industry-sponsored research.

EMTEC is a non-profit technology center that offers technical assistance, business assistance, funding opportunities, and research management to member companies. The mission of EMTEC is to enhance competitiveness and create opportunities for Ohio companies. www.emtec.org

Jon L VanDonkelaar

PVP 413

Cyber Controlled Integration of Smart Grid Technologies

Ali Keyhani, Professor
Mechatronics-Green Energy Laboratory
Keyhani@ece.osu.edu

The proposed effort, depicted in Figure 1, describes a highly integrated smart microgrid test bed including several renewable energy sources (i.e., PV cells, fuel cells and wind turbines). The first stage of this program will concentrate on a photovoltaic implementation of the test bed on the Ohio State University campus.

It is expected that utilization of renewable and green energy would accelerate as the new renewable energy portfolio law requiring up to 20% of electric energy sold to be supplied from green energy is passed by many states in USA and similar efforts are being initiated worldwide. Additionally, there is strong interest in improving utilization and performance of the existing power grid. To this end, exchange of vital information from various nodes (e.g., generators, consumers and distributors) allow monitoring and ultimately modifying system behavior through pricing mechanisms to reduce demands and costs. In turn, benefits include increase in energy efficiency, optimal allocation and matching of demand and resource and increase of overall grid reliability via self-organizing, self-healing microgrids. A unique experimental test bed is being proposed with the vision of developing crucial technologies that play a vital role in design and operation of the next-generation smart grid system with high penetration of renewable and green energy sources. The proposed system will facilitate expansion of the inter-disciplinary knowledge base spanning power systems, power electronics, control systems, optimal resource allocation and pricing. In a smart grid, massive amounts of data are generated for real-time distributed control of the grid. Efficient distributed algorithms taking advantage of processing power at system nodes needs to be developed considering the inherent wide range of time scales in the smart grid system. The test bed will provide a valuable facility to attain detailed input/output data sets from actual operational components of a power grid and the interconnected smart microgrid; this data will be crucial in development of high fidelity models and system identification for individual green energy components and the large-scale interconnected system as a whole. A highly integrated secure reconfigurable communication network will be superimposed on the grid to monitor, process and communicate various quantities (e.g., voltage, current, temperature, pressure and power flow) at all nodes.

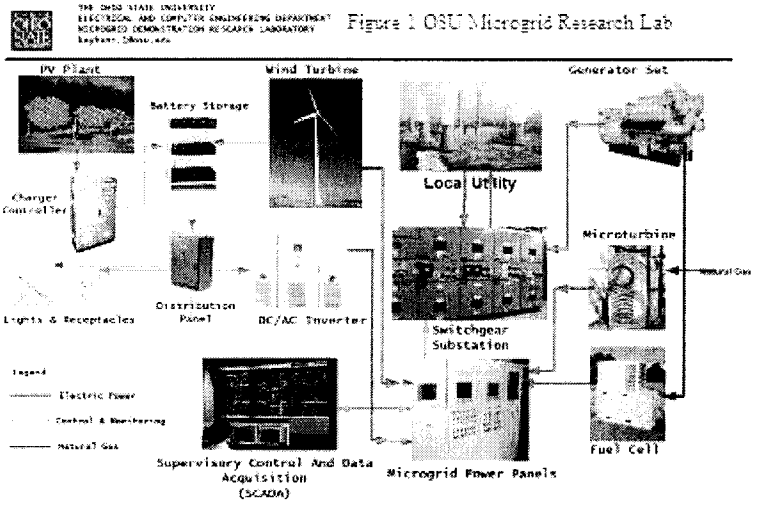

Figure 1 OSU Microgrid Research Lab

PVP 413

1001 Madison Avenue
Toledo, OH 43604
419.255.3830 T
419.255.6101 F

www.ssoe.com

ISO 9001 certified

August 24, 2009

Ohio Third Frontier: Photovoltaics Program
The Ohio Department of Development
Technology and Innovation Division
77 South High Street, 25th Floor
Columbus, OH 43215

RE: 2010 OTFPVP LOI

Dear Ohio Third Frontier Photovoltaics Program,

This letter is submitted per the 2010 OTFPVP RFP requirements as a Letter of Intent to submit a proposal to the Ohio Third Frontier Photovoltaics Program.

Lead Applicant:

SSOE Inc.
1001 Madison Ave
Toledo, OH 43604

Lead Applicant Contact Person:

Zach Platsis Sustainable and Renewable Solutions
419.255.3830
zplatsis@ssoe.com

Proposed Project Title:

Overcoming Impediments to Commercial Implementation of Building Integrated PV systems

Estimated Grant Funds to be Requested:

$1,000,000

Known Collaborators:

Wright Center for Photovoltaic Innovation and Commercialization

Sincerely,

PVP414

Zach Platsis
Energy Specialist
Sustainable and Renewable Solutions

SSOE, INC.
ARCHITECTS • ENGINEERS

Proposed Project Summary

The final proposal submitted in response to the RFP will be to assemble a demonstration of multiple Building Integrated Photovoltaic (BIPV) systems located in Toledo, OH. The demonstration is proposed to be at a local hospitality facility with access to a national market. The goal of the program will be to demonstrate and validate Ohio based BIPV manufacturer's products in an operating facility scenario with the intent of discovering and documenting issues and impediments to the large scale commercial implementation of BIPV systems under similar operating conditions. The objectives of the project will be centered around the third bullet point under section 2.3.1 "Commercially Oriented Demonstration Projects", and is intended to be judged against the Level C metric described in section 2.2 of the RFP.

The initial demonstration will consist of a photovoltaic powered parking canopy alongside a roofing membrane product demonstration of the integration of a roofing material product with a pre-commercial flexible photovoltaic module material. All of the involved technologies and related manufacturing are from Ohio based business. The physical infrastructure developed to demonstrate and further the commercial viability of these two product systems will remain in place and is intended to be broadly applicable to the commercial demonstration of future BIPV system technologies developed with the Wright Center for Photovoltaic Innovation and Commercialization and its partners.

