

Letter of Intent for the Ohio Third Frontier Photovoltaic Program

Project Title: Photovoltaics for Sub-Saharan Africa

Estimated Grant Funds: \$1,000,000

OTFPVP 11-201

Lead Applicant:

Dr. Gregory Beaucage, Professor of
Chemical and Materials Engineering,
492 Rhodes Hall
University of Cincinnati
Cincinnati OH 45221-0012
513 556 3063
beaucag@uc.edu

Collaborators:

Dr. D. Ryan Breese
Technical Director
Eclipse Film Technologies
4434 Muhlhauser Rd. - Suite 200
(513) 942-2900
rbreesc@eclipsefilmttech.com

Dr. David Britton, Professor of Physics
University of Cape Town
Cape Town, South Africa
David.Britton@uct.ac.za
+27-21 650 3327

Summary of Project:

The third world and underdeveloped countries offer a unique market for photovoltaics since grid power is often inaccessible, unreliable and/or extremely expensive in comparison to the situation in developed countries. This proposal seeks to leverage an existing USAID project to bring solar power to Sub-Saharan Africa, with a Cincinnati based small business, the University of Cincinnati and a Georgia based NGO as well as scientists and entrepreneurs from Cape Town, South Africa to develop photovoltaic's targeting third world markets. The key specification of these photovoltaics is low production costs, making the technological and marketing strategies different than efforts that target US or European markets. The proposed work will involve modification of materials produced in Ohio at Eclipse Film Technologies for use in photovoltaic systems for export to Sub-Saharan Africa through existing contacts with NGO's affiliated with the USAID funded Nano-Power Africa Project. The Third Frontier funding will address technical and commercial barriers and will lead to significant employment in Ohio at Eclipse Film Technology.



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 26, 2010

Ohio Department of Development
Ohio Third Frontier Photovoltaics Program

OTFPVP 11-202

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 2011 RFP for the Ohio Third Frontier Photovoltaics Program. The proposed title of the project will be "Commercialization of Environmentally Stable Transparent Conductive Oxide Sputtering Targets for Thin Film Photovoltaic Solar Cell Applications". The grant funds requested will be on the order of \$1,000,000. A known collaborator for this project is Xunlight, Inc. of Toledo, Ohio.

Project Summary

One of the technical barriers to reducing the manufacturing costs of thin film photovoltaic solar cells (TFPSC) is the availability of low cost, environmentally stable transparent conductive oxide (TCO) films. The current TCO materials of choice are indium tin oxide (ITO) and indium zinc oxide (IZO). Both materials exhibit low resistivity and sufficient visible light transmission for most solar cell applications and resist degradation when exposed to the outdoor environmental conditions of power plant installations. However, since these materials contain indium, an expensive raw material (~ \$600/kg at present market prices) of relatively low abundance (only obtained as a by product of zinc mining), indium based TCO sputtering targets are prohibitively expensive for TFPSC solar panel manufacturers working to reduce panel cost to less than \$1.00 per watt (to obtain grid parity).

As a result of this issue, most manufacturers of TFPSC panels are working to replace indium based TCOs with relatively the inexpensive tin oxide or zinc oxide based TCOs. The leading candidate materials are fluorinated tin oxide (F-SnO₂) (applied to glass sheets using a CVD process), aluminum doped zinc oxide (AZO), and gallium doped zinc oxide (GZO). F-SnO₂ is only used in solar cell systems based on cadmium telluride (CdTe) and amorphous silicon (a-Si) absorbers that deposit the thin film solar cells on sheet glass substrates. Those systems using copper indium gallium selenide (CIGS) based absorbers that are deposited on flexible substrates cannot use the CVD process to deposit the TCO layer and instead are attempting to use AZO and GZO applied by sputtering. Both F-SnO₂ and GZO have exhibited environmental stability equivalent to ITO, however AZO suffers a significant degradation in electrical conductivity when exposed to hot moist air environments (all TCOs to be rated environmentally stable must withstand 1000 hours at 85°C and 85% relative humidity without and change in electrical conductivity or light transmission). GZO, although environmentally



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www.SCIEngineeredMaterials.com

stable suffers from reduced transmission in the near infrared compared to AZO and due to the gallium doping, is slightly more expensive.

SCI Engineered Materials, Inc., during research into the effect of dopants on the properties of zinc oxide thin films have identified several candidate dopants that exhibit resistivity and light transmission properties equivalent to AZO and have shown some promise with respect to environmental stability. The purpose of the proposed TFPVP project is to move this technology from the imagining phase of commercialization through to the market entry phase. Xunlight, Inc. has agreed to collaborate with SCI on this project both as a development partner and committed end user.

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



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

OTFPVP 11-203

9/2/2010

RE: Letter of Intent 2011 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 silicon containment systems for use in the production of silicon mono-crystal and multi-crystal ingots.

Americarb's successful 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 \$200,000,000 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

Proposed Project Title: Advanced containment systems for solar silicon ingot production.

Estimated Grant Funds requested: \$550,000

Sincerely,

Matt Reineke
President

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

Sent via E-mail to: OTFPVP2011@development.ohio.gov
September 3, 2010

OTFPVP 11-204

Calyxo USA Inc. is submitting this Letter of Intent in response to the Ohio Third Frontier Photovoltaics Program Fiscal Year 2011 Request for Proposals dated July 27, 2010. 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

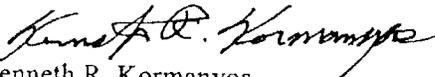
Optimization and Standardization of Atmospheric Pressure Physical Vapor Deposition Components for Improved CdTe Thin-Film PV Module Manufacturing

Estimated Grant Funds ... \$465,000

Known Collaborations

- Wright Center for Photovoltaics Innovation and Commercialization (PVIC) located at the University of Toledo, Toledo, Ohio ... Contact - Dr. Rob Collins
- Edison Welding Institute (EWI) Columbus, Ohio ... Contact – Mr. Matt White

Sincerely,



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

Project Summary - Abstract

Consistent with the goals of the Ohio Third Frontier Photovoltaic Program, (modifying existing components and systems to reduce costs and increase performance of photovoltaics), Calyxo USA will submit a proposal to optimize and standardize system components used for atmospheric pressure physical vapor deposition (APPVD) of cadmium sulfide (CdS) and cadmium telluride (CdTe) thin-films for PV modules. Specifically, the project is focused on achieving improved deposition component reliability, repeatability and uniformity for semiconductor vapor generation, distribution, and thin-film deposition on moving glass sheets.

Value Proposition and Competitive Advantage

While CdS/CdTe thin film on glass solar modules are already the lowest cost per watt and highest volume PV products available, Calyxo USA's patented deposition technology is further leveraging the low cost provider position by achieving increased material utilization, higher throughput, longer uptime and lower capital costs than competitive deposition techniques (i.e. vacuum deposition). Significantly, the Calyxo USA APPVD process is not limited in scale, meaning that glass coating widths as wide as float glass manufacturing widths are practical.

Problem Statement

The sublimation of CdS and CdTe semiconductors occurs at relatively high temperatures at atmospheric pressure. The APPVD deposition components operate in the 1,000 degree C range and require high-temperature materials to meet the process needs of the deposition functions. It is a significant technical challenge to simultaneously optimize deposition equipment designs for the strength, precision, stability and ease of furnace integration required for industrial robustness. To date, iterative design cycles have yielded a variety of implemented hardware configurations for production ramp-up that now must be standardized for economic scale-up, or "copy and paste," industrial expansions.

Goals and Objectives

Technically, the project goal is to define a standardized deposition hardware configuration that will extend coating campaign cycles by at least 2 times, but preferably up to 10 times, current cycles while achieving improvements in material utilization and deposition uniformity.

Commercially, the project goal is to meet OTFPVP Level A, B and C metrics by developing technology that will attract Ohio investment, provide a business case based on verified economics and successfully complete all development tasks. Project completion will provide a "copy and paste" deposition hardware platform that will support Ohio job creation in the Ohio PV Cluster through either deposition hardware manufacturing and engineering or possibly PV module manufacturing factories if supported by the business case analysis.