PVP 414

SSOE, INC.
ARCHITECTS • ENGINEERS

A Letter of Intent
To the Ohio **Third Frontier Photovoltaics Program (OTF-PVP)**

Lead Applicant: Xunlight Corporation
3145 Nebraska Avenue
Toledo, OH 43607
Ph: 419-469-8600; Fax: 419-469-8601
Contact Person: Dr. Aarohi Vijh (Director, Process Development)
avijh@xunlight.com; ph: 419-469-8650; fax: 419-469-8601

Proposed Project Title: **Next Generation Solar Module Manufacturing Technology**
Estimated Grant Funds to Be Requested : $1,000,000
Collaborating Organizations: Edison Welding Institute (EWI), Columbus, OH

Project Summary

Toledo, OH-, headquartered Xunlight Corporation, a manufacturer of lightweight, flexible thin-film silicon-based solar modules proposes to develop next generation manufacturing technology for its cell and module assembly lines.

Xunlight's manufacturing process consists of a thin-film solar cell fabrication process and a module fabrication process. The thin-film solar cell fabrication process is an industry leading roll-to-roll manufacturing process developed and engineered in-house by Xunlight over the last several years and constructed using local subcontractors. The module manufacturing process consists of multiple discrete steps that are currently very labor intensive, and in spite of complicated logistics, would need to be performed at a low labor cost location for economic reasons. Xunlight has targeted high-impact portions of the process for new manufacturing technology. Under this project Xunlight will develop next generation technologies for these selected areas of its cell and module manufacturing lines. It is expected that the new module technology will be highly automated and will enable local, Ohio-based processing of the cells. Once the new technologies are sufficiently proven, Xunlight will partner with local vendors to further develop and incorporate them into a high-volume cell and module line based in Ohio.

Northwest Ohio is economically depressed due to the decline of the automotive industry in the area, but has high-quality human resources in engineering and technical fields. Xunlight has already leveraged this fact, more than doubling its work force every year in the past three years (growing from 4 FTE in 2005 to 96 FTE today), drawing national media attention. This project is expected to help Xunlight accelerate that growth and create direct manufacturing and engineering jobs, transforming NW Ohio into a Silicon Valley of Solar in the process.

PVP 415

2010 Ohio Third Frontier Photovoltaics Program
Letter of Intent

Lead Applicant:	Replex Plastics POB 967 11 Mount Vernon Avenue Mount Vernon, OH 43050 740-397-5535 phone
Contact:	Mel Hazzard mel@replex.com
Project Title:	Low-Cost Low-Concentration Photovoltaic (LC2PV) Systems for Mid-Northern Latitudes
Est. Grant Funds:	$1,000,000
Collaborators:	Wright Center for Photovoltaics Innovation and Commercialization (PVIC) Battelle Memorial Institute

Project Summary:

Replex Plastics, Ohio State University, and Battelle propose to decisively cut the cost of and accelerate 50-state deployment of clean photovoltaic power by developing concentrating solar technology inherently appropriate for diffuse climates. Most Americans live and work in such climates. Nationwide deployment will enable savings of 96,000,000 ton/year of fossil fuels (enhancing energy security), and avoid 130,000,000 ton/yr of CO2 emissions, a major greenhouse gas. Invented, developed, and manufactured in Ohio; distributed and deployed nationally; low-cost, low-concentration photovoltaic (LC2PV) technology will create jobs throughout the supply chain. LC2PV modules use inexpensive acrylic mirrors to concentrate sunlight onto PV cells optimized for 2x-20x solar concentration factors. The mirrors concentrate both direct and diffuse solar radiation due to their special shape. LC2PV technology reduces the use of expensive PV materials by up to 95% compared to conventional flat panel PV, and overcomes thermal and longevity hurdles through clever PV packaging technology.

Problem: Without government subsidies, the best available commercial technology in 1- sun flat panel PV is too expensive for widespread solar electric power generation. PV costs have been declining incrementally a few percent per year for many years, but we need quantum leaps, not small percentage improvements. Concentration photovoltaic (CPV) technology represents the most promising approach for achieving disruptive reductions in the cost of PV solar power. The state of the art in CPV technology arguably involves 500x-800x concentration factor (CF) optics with very efficient (40%) PV cells, increasing output per unit PV area by three orders of magnitude versus 1 sun PV. In addition to vexing engineering implementation issues, these CPV systems suffer from a fundamental optical problem. They can only use direct sunlight, losing the diffuse portion of the solar resource. In most of the USA this is a big penalty. In Columbus, Ohio diffuse sunlight represents 40% of the annual solar insolation. Systems that lose the diffuse energy are therefore at a 40% disadvantage right from the start. In practice this limits the geographical market for state of the art CPV systems to the southwestern USA. The majority of the population of the USA lives in more temperate climates with a high diffuse resource, and we need economical solar electric power systems that work effectively where we live. 1-sun PV works in our diffuse climate, but is too expensive. CPV has great promise, but does not work well in our diffuse climate.

Proposed Solution: This novel approach to CPV using low solar CF (2x to perhaps 20x) designs based on compound parabolic concentrators (CPCs) fabricated from low-cost, high specular reflectivity acrylic mirror material and using low cost mirror manufacturing methods. Such mirrors collect and concentrate the direct irradiance plus most of the diffuse irradiance at (2X-20X) concentration, increasing the energy output per unit of PV area by an order of magnitude. This is a *transformational* improvement over the state of the art today, and is one which can be effectively deployed in all climates across the USA. Successful development of this technology first requires a thorough understanding of the directional nature of the diffuse irradiance in various weather conditions and seasons. Data in the literature is sparse, so our team will gather irradiance data as a function of incidence angle relative to the position of the sun in a range of weather conditions. This knowledge will feed into the optical design of the concentrators (CF, incidence angle) and lead to optimal mirror designs for various mounting strategies, such as fixed, single axis time of day tracking, or two axis ideal tracking. PV cells will be optimized for the CF range of interest, improving efficiency by 10-20% versus 1-sun PV. PV package designs that work for 1-sun are not expected to be sufficiently durable for use in concentrated light, and hence we will develop an appropriate PV package for our target CF. All of this technology will be integrated into a module and field tested. A cost model will be employed to compare the levelized cost of energy (LCOE) from our system against today's commercial technologies. We seek to reduce the LCOE by 50% or more, and to be suitable for deployment in all climates.