Technical Approach

Because Calyxo USA has several years experience in successful hardware development and deployment, we expect that the subsystem-by-subsystem optimization of APPVD hardware, according to rigorously defined engineering requirements, will be successful and verifiable. Specifically, improved deposition system components will be acceptance tested in a full-scale manufacturing furnace to verify compliance to operating requirements.

Collaborations

The Edison Welding Institute (EWI) will be used as a sub-contractor to develop materials joining improvements as well as providing advanced structure design simulations to determine component temperature and stress variations. Confirmation of PV module target product attributes achieved using the improved deposition system components, such as electrical performance, film morphology, composition and optics for example, will be made using Wright Center for Photovoltaics Innovation and Commercialization (PVIC).

Ohio Third Frontier Grant Letter of Intent (Project Overview)

Lead: Melink Corporation
Address: 5140 River Valley Road, Milford OH 45150
Phone: 513-965-7300
Contact: Steve Melink, President
Email: smelink@melinkcorp.com

Project Title: **Pre-Engineered Solar PV for Mass Market**

Funds Requested: \$1 Million

Collaborators:

- Manufacturers – Rough Brothers (Ohio)
- Installers – Mechanical & Electrical Contractors (Ohio)
- Distributors (potential) – AMP (Ohio), Frontgate (Ohio), Honeywell (Ohio), and Utilities (Ohio)
- End-Users - City of Cincinnati, City of Dayton, other Ohio cities & counties

Ohio Third Frontier Grant

Letter of Intent (1-Page Summary)

Pre-Engineered Solar PV for Mass Market

The purpose of this solar PV project is to further improve the design, manufacture, and installation of an already developed grid-tied 2kW prototype that is currently being tested by Melink Corporation in Cincinnati, Ohio. Because conventional solar PV systems are custom-designed and installed for residential and commercial rooftops, they are expensive, have long lead-times, and are difficult to install and maintain.

Melink is committed to helping mainstream solar PV by making the technology more affordable, convenient, and easy to maintain. This is being accomplished by standardizing the design and mass-producing it so that the engineering costs can be amortized over thousands of units rather than one. Furthermore, it is ground-mounted so that it can be installed in less than a day and easily cleaned off for optimal performance. Moreover, it is more visible than most roof-mounted systems and therefore help educate other homeowners and business owners on the benefits of solar power.

Ultimately our plan is to sell hundreds of thousands of these pre-engineered systems to homeowners, schools, businesses, and government entities in Ohio and across the U.S. and even the world. This will potentially create tens if not hundreds of jobs in our State, as well as make Ohio a national leader in the deployment of clean energy.

Melink is uniquely qualified to bring this vision and plan to reality. Our company has been in operation since 1987 and has started and grown three separate businesses. We have engineering, manufacturing, and service capabilities and serve some of the largest customers in the U.S. and world, ie. Wal-Mart. Melink has been named to the INC 5000 list of fastest growing companies 4 years in a row, and is a recognized pioneer and leader in energy efficiency and renewable energy solutions, ie. LEED Platinum Headquarters, AEE Renewable Energy Award.

Melink and its collaborators (Ohio-based manufacturers, distributors, installers, and end-users) will work together to complete the following development schedule:

Engineering Improvements in 2010 – Melink to invest \$0.5 million; OTF to invest \$0.5 million

- Improve pole, racking, and foundation design
- Improve inverter, AC/DC wiring, and raceway protection design
- Obtain UL/ETL and ULC/CSA listing
- Explore 1-axis tracking capability
- Explore battery-based system for off-grid applications (emergency relief, military, construction, camping)
- Above costs include salaries, benefits, engineering, tooling, additional prototyping, and testing.

Manufacturing & Installation Improvements in 2011 – Melink to invest \$0.5 million; OTF to invest \$0.5 million

- Manufacture pre-production run of 50-100 units for City of Cincinnati
- Install these units in strategic locations across the City to gain further experience and promote future sales
- Repeat above for City of Dayton and other Ohio cities and counties

Marketing & Sales – Melink to invest additional \$500,000 on own (to further commercialize this product)

- Set up distributors and installers across Ohio and U.S. (ie. electric car dealers, home/garden retailers, electricians)
- Sell direct/online to existing national account customers (ie. Walgreens, Target, Wal-Mart)
- Initially focus on states with grants, tax credits, and RECs which offer fast paybacks (ie. OH, CA, OR, NJ)
- Initially focus on K-12 schools, trade colleges and universities, national chains (ie. Ohio schools)
- Set target of 1,000 unit sales in 2013 ramping up to 5,000 in 2015 and 100,000 in 2020

Contact Steve Melink at Melink Corporation, Milford, Ohio if any questions: 513-965-7308; smelink@melinkcorp.com

Letter of Intent – Ohio Third Frontier Photovoltaics Program, 2011

Lead Applicant: Process Technology
7010 Lindsay Drive
Mentor, Ohio 44060
440-974-1300
www.process-technology.com

OTFPVP 11-206

Contact Person: Joel Rozga
Engineering Manager
440-974-3708
jrozga@process-technology.com

Project Title: Commercialization of Inline Heater for use in Photovoltaic Solar Cell Manufacturing

Collaborators: PVIC / OSU Nanotech West
Cleveland State University

Estimated Grant Request: \$350,000

Project Summary

The photovoltaic industry currently utilizes a wide variety of wet chemical processes that play a key role in solar cell manufacturing. These include wet chemistries such as: deionized water, solvents, surfactants, acids, and alkalis. One of the main factors for the photovoltaic industry going forward will be the ability to produce high performance devices at low cost. Process Technology currently produces a number of heating and cooling products that have been specifically designed for similar markets, but we currently do not have the ideal product specifically dedicated for the variety of photovoltaic applications. We would like to utilize grant funding from the Third Frontier Photovoltaics Program to assist in the design and development of the ideal product for photovoltaic applications which will strengthen our market position in the photovoltaic industry and by doing so will create and retain jobs in Northeast Ohio.

Our proposal is to design and market an ultrapure, low cost, intrinsically safe, inline chemical/water heater utilizing PTC heating elements. PTC heating elements are positive temperature coefficient thermistors that have a very steep, non-linear rise in resistance within a small temperature range. They are constant temperature, variable power devices that lend themselves to safe, compact, and simple construction that can produce cost effective performance for a wide variety of photovoltaic applications. PTC heating elements offer a unique approach to these applications and a single design would have the capability to heat the acids, bases, solvents, and developers in order to meet all the cleaning, etching, and stripping needs of the photovoltaic industry.

Process Technology believes that a solid photovoltaic foundation for Ohio should not only include the producers of the solar panels themselves, but it should also include the original equipment manufacturers whose innovation will support the development and enhancements of solar cell manufacturing. This is not just a philosophy of Process Technology. According to a white paper written by the PV Group, it states that regardless of which solar technology takes us to eventual grid parity, a common characteristic to the perfect photovoltaic industry will be the expertise of processing equipment manufacturers, material suppliers, automation experts, and other essential manufacturing and development providers (PVGroup, 2008).

**Iosil Energy
Corporation**

Earl Fuller
Chief Executive Officer
317 Commercial St NE
Albuquerque, NM 87102

Tel: (505) 250-1196
Fax: (505) 216-2672
Email: efuller@iosilenergy.com
Web: www.iosil-energy.com



September 8, 2010

OTFPVP 11-207

Re: Ohio Third Frontier Photovoltaics Program – OTFPVP 2011

Letter of Intent (LOI) to Propose

Dear Sir / Madam:

Iosil Energy Corporation hereby provides notice to the Ohio Third Frontier Photovoltaics Program that it intends to propose in response to the Fiscal Year 2011 Request for Proposals.

LOI Information:

Lead Applicant: Iosil Energy Corporation
317 Commercial St NE
Albuquerque, NM 87102
with operations in Groveport, Ohio
phone: (505) 250-1196

Contact Person: Earl Fuller
email: efuller@iosilenergy.com

Proposed Project Title: Optimizing Low Cost, High Purity, Manufacturing of Solar Grade Polysilicon for the Photovoltaics Industry

Estimated Grant Funds: \$1,000,000 in Third Frontier Research and Development Funds plus \$1,000,000 in Wright Capital Funds

known Collaborators: Edison Welding Institute, Columbus Ohio
others being solicited

Summary of the Proposed Project:

Iosil Energy Corporation is developing a patented and innovative, very low cost manufacturing process for the production of solar grade polysilicon, the fastest growing multi-billion dollar industry in the world. Market economics for renewable energy generation require an ever increasing rate of cost reduction for solar photovoltaics, and high-purity polysilicon is the basic raw material for production of solar cells that dominate this market. Iosil has been researching and developing this technology for three years and has raised \$13.5M in venture capital to finance the development of a scaled pre-commercial process for subsequent commercial deployment. This project will scale the process to a manufacturing level, and optimize it for the most cost effective purity level required for high-efficiency solar cells. Process optimization and



Materials Purity Characterization are key elements of the project in order to position it for commercial readiness. It will then be able to offer cost reduction without quality compromise to the solar industry in Ohio and worldwide.

Respectfully Submitted by,

Earl Fuller

McKay, Michael J.

From: Ivanov, Eugene [Eugene.Ivanov@tosoh.com]
Sent: Thursday, September 09, 2010 1:11 AM
To: OTFPVP2011
Cc: Blazic, Marty; Mackim, Mike; marti.brenner@hickspartners.com
Subject: 2011 OTFPVP LOI

September 9, 2010

OTFPVP 11-208

To Ohio Department of Development:

Please accept this Letter of Intent from Tosoh SMD, Inc. for our Fiscal Year 2011 Ohio Third Frontier Photovoltaic Program (OTFPVP) proposal. The requested information about our proposal is as follows:

Lead Applicant: Tosoh SMD, Inc.

Address: 3600 Gantz Road

Grove City, Ohio 43123

Contact Person: Eugene Ivanov

Contact Telephone: 614-277-4130

Contact Email: Eugene.ivanov@tosoh.com

Proposed Project Title:
Commercialization of CIGS sputtering targets used in thin film solar cell manufacturing

Estimated Grant Amount: \$1,000,000

Known Collaborators/Potential commercial partners: Xunlight, W&K, GSE, FSLR

Proposed Project Summary:

Using a mechanical alloying technique, Tosoh will develop and market sputtering targets used for manufacturing of CIG/CIGS (Copper Indium Gallium / Copper Indium Gallium Selenide) solar cells. CIGS solar cells have received significant attention and interest in recent years because of their high efficiency. Utilizing the technology outside of the lab has been a challenge as a result of the complexity of manufacturing.

One of the existing problems in CIGS PV cell manufacturing is composition control of the CIGS layer. Stoichiometric CIG and CIGS sputtering targets will significantly improve process control and replace multi-step deposition process with single PVD process thus decreasing manufacturing cost and improve process stability. Specific tasks for this project will include:

- development of solid state process for manufacturing of CIG/CIGS powder;
- optimization of powder consolidation process to obtain a target body; and
- development of optimized sputtering parameters.

Tosoh SMD and its collaborators will request Ohio Third Frontier funding to accelerate the development and commercialization of this important advancement in manufacturing photovoltaic technology.

Kind Regards,

Eugene Ivanov

Director of Technology/Proposal Leader

Disclaimer - 9/8/2010

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September 9, 2010

Ohio Third Frontier
Photovoltaics Program
Fiscal Year 2011
OTFPVP2011@development.ohio.gov

OTFPVP 11-209

Letter of Intent
"2011 OTFPVP LOI"

Lead Applicant's Name: Energy Focus, Inc.
Lead Applicant's Address: 32000 Aurora Rd.
Solon, OH 44139
Lead Applicant's Phone #: 440-715-1288
Contact Person: Laszlo Takacs
Director of Research and Development
ltakacs@efoi.com

Proposed Project Title: "High Efficiency Photovoltaic Enabled Off-Grid System"
Estimated Grant Funds: \$1,000,000
Known Collaborators: EFOI, OSU, Replex Plastics

Project Summary:

A low concentration (2x – 10x) photovoltaic system will be developed and manufactured in Ohio. The system will take advantage of the low -accuracy point 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 and Silicon substrates will be developed at the Ohio State University 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.

Thank you.

www.energyfocusinc.com

32000 Aurora Road Solon, Ohio 44139
Tel (800) 327-7877 Fax (440) 715-1314

September 9, 2010

Ohio Third Frontier
Photovoltaics Program
Fiscal Year 2011
OTFPVP2011@development.ohio.gov

OTFPVP 11-210

Letter of Intent
"2011 OTFPVP LOI"

Lead Applicant's Name: Energy Focus, Inc.
Lead Applicant's Address: 32000 Aurora Rd.
Solon, OH 44139
Lead Applicant's Phone #: 440-715-1288
Contact Person: Laszlo Takacs
Director of Research and Development
ltakacs@efoi.com

Proposed Project Title: "Photovoltaic Liquid Phase AR Coating"
Estimated Grant Funds: \$1,000,000
Known Collaborators: None

Project Summary:

A liquid phase AR coating product for photovoltaics will be developed and manufactured in Ohio. The Si PV industry has settled on Si₃N₄ as a passivation layer on monocrystalline and polycrystalline Si devices. The passivation properties are not ideal for an optical matching layer. This project develops a new material system on the PV device which can provide good surface and bulk passivation while also providing outstanding optical coupling. The novel new structure enables improved PV plant throughput and cell efficiency. The resultant product will assist in making solar power generation competitive with retail / wholesale electricity market rates. This project assists in restoring the US as a leader in advanced technologies, and accelerates commercialization of clean energy technologies across America.

Thank you.

www.energyfocusinc.com

32000 Aurora Road Solon, Ohio 44139
Tel (800) 327-7877 Fax (440) 715-1314

September 9, 2010

Ohio Third Frontier
Photovoltaics Program
Fiscal Year 2011
OTFPVP2011@development.ohio.gov

OTFPVP 11-211

Letter of Intent
"2011 OTFPVP LOI"

Lead Applicant's Name: Energy Focus, Inc.
Lead Applicant's Address: 32000 Aurora Rd.
Solon, OH 44139
Lead Applicant's Phone #: 440-715-1288
Contact Person: Laszlo Takacs
Director of Research and Development
ltakacs@efoi.com

Proposed Project Title: "Concentration Retrofit Kit Which Maintains Photovoltaic Reliability"
Estimated Grant Funds: \$1,000,000
Known Collaborators: None

Project Summary:

A concentration retrofit kit for photovoltaics will be developed and manufactured in Ohio. The concentration is completed with coated plastic delivered on reels. An elegant solution to inherent reliability issues with retrofitted connectors is integrated into the coating. The proposed project is enabled by breakthroughs developed under the Defense Advanced Research Projects Agency (DARPA) Very High Efficiency Solar Collector (VHESC) program.

Thank you.

www.energyfocusinc.com

32000 Aurora Road Solon, Ohio 44139
Tel (800) 327-7877 Fax (440) 715-1314



Buckeye Silicon 2600 Dorr St. Toledo, OH 43607

Contact: Ryan Reiter

OTFPVP 11-212

Phone: 419.724.BeSi office 248.231.6218 cell

Email: rr@besilicon.com

Project Title: Advanced PV **Green Polysilicon™** Production

Estimated Grant Funds Requested: \$1 Million

Known Collaborators: Toledo Lucas County Port Authority, University of Toledo, Regional Growth Partnership, Rocket Ventures, IPS – Industrial Power Systems

Dramatically improve the efficiency of PV-Grade Polysilicon production (~ 50%). Buckeye Silicon's new **Green Polysilicon™** process is safer, more economical and environmentally friendly than traditional polysilicon production methods. Buckeye Silicon requests Ohio Third Frontier funding to upgrade manufacturing process from Version 2 to Version 3 machines.

Project Summary:

Buckeye Silicon's new solar grade polysilicon manufacturing process, **Green Polysilicon™**, has eliminated the emissions of hazardous and toxic chemicals that are found in the traditional polysilicon manufacturing. Buckeye Silicon also developed a far more cost effective polysilicon manufacturing process through energy efficiency (~ 65%). Buckeye Silicon's modular approach also creates an ease in scalability vs. extremely large capital requirements in traditional polysilicon manufacturing.