PVP416

inexpensive acrylic mirrors to concentrate sunlight onto PV cells optimized for 2x-20x solar concentration factors. The mirrors concentrate both direct and diffuse solar radiation due to their special shape. LC2PV technology reduces the use of expensive PV materials by up to 95% compared to conventional flat panel PV, and overcomes thermal and longevity hurdles through clever PV packaging technology.

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PVP416

BRUSH
ENGINEERED MATERIALS

Brush Engineered Materials Inc.
6070 Parkland Bvd.
Mayfield Heights, OH 44124, USA
Tel: 216-383-6850
Fax: 216-481-2523

E-Mail: stephen_freeman@beminc.com

Stephen Freeman, PhD.
President, Int'l Business Development

August 24, 2009

Ohio Department of Development
Technology Division
77 South High Street, 25th Floor
Columbus, Ohio 43215

Dear Ohio Department of Development:

Please accept this Letter of Intent from Brush Engineered Materials for our Fiscal Year 2010 Ohio Third Frontier Photovoltaics Program proposal.

Lead Applicant Name:	Brush Engineered Materials
Address:	6070 Parkland Boulevard Mayfield Heights, OH 44124
Telephone:	(216) 383-6850
Contact Person:	Dr. Stephen Freeman, President, International Business Development
Contact Email:	stephen_freeman@beminc.com
Project Title:	Photovoltaic Deposition Materials Commercialization and Manufacturing
Estimated Grant Amount Requested:	$1 million
Known Collaborators:	The University of Toledo, Wright Center for Photovoltaics Innovation and Commercialization (PVIC), and others to be determined

Summary of Proposed Project:

The State of Ohio has invested heavily in the creation of a photovoltaic cluster in Ohio. These investments have begun to create a substantial manufacturing capacity for photovoltaic solar cells and other significant photovoltaic supply chain cluster activity across the state. Ohio's thin film production capacity, and the capacity of similar photovoltaic production facilities located around the world, requires the use of source materials critical for the vapor deposition process used to manufacture thin film photovoltaic materials. These source materials are Cadmium Telluride (Cd-Te), Cadmium Sulfide (Cd-S), Tin Alloys and Transparent Conductive Oxides (TCO). Currently, most Cd-Te is imported into the USA from Canada and, similarly, Cd-S is imported from Russia.

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Through the Photovoltaic Deposition Materials Commercialization and Manufacturing project, Brush Engineered Materials proposes to address technical and commercial challenges by leveraging a unique collaboration amongst Ohio's state initiatives, Ohio industry and Ohio academic resources to build and sustain a commercially successful business for fully customized Photovoltaic Deposition Materials in Ohio. This project presents a unique opportunity to leverage Brush Engineered Materials expertise to position Ohio as the sole domestic supplier and world leader in these highly customized materials to meet the needs of targeted thin film solar cell companies.

Cd-Te and Cd-S materials are manufactured using controlled atmosphere zone refining purification and synthesis processes which have been well proven for process reliability and reproducibility in commercial volumes. The levels of product purity and product integrity have been proven, and the process is scalable. Brush Engineered Materials intends to be the leading producer of Cd-Te and Cd-S materials in the United States, with production headquartered in Ohio.

The Tin Alloys and other materials used to produce Transparent Conductive Oxides may be manufactured using a novel casting technology recently developed to overcome the normal equilibrium heterogeneous separation of the two or more alloying element constituents. Brush Engineered Materials proposes to further develop its novel casting technology, proven to overcome the formation of heterogeneous structures, and commercialize Photovoltaic Deposition Materials with significantly improved operational advantages for solar cell manufacturers.

Proof of concept development work has also been demonstrated on the casting technology, and the proposed project will involve developing commercial scale processes and establishing a manufacturing location in Ohio to bring the Photovoltaic Deposition Materials to commercial scale production. The project will include the development and installation of production scale manufacturing equipment, employing newly hired and well paid employees in a newly established Ohio production facility.

Third Frontier funding would enable Brush Engineered Materials to: (1) Exceed the demands of Ohio's photovoltaic industry cluster for tailored Photovoltaic Deposition Materials; (2) supply global photovoltaic solar cell manufacturer demand for Photovoltaic Deposition Materials at a reduced cost through process improvements and economies of scale; and (3) help position Ohio as a world leader in photovoltaic technology innovation and commercialization.

Sincerely,

Dr. Stephen Freeman

PVP417

12900 Eckel Junction Road
Perrysburg, Ohio 43551-1309
(419) 872-3740 Tel (419) 872-3744 Fax

Sent via E-mail to: OTFPVP2010@development.ohio.gov
August 24, 2009

Calyxo USA Inc. is submitting this Letter of Intent in response to the Ohio Third Frontier Photovoltaics Program Fiscal Year 2010 Revised Request for Proposals dated August 11, 2009. Per the requirements listed in the RFP, the following information and Project Summary are provided.

Lead Applicant
Calyxo USA, Inc.
12900 Eckel Junction Road
Perrysburg, Ohio 43551-1309
419-872-3740

Contact Person
Kenneth R. Kormanyos
419-872-3714 (office), 419-450-8713 (cell)
K.Kormanyos@CalyxoUSA.com

Project Title
Re-Circulating Atmospheric Pressure Vapor Deposition of Polycrystalline Thin-film PV Semiconductor Materials on Glass

Estimated Grant Funds
$965,500 (does not include estimate for the "Exceptional Funding Opportunity")

Known Collaborators
- Wright Center for Photovoltaics Innovation and Commercialization (PVIC) located at the University of Toledo, Toledo, Ohio ... Collaborator Contact - Dr. Rob Collins
- Ohio Advanced Energy ... Collaborator Contact – Dr. Norman Johnston, Chairman

Sincerely,

Kenneth R. Kormanyos
VP, Senior Research Fellow
Calyxo USA, Inc.