Buckeye Silicon will begin production in Toledo, OH November 2010. This initial Ohio installation will serve as a small scale manufacturing facility. Current and future, strong polysilicon demand will require additional machines be built and installed online immediately. Buckeye Silicon continues to refine its solar grade polysilicon manufacturing process with new, more advanced versions of the original **Green Polysilicon™** systems – RCP Version 2 (reductive Combustion Process). Buckeye Silicon is currently in the 4th stage of commercialization identified by Ohio Third Frontier - **Mobilizing Resources for Market Entry.**

Buckeye Silicon is requesting Third Frontier funding to support upgrades for new Version 3 machine systems from Version 2 which lower cost, improve production efficiency and reduce production costs (~50%) even further. Requested funding from Ohio Third Frontier will assist Buckeye Silicon to enter the final stage of commercialization identified by Ohio Third Frontier - **Mobilizing Resources for Growth and Sustainability.** Financial assistance through Ohio Third Frontier will advance this cutting-edge technology more rapidly and accelerate job creation for NW Ohio. Immediate job creation is expected to begin 4th Qtr. 2010 and with OTF funds, additional job creation will occur 1st Qtr. 2011 (up to 150 net-new jobs).

OTFPVP 11-213

2011 OTFPVP LOI

Lead applicant name	DyeTec Solar, Inc.
Address	811 Madison Avenue Toledo, OH 43604
Phone number	419.247.4974
Contact person	William N. McCreary, Chairman of the Board
Contact e-mail address	William.McCreary@nsg.com
Project Title	Dye-Sensitized PV Architectural Glass
Estimated grant funding request	\$1,000,000
Known collaborators	Pilkington North America (Toledo, OH)

Project Summary

Public policy goals and market expectations remain largely unfulfilled for the widespread installation and significant aggregate electricity generation of photovoltaic (PV) solar. PV markets, defined by end use as utility, commercial, or residential, have been led by utilities. Utility markets account for nearly all PV electricity generation in the United States, while commercial and residential building market adoption has lagged. Utility economics of multi-decade PV paybacks, project siting in ideal climates, and economies of scale achieved by sheer installation size are not applicable in the commercial and residential market segments. Highly extended payback terms with large capital investments cannot be borne in the commercial and residential markets, as they operate under stricter financial models than the electric power industry. For these markets, the cost and inadequate electricity-generating capability of PV products have combined for a high-cost, low-impact energy generation proposition that is not cost competitive with grid-supplied electricity. Furthermore, conventional PV technologies have not penetrated this market due to very high capital costs as a fraction of the actual building value, so other spending options can easily crowd out a PV installation.

In response to high-cost, poor reliability, and low-performance PV for commercial and residential markets, there has been a focus on developing building-integrated PV (BIPV) products. The concept of a BIPV product is that it replaces one-for-one an existing product in the structure, which means roofing, siding, or windows. Since the building would require these elements anyhow, BIPV products allow the power generation benefits to be measured against only the incremental cost of the BIPV product itself. While certain PV materials are achieving greater overall electricity generation, particularly thin-film coatings with optimized surface morphologies to gather more ambient light, none have yet been able to provide a workable BIPV product. In spite of advances, no BIPV product has been commercialized that achieves installed cost parity with the U.S. average cost of grid-supplied electricity, let alone a comparable leveled cost.

To further lower PV solar cost, increase performance, and stimulate adoption in commercial and residential markets, DyeTec Solar builds upon DyeSol Inc.'s dye-sensitized PV innovation and collaborator Pilkington North America's position as a world-leading manufacturer of architectural glass to deliver a new BIPV solution. DyeTec Solar's BIPV product is commercial and residential window glass, to be developed with the high visibility and transparency properties of today's window glass, but also having superior light-gathering PV capability throughout daylight hours. It is the unique ability to efficiently convert light into electricity throughout the day as sun angle changes which differentiates it apart from current PV products, and makes it a perfect fit for BIPV applications where the product must be functionally installed in the building. This product will make DyeTec Solar a first mover in the BIPV window market, and further extend the growing solar cluster in Northwest Ohio.

DyeTec Solar intends to request \$1,000,000 for this project, "Dye-Sensitized PV Architectural Glass," to investigate the development of dye-sensitized PV cells for application in architectural glass. Primary areas of technical investigation will include the engineering and fabrication of production equipment, establishing prototype analysis capabilities, fabricating and testing 12" x 12" prototypes, and optimizing prototype efficiency. Technical outcomes are anticipated to include the design for a prototype production line, efficiency-tested 12" x 12" prototype cells, and efficiency optimization by the modulation of material inputs and fabrication processes. Primary areas of commercial investigation will include refining the cost model as prototype production data is collected, continuing market analysis, and protecting intellectual property by patent filing.

September 9, 2010

OTFPVP 11-214

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

Dear Ohio Department of Development:

Please accept this letter of intent from eQED, LLC for our Fiscal Year 2011 Ohio Third Frontier Photovoltaic Program ("OTFPVP") proposal.

Lead Applicant Name: eQED, LLC
Address: 700 Beta Drive, Suite 100
Mayfield Village, OH 44143
Telephone: (440) 484-2225
Contact Person: Dr. Hiroyuki Fujita, President and CEO
Contact Email: hiroyuki.fujita@quaedyn.com
Project Title: Commercialization of Next Generation Solar Microinverters for Photovoltaic Power Systems
Estimated Grant Amount: \$1 million
Known Collaborators: Case Western Reserve University, QED and others to be determined

Summary of the Proposed Project:

eQED, LLC ("eQED") was started in 2010 with the vision to revolutionize solar microinverters through advanced technical innovation. eQED's parent company, Quality Electrodynamics ("QED"), has earned an outstanding reputation in the global medical imaging industry. The proposed OTFPVP project allows eQED to leverage its parent company's core competencies in medical imaging, electrical engineering, product development and manufacturing to successfully diversify into the photovoltaic ("PV") renewable energy industry.

A solar inverter converts the direct current ("DC") produced by a PV array into usable alternating current ("AC") to generate power. PV installations have traditionally used central inverter technology to aggregate and convert the power generated by the entire array of PV modules. With central inverters, if a single PV module in the array fails, the entire array operates inefficiently. Microinverters offer an alternative to central inverters by providing system design and operational performance advantages.

In collaboration with QED, Case Western Reserve University, a large international solar panel OEM, and other Ohio-based entities, eQED plans to continue product development activities on its optimized microinverter for use in PV installations around the world. OTFPVP resources will enable eQED to continue the development of its microinverter and demonstrate the technology at installations in Ohio for data collection and product evaluation.



HF

While still in its infancy, the microinverter market presents a unique opportunity for eQED to apply its engineering expertise and novel microinverter value proposition to a growing industry with a well defined market need. eQED believes its microinverters will provide significant advantages over existing central inverter technologies including superior reliability, efficiency and increased return on investment for system owners.

eQED's proposed OTFPVP project will commercialize a novel microinverter technology in Ohio and advance the OTFPVP goal of accelerating the development and growth of Ohio's PV industry and its supply chain.

Sincerely,



Dr. Hiroyuki Fujita
President and CEO



Low Cost Concentrated PV Design

Lead Applicant: GreenField Solar Corp.

Address:

126 Artino Street
Oberlin, OH 44074

OTFPVP 11-215

Telephone: 440-596-6802

Contact Person: Mico Perales

Email address: mico.perales@greenfieldsolar.com

Project Title: Low Cost 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

Low Cost Concentrated PV Design

Summary of Proposed Project

GreenField Solar Corp (GreenField), Ohio's only producer of concentrated photovoltaic (CPV) solar energy systems, that produce electric and thermal energy for the utility scale market, is submitting this proposal for consideration for the Ohio Third Frontier Photovoltaics Program. Our unique CPV system, the StarGen, 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 execution of this proposal will accelerate our effort to drive down our product's costs and achieve a price leadership position.

We have deployed StarGen demonstration units across Ohio demonstrating the viability of our technology; however, we must reduce installed system costs in order to achieve mass market acceptance. Our Third Frontier project supports and accelerates our engineering effort to reduce StarGen total installed system prices to \$3.00 per peak watt. Furthermore, by the completion of the project, we will establish the manufacturing capacity and competency to achieve volume production of StarGen systems, through both in-house capabilities and within our supplier base, much of which is in Ohio.

With the completion of our project, we will demonstrate performance of our 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 UL product certification

Together with our collaborators and other stake holders, 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.



OTFPVP 11-216

September 9, 2010

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

Re: 2010 OTFPVP2010 LOI

Dear Administrator,

Willard & Kelsey Solar Group is pleased to submit a letter of intent in response to your solicitation referenced above. We are aggressively establishing a large-volume manufacturing operation based on thin film CdTe PV modules. We have demonstrated greater than 10% module efficiency from our high throughput coater and prototype module manufacturing line. The base-line plant with 70MW/year capacity is being built in Perrysburg with production start scheduled for the first quarter of 2011. Production will increase to hundreds of MW/year by multiplication of the base-line plant. We will be submitting a proposal with a title as follows:

Project Title: "Improved Back Contact Electrode for high-efficiency CdTe Solar Modules"

Estimated Grant Funds: \$1M

Known Collaborator: None. We strategically intend to develop core capabilities in-house

The lead applicant will be: Syed Zafar, Director of Research and Development
Willard & Kelsey Solar Group
1775 Progress Drive, Perrysburg, OH 43551
Email: szafar@wksolargroup.com

Project summary: Recent years have demonstrated successful deployment of CdTe-based solar modules in the commercial energy industry. The industry's primary goal going forward is to improve conversion efficiency of solar modules and reduce cost to compete with energy generated from fossil fuels. CdTe based solar cells reveal ohmic losses at metal/CdTe interface which often increases to higher levels during long-term field exposure. This is one of the primary issues the improvement of which will lead to significant reduction in module cost to customers. Our intent from this grant is to engineer novel bulk and surface materials that can help to alleviate these problems. The funds from this grant will help to develop appropriate tools to explore improved device architecture suitable for large scale manufacturing which will then lead to improved efficiency and reduced costs.

Best regards,

A handwritten signature in black ink, appearing to read 'Mossie Murphy', is written over a white background.

Mossie Murphy
Chief Financial Officer
Willard & Kelsey Solar Group

1775 Progress Drive
Perrysburg, Ohio

419-931-2001
Fax 419-931-2030

www.wksolargroup.com
info@wksolargroup.com



OTFPVP 11-217

September 9, 2010

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

Re: 2010 OTFPVP2010 LOI

Dear Administrator,

Willard & Kelsey Solar Group is pleased to submit a letter of intent in response to your solicitation referenced above. We are aggressively establishing a large-volume manufacturing operation based on thin film CdTe PV modules. We have demonstrated greater than 10% module efficiency from our high throughput coater and prototype module manufacturing line. The base-line plant with 70MW/year capacity is being built in Perrysburg with production start scheduled for the first quarter of 2011. Production will increase to hundreds of MW/year by multiplication of the base-line plant. We will be submitting a proposal with a title as follows:

Project Title: "Alternative n-type Materials for CdTe-based Solar Modules"

Estimated Grant Funds: \$1M

Known Collaborator: None. We strategically intend to develop core capabilities in-house

The lead applicant will be: Syed Zafar, Director of Research and Development
Willard & Kelsey Solar Group
1775 Progress Drive, Perrysburg, OH 43551
Email: szafar@wksolargroup.com

Project summary: Recent years have demonstrated successful deployment of CdTe-based solar modules in the commercial energy industry. The industry's primary goal going forward is to improve conversion efficiency of solar modules and reduce cost to compete with energy generated from fossil fuels. While record efficiencies are achieved with CdS as a heterojunction partner, it exhibits no photovoltaic due likely to the valence band off set at the metallurgical interface. Our intent is to evaluate several new alternative n-type compound semiconductor materials and, with appropriate analytical tools and techniques, develop improved device architecture suitable for large scale manufacturing which will then lead to improved conversion efficiency and reduced costs.

Best regards,

A handwritten signature in black ink, appearing to read 'Mossie Murphy', is written over a white background.

Mossie Murphy
Chief Financial Officer
Willard & Kelsey Solar Group

1775 Progress Drive
Perrysburg, Ohio

419-931-2001
Fax 419-931-2030

www.wksolargroup.com
info@wksolargroup.com



OTFPVP 11-218

September 9, 2010

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

Re: 2010 OTFPVP2010 LOI

Dear Administrator,

Willard & Kelsey Solar Group is pleased to submit a letter of intent in response to your solicitation referenced above. We are aggressively establishing a large-volume manufacturing operation based on thin film CdTe PV modules. We have demonstrated greater than 10% module efficiency from our high throughput coater and prototype module manufacturing line. The base-line plant with 70MW/year capacity is being built in Perrysburg with production start scheduled for the first quarter of 2011. Production will increase to hundreds of MW/year by multiplication of the base-line plant. We will be submitting a proposal with a title as follows:

Project Title: "Improved quality of CdTe for high-efficiency Solar Modules"

Estimated Grant Funds: \$1M

Known Collaborator: None. We strategically intend to develop core capabilities in-house

The lead applicant will be: Syed Zafar, Director of Research and Development
Willard & Kelsey Solar Group
1775 Progress Drive, Perrysburg, OH 43551
Email: szafar@wksolargroup.com

Project summary: Recent years have demonstrated successful deployment of CdTe-based solar modules in the commercial energy industry. The industry's primary goal going forward is to improve conversion efficiency of solar modules and reduce cost to compete with energy generated from fossil fuels. CdTe solar cells reveal lower Voc which is attributable to excessive compensation that leads to lower net doping density. While Cu is used as an extrinsic dopant, it exhibits high mobility in CdTe and causes long-term stability problems. Our intent from this grant is to evaluate several potential dopants and alloying of CdTe in order to improve bond strength of Cu or other dopants to the host lattice. The funds will help to develop appropriate tools to explore improved device architecture suitable for large scale manufacturing which will then lead to improved efficiency and reduced costs.

Best regards,

A handwritten signature in black ink, appearing to read 'Mossie Murphy', is written over a white background.

Mossie Murphy
Chief Financial Officer
Willard & Kelsey Solar Group

1775 Progress Drive
Perrysburg, Ohio

419-931-2001
Fax 419-931-2030

www.wksolargroup.com
info@wksolargroup.com

Lead Applicant:

Benjamin T. Bernard
Director, Business Development
Surface Combustion, Inc.
1700 Indian Wood Circle
Maumee, OH 43537

OTFPVP 11-219

(P) 419/891-7134

Benjamin T. Bernard
(e) bbernard@surfacecombustion.com

Project Title: First Solar Heat Activation Furnace

Estimated Grant Funds to be Requested: \$975,000.00

Collaborator:

First Solar, Inc.
28101 Cedar Park Blvd.
Perrysburg, OH
Key Contact: Steve Murphy

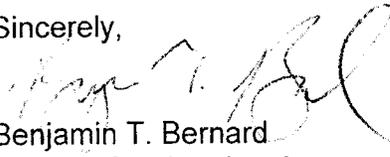
Project Summary:

Surface Combustion, Inc. (a Maumee Ohio based company) has manufactured or licensed 250,000 thermal processing systems worldwide. The process knowledge from these installations will be applied to specific requested operational parameters and improvements by a solar panel OEM. Surface Combustion and First Solar are in initial discussions regarding a specific R&D project. The project is to design and prototype a heat activation furnace for manufacturing of First Solar thin film solar modules as defined in the equipment technical specifications which will include: Improvements in process control of the defined manufacturing operation, improvements in equipment cycle time, capability to measure process parameters during operation, and compliance to First Solar Environmental Health and Safety requirements. The new heat activation furnace is a modification to an existing proven technology. First Solar has achieved proof of concept of the heat activation technology. Surface Combustion has experience with manufacture and supply of atmosphere tight, continuous industrial furnace units.

By collaborating together and with State of Ohio support, a photovoltaic commercial supply chain in Northwest Ohio may be realized. The project work will occur at Surface Combustion's plant in Waterville, Ohio using primarily Ohio suppliers and vendors. The goal of the project is to satisfy the requirements of First Solar's technical specification and thereby establish a Northwest Ohio engineering firm, OEM for a supply of furnace equipment for future plant installations.

By leveraging the significant private investment and ninety-five (95) years experience of Surface Combustion, First Solar's photovoltaic production experience, and support of this Ohio Third Frontier Photovoltaic Program grant, the goals can be met.