PVP418

Project Summary

Calyxo USA, Inc. proposes to demonstrate the viability of a novel atmospheric pressure PV semi-conductor material deposition process which uses re-circulation of the semiconductor vapors. To date, no other reported thin-film deposition technologies employ the application and re-circulation of the semiconductor vapor mixture for enhanced manufacturing capability that is easily scaled to very large area continuous thin-film deposition processes. The vapor mixture's initial impingement on the surface of the substrate causes condensation of a fraction of its semiconductor content, the remaining uncondensed vapor fraction is immediately collected, returned to the vapor generator for reheating, the vapor concentration is adjusted, and re-applied to the substrate surface. In this manner, the semiconductor material is not lost to the deposition process if it does not contribute to film growth during its first contact with the substrate. Technical evaluation of the thin-film semiconductor materials deposited and PV devices developed during the course of the project will be directly supported by close collaboration with the Wright Center for Photovoltaics Innovation and Commercialization (PVIC).

Anticipated manufacturing process benefits for the use of a re-circulating vapor deposition system derive from increased semiconductor materials usage efficiency driving down the cost of production, increased deposition process up-time; a key factor for thin-film production and manufacturing economics, and waste stream quantity reduction through efficient deposition of the semiconductor on the substrate. The goal of the 24 month project is a demonstration of thin-film CdS/CdTe deposition using the above described atmospheric pressure re-circulation process on 60 cm x 120 cm glass sheets with a prototype system. The prototype defines manufacturing viability of the concept and is the technical deliverable of the project. Additionally, an engineering design based on fluid flow modeling of a wider deposition system is an integral portion of the project deliverable set.

PVIC will assist in the development of the semiconductor deposition process by providing thickness maps of the two semiconductor layers over the full 60 cm x 120 cm area of the glass sheet in order to evaluate non-uniformity. Analytical measurements such as quantum efficiency, atomic force microscopy, and Auger electron spectroscopy will be completed on the thin-films and PV devices using the PVIC capabilities. Fabrication and testing of small area devices to guide process optimization will be performed on 7.5 cm x 7.5 cm coupons selected on the basis of the uniformity maps to identify the extremes in performance. Device processing by PVIC on coupons will apply methods scalable to in-line manufacturing, including the processes of CdS/CdTe film activation, back-contact formation, and laser scribing. PVIC will also assist in scaling up these processes to the full 60 cm x 120 cm area through the development of large area equipment capabilities.

Once demonstrated, system scale-ups can be undertaken that employ combination of technical process information from the project with known fluid flow modeling techniques to increase the size of the thin-film deposition technology so systems processing larger width can be designed for use within the thin-film PV manufacturing arena. Deposition systems sized at 2 meters wide, or larger, can be achieved through application of the atmospheric pressure re-circulating deposition concept. These large area deposition systems will form the core technology for the establishment of a new thin-film PV manufacturing facility in Ohio. The deposition system, combined with associated PV module manufacturing sub-processes, comprise the new manufacturing facility's basis of operation.

The facility envisioned is a fully operational new entity that will manufacture large area thin-film PV modules on glass substrates to meet the needs of the alternate energy industry. Input from Ohio Advanced Energy collaboration will assist to define the new manufacturing facility. The manufacturing facility falls within the scope of an "Exceptional Funding Opportunity" as defined in the 2010-OTFPVP RFP; a white paper describing the opportunity will accompany the proposal submitted by Calyxo USA. Preliminary product production is estimated as 40MW/year for single shift operation. Conservative estimates of the new work force required for the manufacturing operation are initially set at approximately 200 employees for preliminary product production, with additional jobs provided as the facility ramps to maximum output of 120MW/year. Support industry and materials supply groups will also be required to be developed providing additional new jobs for materials and services required by the new manufacturing facility.

PVP418

Stock, Pete A.

From: Ed Zdankiewicz [ezdankiewicz@rexorce.com]
Sent: Friday, August 21, 2009 3:59 PM
To: OTFPVP2010
Cc: ezdankiewicz; mgurin; mark terzola; Philip brennan
Subject: 2010 OTFPVP LOI

Lead Applicant

rexorce Thermionics Inc.
405 S. High St.
Akron, OH 44311
Phone: (234) 542-4379

Contact person: Mark Terzola, VP Corporate Affairs
Contact person email: mterzola@rexorce.com
Contact person mobile phone: (330) 807-0142

Project Title

High Efficiency Hybrid Solar Collector and System

Estimated grant funds requested

State funds: $1,000,000
Cost match: $1,000,000

Proposed Program Summary

rexorce proposes to develop a hybrid concentrated solar receiver (HCSR) that combines multi-junction photovoltaic cells and an advanced solar thermal receiver with micro / nano-structured active thermal management for the PV cell. The proposed patent-pending technology will produce a greater amount of electrical generation from the same physical footprint and smaller system size to open up the distributed energy market to solar applications.

The hybrid receiver concentrates, converts, and recovers both optical and thermal solar energy. Nano-structured, carbon-based materials are used as a thermal spreader to provide thermal management for the PV cell and as a microchannel heat exchanger to transfer heat from the concentrator assembly. The recovered waste heat will be used to drive a rexorce Thermafficient thermal engine where it is converted into usable electricity.

Collaborator Team

Angtron Materials LLC (Dayton, OH) --- a manufacturer of nano-scale fillers to create low-cost, high-performance polymer composite heat exchangers for PV cell thermal management.

Arch Solar Command LLC (Cuyahoga Falls, OH) --- an architectural glass and extruded aluminum manufacturer of concentrated solar thermal collector panels and tracking subsystems.

GrafTech International (Parma, OH) --- a leading manufacturer of engineered graphite and carbon products for heat transfer and advanced thermal management.

GreenField Solar (North Olmsted, OH) --- a developer of high intensity photovoltaic solar concentrator systems and tracking subsystems.

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NanoEngineering Laboratory, Case Western Reserve University (Cleveland, OH) --- a northeast Ohio-based university with staff and facilities for testing and characterization of advanced solar / photovoltaic receivers.

Taylor-Winfield Corp. (Brookfield, OH) --- an international manufacturer of metal fabrication equipment, specializing in the development of metal forming, roll-forming and metal joining machinery.