Sincerely,



Benjamin T. Bernard
Surface Combustion, Inc.
1700 Indian Wood Circle
Maumee, OH 43537
(419)891-7134

McKay, Michael J.

From: Joseph Recchie [jrecchie@gmail.com]
Sent: Friday, September 10, 2010 8:55 AM
To: OTFPVP2011
Cc: Joseph Recchie
Subject: 2011 OTFPVP LOI

OTFPVP 11-220

Re: Letter of Intent, Ohio Third Frontier 2011 OTFPVP LOI

Ladies and Gentlemen:

Please be advised that Community Building Systems, Inc., an Ohio corporation, as proposed lead applicant, intends to submit an application under the OTF PVP program in conformity with the following information:

Lead Applicant Name: Community Building System, Inc.
Address: 3758 Lancaster Road
Granville, Ohio 43023
Contact Person: Joseph J. Recchie
Phone: 614-306-0640
Email: jrecchie@gmail.com
Anticipated Collaborators: Licking County
Hocking Energy Institute
Central Ohio Technical College
Community Renewable Energy LLC
First Solar
Proposal Type: OTFPVP 2011 grant Photovoltaic Program
Title: Central Ohio Renewable Energy Jobs
Estimated Grant: \$1 Million

Synopsis

Central Ohio Renewable Energy Jobs intends to capitalize on federal and state legislation encouraging the investment in solar pv renewable energy systems and to develop a local work force and supply chain to accommodate such investment. Utilizing innovative capital formation techniques including the Federal Energy Tax Credit/Rebate, the long term sale of SREC and the placement of PACE bonds with available credit enhancement, the program will enable the investment by residential and commercial users in renewable energy systems, systems to be constructed and installed with the maximum state based content and labor. The innovative and highly replicable processes include:

1. Capital formation to achieve stable, low cost funding for end users.

2. Streamlining the supply chain to achieve standardization, modular-bench tested system construction and certified installation.
3. Ongoing maintenance of systems by locally developed businesses.

Grant and matching funds will be used for authorized expenditures in streamlining the supply chain, developing the modular construction model for commercial scale operation and implementing a certified and trained work force. Significant barriers to commercialization of renewable energy systems will be overcome, documented and promoted for replication throughout the State of Ohio in a real time open reporting protocol.

Respectfully submitted,

Joseph J. Recchie

2011 OTFPVP Letter of Intent

Lead Applicant's Name: Ecolibrium Solar, LLC
Address: PO Box 5668, Athens, OH 45701
Phone Number: 740-205-6783
Contact Person: Brian Wildes
Contact Email Address: brian@ecolibrumsolar.com
Project Title: Low cost flat roof mounting system
Estimated Grant Funds To Be Requested: \$200,000
Known Collaborators: Paul J. Ford and Company
Composite Technologies (CTC)

Summary of Project:

Government subsidies have historically supported the solar industry enabling significant cost reductions. However, in order to compete with traditional energy sources without subsidies, solar energy costs must continue to decrease. The cost of mounting equipment and installation labor constitutes a significant portion of the installed cost of a PV system. Ecolibrium Solar has developed a flat roof mounting system that will significantly reduce these costs. The novel design allows the installer to use any PV module and install in either portrait or landscape orientation without any custom fabrication required at the factory or on site. The design consists of two parts and one fastener, with no tools required, allowing for a fast installation. Most importantly, the low cost structure of this design allows for its sale at half the cost of other mounting systems.

Analysis of wind loads will be conducted at the University of Dayton. These results will be used by a professional engineering firm located in Columbus, Ohio - Paul J. Ford and Company - to ensure that the system conforms to code ASCE 7-05. Composite Technologies located in Dayton, Ohio will be the material compounder and injection molding manufacturer. This grant in conjunction with local partnerships will propel Ecolibrium Solar into commercialization with strong product, marketing, and company structure.

A Letter of Intent

To the 2011 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: Mr. John Buckey (Vice President, Marketing)
jbuckey@xunlight.com; ph: 419-469-8677; fax: 419-469-8601

Project Title: **Systems-Level Innovations using Flexible PV Products**

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

Collaborating Organizations: To be determined

Project Summary

Xunlight Corporation proposes to develop and demonstrate cost-effective models for system installations that leverage the advantages of its unique lightweight, flexible thin-film silicon-based solar modules. This project is expected to lead to advancements that will significantly lower total PV systems cost, reduce deployment time and enable PV applications in new market areas.

Growing PV demand and declining prices are driving solar companies worldwide to cut costs. In order to maintain its strong position in this increasingly competitive PV market Xunlight is working on next generation technologies as well as continuously improving its product and production technology to improve efficiencies and production costs for its solar modules. However, as module costs drop there is an increasing focus on the installation and balance-of-systems cost components of a PV system. Today, these components and methods are often selected based on the flat plate (glass-based) modules that currently dominate the market. Unlike conventional modules, Xunlight's modules are lightweight, thin and flexible, and do not need extensive racking systems, roof or wall penetration, all critical decision criteria for a PV system. Xunlight proposes to develop and demonstrate optimized installation methods that will allow systems built with its products to reach their ultimate market potential.

This project is expected to strengthen Toledo, OH-based Xunlight Corporation's competitive position in the PV industry. It can also be also expected to enhance northwest Ohio's PV strengths by creating new partnerships with component manufacturers and PV installers who are trained to optimize the application of Xunlight modules to create cost-effective large-scale PV systems.

**A Letter of Intent
to the Ohio Third Frontier Photovoltaics 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: *Semitransparent Building-Integrated PV*

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

Known Collaborating Organizations:

- Xunlight Corporation
- The University of Toledo
- DuPont CPM Business Unit

Project Summary

Xunlight 26 Solar will team with *Xunlight Corporation* and *The University of Toledo* for the development of ***Semitransparent Building-Integrated PV***. This project will develop solar-electric modules in the form of thin-film photovoltaics (PV) on flexible polymer substrates and as coatings directly applied to window glass. This innovation complements PV products designed for rooftops and ground-mounted arrays. It is particularly suited for buildings with large amounts of window area and provides a fully building-integrated PV window system suitable for new construction and retrofits as well as a lamination product that can be applied to existing windows. *Xunlight 26 Solar* and *The University of Toledo* have demonstrated a small-area PV device with efficiency over 7% and transparency of about 5% and this project is designed to demonstrate cost-effective manufacturability by developing prototype modules of ~ one square foot and larger. The prototype modules will be monolithically integrated with laser scribing into high voltage modules suitable for a variety of power needs in buildings, including grid integration.

In comparison with existing rigid and flexible transparent PV module products now on the market, this innovative product can provide significantly higher efficiency, new market potential, and additional job creation opportunities over traditional PV installations. The 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. This project will include collaboration with *The University of Toledo's* PV group that further leverages on-going and prior Third Frontier investments. Our team will work also with the *DuPont CPM Business Unit* in *Circleville, OH*, to develop and test the flexible PV laminate products.

Xunlight is a leader in flexible and lightweight thin-film silicon photovoltaic modules with headquarters, manufacturing and R&D 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 and modules using advanced magnetron sputtering processes.



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: Integration of PV into Critical Power Sites

Estimate Dollars Requested: \$1,000,000 in Third Frontier R&D Funds
\$1,000,000 in Wright Capital Funds

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 Van Donkelaar

EMTEC Programs:

Energy Development

- Alternative Energy Materials
- Supply Chain Development

Advanced Materials

- Core Technology
- New Product Development PDQ Center

Commercialization

- Business Development
- Materials Help Desk – RFH

International Services

- Bilateral Trade Support
- Foreign Company Attraction

Technology Transfer

- Air Force Research Lab
- SBIR Support

Procurement Technical Assistance Center

- Training
- Networking

Small Business Centers

- Business Assistance
- Capital Formation

The Edison Materials Technology Center

An Ohio Edison Technology Center



Electric power users with critical power reliability requirements want to use solar energy now that it has reached cost parity with grid electricity. They have been unable to do so because of the integration costs associated with the intermittent nature of solar power. Users such as data centers, dispatch centers, systems control centers, and traffic management need electric energy without interruption. They commonly use uninterruptible power supply (UPS) systems to provide 99.999% electricity availability. Typical utility grid availability is 99.97% and typical solar power availability is less than 50%. This makes the need for conditioning solar power obvious in order to meet the end customer's requirements.

There are many drivers in the decision to use solar power. The typical UPS users are large scale consumers of electricity and have been mandated by local, state, and federal governments to reduce their use of energy with its associated pollutants and to increase their energy efficiency. The UPS, which includes power conditioning and control, provides a unique opportunity to integrate intermittent resources with dispatchable resources in order to meet the customer's needs for clean, efficient, stable electric energy.

Liebert's customers see an opportunity to realize improved efficiency as well as lower initial capital costs by leveraging the existing power conversion stages in the UPS in lieu of a separate PV (Photovoltaic) inverter. The proposed program includes development of an integrated PV and UPS system that offers these benefits while maintaining reliable power to the critical load. These integrated systems will expand the market for UPS systems manufactured by Liebert in their Delaware, Ohio plant.

The results of this project will be extrapolated to the smart grid using modeling and simulation in the OSU Mechatronics Lab. Therefore the impact of this development effort will be applicable on a state and national level.

**Ohio Third Frontier Photovoltaics Program
Letter of Intent for Proposal 2011 OTFPVP**

Prospective Applicant: Heyabby Renewable Energy, Inc.

Prospective Applicant's Address: 1521 Georgetown Rd., Ste 307
Hudson, OH 44236

Contact Person: Yohannes Haile

Phone Number: 330-655-9262

Email Address: yhaile@heyabbyrenewables.com

Expected Collaborators: BGSU – Photochemistry Department

Proposal Type: Photovoltaic Program

Proposed Project Title: Advanced Wet Cell Development (Ez4715)

Estimated Dollar Request: \$300,000

Heyabby Renewable Energy, Inc. is a creative renewable energy systems developer to meet the growing world energy demand in a sustainable way, increase our energy security and environmental stewardship. To these ends, Heyabby is engaged in the development of advanced energy conversion systems, optimized energy systems integration, verification and validation, deployment and O&M.

Summary of Proposed Project:

Solar photovoltaics power generation for grid-tied and standalone systems has a great market potential here in the U.S. and overseas. In order to hasten the large scale implementation of solar PV power generation, we surmise it is essential to develop a solar PV system with built-in passive modular energy storage system. In this proposal we plan to investigate and develop a cost effective and efficient PV system that has comparable or better efficiency with crystalline and thin film PV with the added benefits of built-in energy storage and power conditioning attributes, while reducing the device and system cost per kWhr.

OTFPVP 11-226

September 10, 2010

Ohio Third Frontier Photovoltaics Program
Ohio Department of Development
Technology and Innovation Division
77 S. High St., 25th Floor
Columbus, Ohio 43215

To Whom It May Concern:

This letter represents a Letter of Intent filed by the Lead Applicant, in conjunction with the Known Collaborators, under the 2011 Ohio Third Frontier Photovoltaics Program (2011 OTFPVP) RFP issued July 27, 2010. Set forth below is the information required to be submitted in the Letter of Intent under the RFP.

Lead Applicant: **Solscient Energy, LLC**
2600 Dorr St.
Suite 2000A
Toledo, Ohio 43606
Ph. 419.725.3531

Contact Person: W. Granger Souder
gsouder@solscient.com
Ph. 419.725.3531

Project Title: "Low Cost High Labor Efficiency PV Installation Methodology for Sloped and Flat Rooftops Without Penetration"

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

Known Collaborators: **T.A. Industrial Solutions, Inc.**, Perrysburg, Ohio, a provider of abrasive, cutting tools and industrial services and supplies (TAI). TAI has developed for commercial sales a proprietary ballasted PV solar racking system and is a 3M Distributor and a representative of 3M's Renewable Energy Division.

3M Co., St. Paul, Minnesota, is a diversified technology company which manufactures, among other things, high quality adhesives and tapes for industrial and commercial applications.

University of Toledo, Toledo, Ohio, and the Wright Center for Photovoltaic Innovation and Commercialization

Proposed Project Summary

Solscient Energy will collaborate with TA Industrial, 3M and the University of Toledo to develop a photovoltaic solar module installation methodology for sloped and flat metal rooftops which will avoid the necessity for rooftop penetrations and thereby greatly enhance the attractiveness of commercial PV rooftop applications. The objectives of the proposed project will be centered around the fourth bullet in Section 2.2 of the RFP, specifically “to move photovoltaic related products, manufacturing processes, components and systems to a point in the commercialization process where the applicant is ready to demonstrate a commercial prototype or actually enter the market with a product”.

Distributed generation is arguably the most efficient and effective application of PV solar for small commercial applications, as it makes use of otherwise unutilized space and enables the property owner to derive value from an otherwise sunk cost. A major barrier to PV development for many rooftop configurations is the necessity to make penetrations in the rooftop to secure the PV panels, which may heighten the risk of leakage and is generally perceived negatively by potential PV system hosts. The rapid growth rate of ballasted racking systems for flat rooftops underscores the value of providing building owners with a penetration-less solution for PV deployment.

The utilization of a high performance, durable bonding tape as an adhesion vehicle for PV racking systems for sloped and flat metal roof applications may eliminate the need for the use of mechanical fasteners and roofing penetrations, thereby making more attractive the deployment of PV solar on commercial rooftops. The benefits of this system would include: eliminating the risk of roof leaks; ease and speed of installation; reduction in rooftop load associated with the PV array; and reduction in risk of the loss of roofing material or installation warranty. The end result of the use of this methodology would be to reduce installation costs (labor and materials), reduce the risk of water ingress, increase the attractiveness of rooftop PV solar to building owners and stimulate development of PV solar in the State of Ohio.

The proposed project would be conducted in two distinct phases: Phase 1 – testing and validation phase, in which various technology solutions would be tested in laboratory and actual conditions for durability, load, wind uplift, temperature and related characteristics. This phase will also include the development of installation methodologies and processes. Phase 2 – commercial demonstration phase, in which a commercial-scale rooftop array will be constructed and tested for proof of concept and commercial viability.

The widespread usage of the photovoltaic solar module installation methodology for sloped and flat commercial rooftops is expected to eliminate a significant barrier to the deployment of PV solar on rooftops and to enhance PV development in Ohio and increase employment and economic development.



OTFPVP 11-227

September 9, 2010

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

Re: 2010 OTFPVP2010 LOI

Dear Administrator,

Willard & Kelsey Solar Group is pleased to submit a letter of intent in response to your solicitation referenced above. We are aggressively establishing a large-volume manufacturing operation based on thin film CdTe PV modules. We have demonstrated greater than 10% module efficiency from our high throughput coater and prototype module manufacturing line. The base-line plant with 70MW/year capacity is being built in Perrysburg with production start scheduled for the first quarter of 2011. Production will increase to hundreds of MW/year by multiplication of the base-line plant. We will be submitting a proposal with a title as follows:

Project Title: "Alternative Transparent Front Contact Materials for CdTe-based Solar Modules"

Estimated Grant Funds: \$1M

Known Collaborator: None. We strategically intend to develop core capabilities in-house

The lead applicant will be: Syed Zafar, Director of Research and Development
Willard & Kelsey Solar Group
1775 Progress Drive, Perrysburg, OH 43551
Email: szafar@wksolargroup.com

Project summary: Recent years have demonstrated successful deployment of CdTe-based solar modules in the commercial energy industry. The industry's primary goal going forward is to improve conversion efficiency of solar modules and reduce cost to compete with energy generated from fossil fuels. An alternative transparent front contact is an important development necessary in achieving this goal. Fluorine-doped Tin Oxide is currently used due to its established presence in the architectural glass industry, but it has not been optimized for PV devices. Our intent is to evaluate several new alternative transparent front contact materials and, with appropriate analytical tools and techniques, develop an improved transparent front contact suitable for large-scale manufacturing which will then lead to improved conversion efficiency and reduced costs.

Best regards,

A handwritten signature in black ink, appearing to read 'Mossie Murphy', is written over a white background.