ThermoAnalytics Inc. (Calumet, MI) --- engineering service provider for advanced CFD modeling and analysis of steady-state and transient fluid, thermal, and heat transfer problems for demanding industrial and environmental applications.

Truly yours,

Edward M. Zdankiewicz, PE
Proposal Leader
rexorce Thermionics Inc.

email: ezdankiewicz@rexorce.com
cell: 216-374-3377

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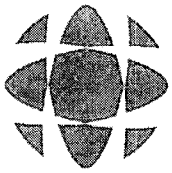

SCI Engineered Materials

SCI Engineered Materials, Inc.
2839 Charter St., Columbus, Ohio 43228
Phone: (614) 486-0261, 1-800-346-6567 FAX (614) 486-0912
www.SCIEngineeredMaterials.com

August 19, 2009

Ohio Department of Development
Ohio Third Frontier Photovoltaics Program

Dear Sirs,

I am writing on behalf of SCI Engineered Materials, Inc. to notify the Ohio Department of our intent to submit a proposal in response to the 2010 RFP for the Ohio Third Frontier Photovoltaics Program. The proposed title of the project will be "Commercialization of Advanced Attachment Technology for Rotatable Ceramic Sputtering Targets used for Thin Film Photovoltaic Solar Cell Manufacturing". The grant funds requested will be on the order of $1,000,000. A known collaborator for this project is Robinson Fin Machines, Inc. of Kenton, Ohio.

Project Summary

One of the technical barriers to the large scale manufacture of thin film photovoltaic solar cells (TFPSC) is the availability of low cost sheet glass coated with a thin layer of transparent conductive oxide (TCO). Plates TCO coated glass are the substrate (foundation) upon which the thin film solar cell panel is deposited and serves also as the front contact for drawing the power from the cell panel. Currently there are only three main suppliers worldwide for this product and supply is so limited that both prices and leadtimes are increasing rapidly to unacceptable levels. For the TFPSC to meet its goal of producing panels at a cost of $1/watt, a solution must be found for the lack of supply and increasing costs.

As a result of this issue, most manufacturers of TFPSC panels are now installing equipment to produce TCO coated glass panels in-house. Not only does this give the manufacturers control over the supply, but it also provides the manufacturers to custom design their own TCO layers to provide advantages over the currently available TCO layers deposited on glass. The method chosen by most TFPSC manufacturers to deposit TCO coatings on glass is the physical vapor deposition (PVD) process known as sputtering. In order to sputter TCO coatings, cost effective, high quality sputtering targets composed of the TCO material desired in the coating must be available in sufficient quantity to meet the needs of this industry. The TFPSC industry has chosen to use high volume coating systems that utilize rotatable sputtering targets and specifically rotatable ceramic sputtering targets.

SCI Engineered Materials, Inc. has been manufacturing ceramic sputtering targets for more than 15 years and has been developing ceramic sputtering targets for TCO layer deposition for at least 6 years. SCI is currently in the Market Entry Phase for the current art technology. However, TFPSC manufacturers are demanding sputtering targets that can operate at higher

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SCI Engineered Materials

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power levels and temperatures in order to increase productivity; power levels and temperatures that the current art technology cannot withstand due to the low melting point of the material used to attach the ceramic components of the target to the metallic components. Any new attachment technology must be not only low cost, but environmentally friendly eliminating most options for an "off the shelf" solution. SCI Engineered Materials, Inc., has devised an attachment technology that can potentially meet all of the specifications listed above. Currently, SCI is in the Demonstration Phase of the project to commercialize this technology and is desirous to obtain an Ohio Third Frontier Photovoltaic Program grant to move the project to the Market Entry Phase. The purpose of the proposed project is to scale the technology developed in Demonstrating Phase to the Market Entry Phase in order to supply the TFPSC manufacturers with high performance, low cost rotatable ceramic sputtering targets for TFPSC manufacturing applications.

I will serve as the contact person for SCI and my e-mail contact information is provided below. Thank you for the opportunity to propose a project for this RFP.

Regards,

Dr. Scott Campbell
scott@sciengineeredmaterials.com

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Letter of Intent for The Ohio Third Frontier Photovoltaics Program

Lead: Ferro Corporation, 7500 East Pleasant Valley Rd., Independence, Ohio, 44131-5592

Lead Applicant Contacts: Dr. Matthew Healy (216-750-7906, healym@ferro.com) and Dr. Robert Blonski (216-750-6959, blonskib@ferro.com)

Collaborators: The Ohio State University, Edison Welding Institute, StrateNexus Technologies LLC, Wright Center for Photovoltaics Innovation and Commercialization (PVIC), Oak Ridge National Laboratory, Idaho National Laboratory

Grant Funds Requested: $1 million

Project Title: Indium-Free Transparent Conducting Electrodes with Tailored Nanoscale Enhancements for Displays and Photovoltaics

Transparent conducting oxides (TCOs) are ubiquitous throughout almost all solar cell platforms and all flat panel display technologies, including high definition television and cell phones. The growth of flat panel technologies and the need for affordable green energy are making TCOs a vital commodity to this expanding infrastructure. Indium tin oxide (ITO) is the preferred choice for TCOs; however, worldwide indium supplies are very limited and are being depleted rapidly. Thus, a vast market potential exists for any company finding a cost-effective alternative to ITO that meets the performance specifications of ITO.

The challenges of organic photovoltaics (OPV) present an ideal platform for indium replacement that could translate extremely well to the larger market sectors highlighted above. OPVs offer advantages such as cost, compatibility with flexible substrates and incorporation of plasmonic nanostructures to enhance spectral absorption.

This team, lead by Ferro, integrates key team members (OSU, StrateNexus Technologies, EWI, and the National Labs) who can uniquely address these needs. TCOs are typically synthesized by a variety of deposition techniques, particularly vacuum sputtering. However, sputtering is not very cost effective due to its low throughput and added costs associated with vacuum processing. Ferro is one of the world's leaders in supplying conductive metallization systems for solar cells. The company produces precious metal powders in various morphologies as well as the vitreous glass frits used in electronic conductor systems. Ferro also manufactures a line of organometallic precious metal compounds that form colloidal coatings. We will explore the wide area application of thin films from colloids and colloidal solution chemistry.

Another aspect of this proposal that differentiates it from other approaches is our proposal to add functionality to the TCO surfaces by embedding a self-assembled matrix of metallic nanoparticles that will absorb incident solar radiation outside the absorption range of organic polymers. The incident radiation will be converted to surface plasmon waves that induce secondary absorption in the electroactive polymers, raising the OPV quantum efficiency. If a cost effective method to add a plasmonic layer of metallic nanoparticles were developed and commercialized, it would have outstanding impact within all photovoltaic technology platforms and even provide enhanced off-axis viewability for flat panel display technologies.

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1025 Faultless Drive
Ashland, OH 44805
Ph: (419) 281-5800
Fax: (419) 281-0059

8/16/2009

RE: Letter of Intent 2010 OTFPVP

Dear Ohio Third Frontier,

Americarb Inc. is a carbon and graphite manufacturing company located in Ashland, Ohio. Since 2007, Americarb has been manufacturing components for vacuum furnace systems that produce mono crystal and poly crystal silicon ingots. These ingots are used to produce wafers for photovoltaic solar panels. Americarb's proposal is to develop improved insulating and containment systems for use in the production of silicon ingots. Americarb will collaborate with The University of Dayton Research Institute, one of the foremost institutions studying carbon materials in the United States, to provide techinical support and testing facilities for the project.

Americarb's sucessful proposal will reduce the cost of production and the use of fossil fuel generated power used to produce photovoltaic solar panels. Upon the completion of the project the lab testing results can be used to assist in the marketing and commercialization of the products for a ready and waiting $400,000,000 world market in a very short period of time, creating jobs and revenue for the state of Ohio.

Lead Applicant Contact Information:
Americarb Inc.
1025 Faultless Drive
Ashland, Ohio 44805
Email: mattr@americarbinc.com
Phone (419) 281-5800
Fax (419) 281-0059
Contact Name: Matt Reineke, President

Colloborator Information:
University of Dayton Research Institute
300 College Park
Dayton, Ohio 45469-0101
Email: Khalid.Lafdi@udri.udayton.edu
Phone: (937) 229-2113
Fax: (937) 229-2888
Contact Name: Dr. Khalid Lafdi

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Proposed Project Title: Advanced carbon materials for photovoltaic silicon ingot production.

Estimated Grant Funds requested: $1,000,000

Sincerely,

Matt Reineke
President

PVP 422

August 10, 2009

The Ohio Department of Development
Technology and Innovation Division
77 South High Street, 25th Floor
Columbus, OH 43215

RE: Ohio Third Frontier Photovoltaic Program Letter of Intent

Lead Applicant Organization: United Initiators, Inc.
Address: 555 Garden Street; Elyria, OH 44035
Phone Number: 1-800-231-2702 & 440-323-3112
Contact Person: Onofrio Palazzolo, Commercial Manager
Email Address: onofrio.palazzolo@united-in.com

Project Title: Development of Peroxide manufacturing processes to support high quality low cost photovoltaic encapsulants for photovoltaic modules.

Estimated Grant Funds Requested: $1,000,000

Known Collaborators:
Name: Jonas Angus
Title: President
Organization: TPE Solutions, Inc.
Address: 3 Patterson Road
City, State Zip: Shirley, MA 01464
Phone Number: 978-425-3033
Email Address: **jonas.angus@tpesinc.com**

Known Collaborators:
Name: Marc Gagnon
Title: Development Engineer
Organization: Bixby International
Address: One Preble Road
City, State Zip: Newburyport, MA 01950
Phone Number: 978-466-4102
Email Address: **MGG@BixbyIntl.com**

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Project Summary:

This project seeks to develop and commercialize a low cost process for producing an innovative class of peroxide crosslinking agents for photovoltaic encapsulates in photovoltaic modules. The initial development work for peroxide crosslinking agents was done in 1983 by the U.S. Department of Energy (DOE) in the report "Application of Ethylene Vinyl Acetate as an Encapsulation Material for Terrestrial Photovoltaic Modules." DOE defined 2,5-Dimethyl-2,5-di(tert.butylperoxy)hexane (DHBP) (CAS Number 78-63-7) as the peroxide crosslinking agent recommendation. This became the standard crosslinking peroxide for photovoltaic encapsulants for the next decade. It was not until The National Renewable Energy Laboratory (NREL) in the report "PVMaT Improvements in the BP Solar Photovoltaic Module Manufacturing Technology" (NREL/SR-520-32066) in April of 2002 demonstrated a new crosslinking peroxide (tert.Butylperoxy-2-ethylhexylcarbonate) (TBPEHC) (CAS Number 34442-12-4) that performed better and at lower temperatures.

United Initiator, Inc.'s intent is to develop a low cost domestic manufacturing process for DHBP and TBPEHC. As the solar market grows and government subsidies for solar applications are eliminated, there is an extreme push to reduce costs to offset lost subsidies but also to make solar energy competitive with conventional sources. This is also true in the encapsulant segment of the photovoltaic module market. United Initiators has the opportunity to develop and create a low cost supply chain process through the backward integration of raw materials and or upgrade of existing technology to be able to produce DHBP and TBPEHC. This would create a strategic advantage for United Initiators. Currently, the crosslinking peroxides for photovoltaic modules are made abroad and shipped into the U.S thus creating a competitive disadvantage due to raw materials, currency exchanges and shipping costs. The ability to manufacture DHBP and TBPEHC in the U.S. and specifically Ohio with low cost raw materials will allow the cost structure for the crosslinking peroxides to be drastically reduced thus creating a competitive advantage that would be sustainable moving forward.

United Initiators, Inc. is an Ohio-based company that has developed peroxides for over 40 years. This project is a new venture and direction for the company, and represents our continued commitment to the peroxide business and our new commitment to the solar market. Our goal is to expand Ohio's role in the solar market and create centers of excellence to promote technologies in the solar market. We feel our collaborative efforts with our partners will allow us to ensure a positive outcome, and thus create a business model that will be sustainable for generations resulting in the creation of "green" jobs.

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Letter of Intent for The Ohio Third Frontier Photovoltaics Program

Lead Applicant: Ferro Corporation, 7500 East Pleasant Valley Rd., Independence, Ohio, 44131-5592

Lead Applicant Contacts: Dr. Matthew Healy (216-750-7906, healym@ferro.com) and Dr. Robert Blonski (216-750-6959, blonskib@ferro.com)

Collaborators: The Ohio State University, Edison Welding Institute, StrateNexus Technologies LLC, Wright Center for Photovoltaics Innovation and Commercialization (PVIC), Oak Ridge National Laboratory, Idaho National Laboratory

Grant Funds Requested: $1 million

Project Title: Advanced Durability Sealing Systems for Solar Cells

Although the efficiency of second generation and third generation thin film solar cells, such as CIGS, CdTe CIS and Organic Photovoltaics (OPV), have been rapidly improving, they all share the same problem in that they are extremely sensitive to degradation caused by air and moisture. For this reason they must be encapsulated (often hermetically) to stop any ingress of oxygen or moisture from the air. Currently most second generation and third generation thin film solar cells are sealed with organic sealants. This is problematic because organic sealants typically lose their hermeticity in time, especially if exposed to UV radiation. The problem with such organic seals is exacerbated by the fact that they are exposed to daily, and seasonal temperature fluctuations that tend to weaken the hermeticity of the organic sealant. It has not yet been demonstrated that the current organic sealant technology can survive the desired twenty plus years of solar module service life without allowing a deleterious amount of oxygen or water vapor into the solar cell. Sealing of glass surfaces with a vitreous glass frit seal has proven to be a reliable method of insuring hermaticity in vacuum devices such as lamps, plasma displays and MEMS devices. Ferro supplies vitreous frits to these, and similar industries, and has the capability to engineer a vitreous frit system to reliably hermetically seal second generation second and third generation thin film solar cells for the desired service life of the solar module.

The problem to be addressed is that second generation and third generation thin film solar cells are very temperature sensitive and cannot be inorganically sealed using conventional sealing firing technologies. A product development team has been formed that consists of four Ohio organizations including The Ohio State University, Ferro Corporation, Edison Welding Institute, and StrateNexus Technologies LLC to address the serious limitations of solar cells longevity and the preservation of photovoltaic cell efficiencies. The Edison Welding Institute and Oak Ridge National Laboratory have experience in the application of a number of localized energy deposition technologies that can potentially allow for the successful vitreous hermetic sealing of second and third generation solar cells, including both laser based and ultrasonic energy deposition systems. By combining the localized energy deposition expertise of the Edison Welding Institute with Ferro's expertise in engineering vitreous sealing chemistries and StrateNexus Technologies expertise in binder synthesis and OSU's photovoltaic device engineering, it is anticipated that an advanced durability sealing system can be obtained.

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Sunflower SOLUTIONS

August 25, 2009

Ohio Department of Development
Technology Division
77 South High Street, 25th Floor
Columbus, Ohio 43215

Subject: 2010 OTFAEP Letter of Intent
VIA: E-mail to OTFAEP2010@development.ohio.gov

To Whom It May Concern:

Please let this letter serve as Sunflower Solution's notice of intent to apply for the fiscal year 2010 Ohio Third Frontier Advanced Energy Program (OTFAEP). Below is the information requested in Section 1.3.3 of the Request for Proposal for the OTFAEP. The attached project summary provides additional details about our project.

Lead applicant: Sunflower Solutions
Contact: Nick Gory
Address: 1425 W. 114th St. Suite 2 Cleveland, OH 44102
Telephone: 216-526-8855
Fax:
E-mail: nick@sunflower-solutions.com
Proposed project title: Sunflower Solutions Project
Estimated grant funds to be requested: $1 million
Target collaborators: MAGNET, Wright Center for Photovoltaics Innovation and Commercialization, University of Toledo

Sunflower Solutions LLC, is a Cleveland based renewable energy company has designed the world's first product line of manually tracking solar systems. These innovative solar systems produce 35-50% more power than traditional roof mounted systems and cost half as much as current automatic solar trackers. The products are designed and manufactured in Cleveland then exported to underdeveloped and developing areas of the world to aid in development projects that span the areas of health, education, economic development, and agriculture. They are also being targeted toward small niche markets in the States. One Laptop Per Child and Cornell University are currently using Sunflower Solutions systems to power operations in Rwanda and Kenya and were saved a total of 40% on their budget expenses for their solar power operations.

Sunflower Solutions is in talks with renewable energy distributors around the world, the United Nations, USAID, and philanthropic organizations to supply the world's lowest cost and most reliable solar tracking systems. Sunflower is seeking funds to expand its product line to offer triple the number of products to be ready for sale within the next 6 months. This product

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~~AEP 333~~

expansion moves Sunflower toward a more robust offering of manual solar tracking systems as its solar products will be expanded and reduced in size to tailor to customers' diverse needs. Commercialization of the products will be under 12 months of receiving grant funds as a substantial customer base has already been defined in need of these niche energy products.

Thank you for your assistance. Please feel free to contact me if you need additional information.

Sincerely,

Nick Gory

Attachment: Project Summary

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~~AEP333~~

Sunflower Solutions
2010 Ohio Third Frontier Advanced Energy Program Project Summary

Business Overview: Sunflower Solutions LLC, is a Cleveland based renewable energy company that designs, manufactures, and markets the world's first line of manual tracking solar energy systems. These solar power systems are manufactured in Cleveland and exported to underdeveloped and developing areas of the world.

Project Description: Sunflower Solutions has identified, designed and implemented the world's first manual solar tracking systems. These manual tracking systems produce 35-50% more power than traditional solar roof mounted systems and are half the cost of current automatic solar trackers. Sunflower Solutions currently offers 1 kilowatt to 1.5 kilowatt sized systems but has identified a large global un-served need for both smaller and larger sized manual tracking solar systems. Sunflower Solutions is requesting funds to design and implement these additional product offerings in its solar market space. These systems are exported to global renewable energy companies, NGO's, and philanthropic organizations.

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~~AEP 333~~

Ohio Third Frontier Advanced Energy Program: Letter of Intent

Lead Applicant:
buyCASTINGS.com Inc., 2411 CrossPointe Drive, Miamisburg, Ohio 45342
Contact: Neil Chaudhry, Chief Operating Officer; Phone: 937-259-1317,
E-mail: nchaudhry@buycastings.com

Project Title:
Converting Foundry Sand (an Industrial Waste) into Solar Cell Grade Pure Silicon (PureSi) to Enable Mass Commercialization of Low Cost Photovoltaic (PV) Cells for the Solar Industry

Grant Funds to be Requested:
$897,500

Collaborators:
buyCASTINGS.com, Inc., Dayton, Ohio

Ransom & Randolph, Maumee, Ohio

University of Toledo, Toledo, Ohio

The Ohio State University, Columbus, Ohio

Photovoltaic Innovation Center, Toledo, Ohio

Replex Plastics, Mount Vernon, Ohio

Ohio Cast Metals Association, Columbus, Ohio

Ferro Corporation, Independence, Ohio

~~AEP 343~~
PVP 426

Project Summary:
Converting Foundry Sand (an Industrial Waste) into Solar Cell Grade Pure Silicon (PureSi) to Enable Mass Commercialization of Low Cost Photovoltaic (PV) Cells for the Solar Industry

Project Objective: Low Cost Innovative Manufacturing of Solar Grade Silicon – an Alternative Energy Device Material, by Converting Foundry Waste, Deploying Currently Known Metallurgical Processes and Nano-technology.

We propose to convert spent foundry sand (which currently goes into landfills as solid waste) into high purity silicon which will be used to manufacture photovoltaic (PV) cells for the solar panel industry. Deploying the latest techniques in metallurgical manufacturing and nanotechnology, we will manufacture high purity silicon nano-rods which will significantly increase the solar energy efficiency over the current solar materials.

A major challenge presently facing the mass commercialization of solar energy is that there is a critical shortage of high purity silicon at an affordable price. The silicon used to make solar cells must be purified in very expensive facilities. The PV industry used to consume 10% of the world's high purity silicon (off-spec silicon from the integrated circuit industry), but this figure has recently jumped to 50%. Therefore, the goal of this program is to **lower the cost of manufacturing high purity (99.99%+ pure) silicon metal by 10x, which would lower the cost of silicon feedstock used to make PVs from ~$50/lb to less than $5/lb.**

PROPOSED SOLUTION: Develop, demonstrate, and deploy novel metallurgical routes in conjunction with nanotechnology for manufacturing high purity silicon metal - *PureSi* – in a format endowed with high photon capture and utilization efficiency. This will allow for mass commercialization of PV cells, lowering the nation's dependence on foreign oil significantly.

The 18-month program will integrate the following emergent technologies:

- Conversion of low-cost SiO_2 (foundry sand) into high purity Si metal using metallurgical technologies currently emerging in industrial markets;
- Scale-up of innovative cast metal manufacturing technologies and their application to manufacture Si metal with impurities below 0.0001% (1 ppm); and
- Development of continuous cast, high purity Si metal to allow for economical production of PV cells.

Phase 1 would involve the designing of processes for making *PureSi* and the integration of lab-scale components into prototype demonstration capability. Phase 2 would include scale-up and integration of a low-end *PureSi* capability. Phase 3 will result in the integration and demonstration of a full-scale continuous casting production system, including demonstration of engineering, manufacturing, and economic feasibility.

The team expertise encompasses the entire spectrum of technology development to product commercialization from raw material suppliers to device manufacturers, solar energy suppliers, nano-technology experts, tech transfer and market experts.

~~AEP 343~~
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A Letter of Intent

To the Ohio **Third Frontier Advanced Energy Program (TFAEP)**,

Lead Applicant: Xunlight Corporation
3145 Nebraska Avenue
Toledo, OH 43607
Ph: 419-469-8600; Fax: 419-469-8601

Contact Person: Dr. Masat Izu, Senior Vice-President, Engineering
mizu@xunlight.com; ph: 419-469-8630; fax: 419-469-8601

Proposed Project Title: ***Power Conversion Technology for Hybrid PV Autos***

Estimated Grant Funds to Be Requested: $1,000,000

Collaborating Organizations:

- The University of Toledo (Prof. Tom Stuart)
- Center for Automotive Research/The Ohio State University (Prof. Giorgio Rizzoni)

Project Summary

Xunlight proposes a project to cut the need for fossil fuels for transportation by generating electricity directly on auto bodies by developing and commercializing low-cost photovoltaic auto body panels. The PV auto panels will be manufactured using *existing* proprietary roll-to-roll technology for depositing thin-film silicon solar cells. This project can lead to widespread adoption of practical on-board PV power generation for the automobile industry, especially suited for hybrid and electric vehicles. On-board, solar-generated electricity can displace up to 40% of the gasoline and electrical needs for electric or plug-in hybrid vehicles used in typical commuter applications. The size of the automobile market provides a huge opportunity for the commercial success of this project.

Xunlight is a leader in flexible and lightweight thin-film photovoltaic (PV) modules with all our manufacturing and R&D employment located in Toledo in close proximity to many Ohio plants and companies that supply the automotive industry.

We would leverage the work done at The University of Toledo to develop a low-cost efficient DC charging mechanism for the efficient use of the PV-generated electricity for autos. We would also leverage the deep expertise of the CAR (Center for Automotive Research) program at The Ohio State University. The final envisioned commercialization is to apply these low-cost panels to the feasible surface area of hybrids and electric cars to a) significantly reduce the need for grid electricity and gasoline, b) significantly boost gas mileage and reduce air pollution; and, c) reduce the size and weight of the battery pack.

The outcome of this project would be 1) a prototype vehicle that can be successfully demonstrated to the major automotive corporations as well as Tier 1 suppliers to ensure successful market penetration and 2) a near-term commercialization plan.

~~AEP 354~~

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