Mossie Murphy
Chief Financial Officer
Willard & Kelsey Solar Group

Letter of Intent for the Ohio Third Frontier Photovoltaics Program

2011 OTFPVP LOI

OTFPVP 11-228

Project Title: Multifunctional Performance Films for Organic Photovoltaics (OPV)

Lead Applicant: StrateNexus Technologies LLC, 1381 Kinnear Rd., Columbus, Ohio 43212

Contact Person: Alex W. Kawczak, President, StrateNexus Technologies LLC, 614.940.7737, akawczak@stratenexus.com

Collaborators: StrateNexus Technologies intends to collaborate with DuPont (Circleville, Ohio), The Ohio State University, Wright Center for Photovoltaics Innovation and Commercialization (PVIC), Case Western Reserve University and Kunststoffe Solar.

Grant Funds Requested: \$1.0 million

Summary: This innovation project is focused on developing and commercializing multifunctional high performance films for organic photovoltaics (OPV) that will reduce the cost of organic solar cells by thirty percent and improve the retention of energy efficiency by twenty to thirty percent. These transformative materials innovations will be transferable with little to no modifications to non-organic PV platforms, such as CdTe, CIGS, Si, and III-V. The new materials developed will not only boost efficiency, reduce manufacturing costs, but also enhance durability by the removal of some known degradation mechanisms in materials currently used.



TECHMETALS

OTFPVP 11-229

Headquarters Location- 345 Springfield Street – Dayton, OH 45403 & P.O. Box 1266 – Dayton, OH 45401-1266
Phone (937)-253-5311 Fax (937)-253-5096 & Web @ <http://www.techmetals.com>

Ohio Third Frontier Photovoltaics Program (PVP)

9/9/2010

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

OTFPVP2011@development.ohio.gov

LETTER OF INTENT

Techmetals is located in Dayton, Ohio and intends to submit a proposal entitled “Advanced Nano Material Alloy for Manufacturing Cost Reduction and Higher Purity Photovoltaic Growth”. This will create a supply chain need in Ohio for this product. This advanced material is designed to reduce production cost for mass photovoltaic growth production around 10 to 20 % during certain processing steps of photovoltaic manufacturing. Techmetals, will bring in out of state funding of 3.5 million for R&D services and capital based on our current R&D lab efforts and validation results from large Photovoltaic OEMs. Techmetals will spend another \$1 million in 2011 if \$1 million funding is granted to further this development. This advanced material is designed to reduce alternative energy costs. This is in response to the Ohio Third Frontier Photovoltaic Program (PVP), fiscal year 2011 Request for Proposals (RFP).

Per the requirements of the OTFPVP 2011 Request for Proposal please note the following:

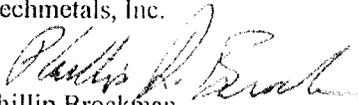
Applicant’s Name: Techmetals, Inc.
Address: 345 Springfield Street
Dayton, OH 45403
Project Name: Advanced Nano Material Alloy for Manufacturing Cost Reduction and Higher Purity Photovoltaic Growth”
Estimated Grant Funds: \$1,000,000
Contact Name: Phillip Brockman, Engineer
Telephone Number: 937-253-5311
Email: pbrockman@techmetals.com

The projects known collaborators:

- Process Equipment Company, PECO- Design, Fabricator, and Manufacture
- American Metalworks – Design and Fabricator
- Faxon Machine: Tool and Die and full service machine, engineering, and manufacturing shop
- The Edison Materials Technology Center (EMTEC) – experience in project management, product development, and commercialization.
- A-Lab Corp. – Analytical Chemistry, Metallography, Mechanical, & Nondestructive Testing

The team is pleased to submit this letter indicating our intent to submit a full proposal for Third Frontier Photovoltaics Program funding.

Yours truly,
Techmetals, Inc.


Phillip Brockman

Director of Business Development, Eng

Dennis J. Flood
Natcore Technology, Inc.
161 Forest Street
Oberlin, Ohio 44074
(440) 774-2551
djflood@natcoresolar.com

OTFPVP 11-230

Arthur J. Epstein
Distinguished University Professor of Physics and Chemistry
The Ohio State University
191 W. Woodruff Avenue,
Columbus, Ohio 43210-1117
(614) 292-1133
epstein@mps.ohio-state.edu

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

September 10, 2010
Re: OTFPVP2011

To Whom It May Concern:

Natcore Technology, a Delaware Corporation registered as a foreign corporation in the State of Ohio, in collaboration with The Ohio State University, intends to submit a full proposal to the Ohio Third Frontier Photovoltaics Program FY2011 to seek funding to accelerate the development of affordable, high performance CdSe solar cells through a chemical bath deposition, roll-to-roll manufacturing process.

The proposed project title, **“Accelerated commercialization of nanostructured CdSe solar cells”** will request \$1,000,000 over the course of 3 years.

With the requested funding we will accelerate commercialization and demonstrate processes and products in a commercial context by achieving the following goals:

- 1) We will investigate, develop and select nanostructured substrates composed of organic semiconductor nanotubes or nanofibers that will be suitable for use in a commercial roll-to-roll processing facility. We will determine CdSe deposition times and rates to achieve the required film thickness for optimum solar cell operation using the nanostructured substrates described in (1).
- 2) We will develop a sub commercial scale pilot line roll-to-roll system at Nanotech West using suitably scaled substrates which will serve as a pre-industrial production scale facility.

- 3) We will use the pilot production facility in (3) to demonstrate scalability and obtain additional outside investment in anticipation of full scale production of market-ready solar cells.

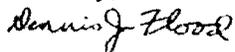
Natcore Technology has an exclusive license to the patented deposition of inorganic semiconductors (e.g. CdSe) on organic semiconductors (e.g. CNT) to form a photovoltaic device (Patent # 7,682,527). This achievement was made in part due to seed funding received through the US Air Force SBIR and STTR programs. We expect to build on this success by using Ohio Third Frontier support to fund our “Accelerated commercialization of nanostructured CdSe solar cells” program. After achieving the end goal of the program, a pre-industrial pilot scale production facility, the company anticipates full commercial production in 2014. We expect the CdSe on nanostructured substrate solar cell manufacturing process to enable the Company to achieve a market-ready product that will be a competitive terrestrial photovoltaic technology. The basis for this assertion is two-fold: 1) the dramatically reduced capital expenditure that results from using existing and under used or no longer used film roll-to-roll production facilities in Ohio and elsewhere; and 2) the low cost of the materials used in fabrication. We have demonstrated working small area prototypes of our product and are now ready to pursue the challenge of pushing the technology to commercialization. Our company’s technical operation already employs 3 people (2 at the OSU Nanotech West facility) and we anticipate increasing this to 20 Ohio employees by 2014.

Natcore Technology is teaming up with Art Epstein’s research group at The Ohio State University to address anticipated complications with commercialization of the chemical bath deposition of CdSe on organic nanostructures. The Epstein group was an original member of the Third Frontier Program, being funded under the University of Toledo’s Wright Center for Photovoltaic Innovation and Commercialization (PVIC) and has extensive experience in issues related to carbon nanotubes and other organic nanostructures, organic-inorganic interfaces, photovoltaic heterojunctions, organic charge transport, and electron-hole recombination. This expertise will be vitally important in the commercialization of nanostructured CdSe solar cells.

The commercialization of this technology will be an important step toward the future of the burgeoning photovoltaic industry in Ohio. There is great opportunity in refurbishing film-processing plants to produce inexpensive, efficient solar cells. This will be yet another step toward a long-term, vibrant photovoltaic industry in Ohio.

We look forward to the opportunity to submit a full proposal.

Sincerely,



Dennis J. Flood
Co-Founder and Chief Technology Officer
Natcore Technology, Inc.



September 10, 2010

Dear Ohio Department of Development,

Please accept this Letter of Intent (LOI) from Case Western Reserve University (CWRU) for our 2011 Photovoltaics Program proposal.

Lead Applicant's Name: Case Western Reserve University (CWRU)
Address: Great Lakes Energy Institute (GLEI) at CWRU
 10900 Euclid Avenue, Olin 305
 Cleveland, Ohio 44106
 (216) 368-0748

Telephone: Dr. Roger French
Contact Person: roger.french@case.edu
Contact Email:

Proposed Project Title: Ohio Photovoltaics Lifetime & Degradation Center (Ohio PV-LDC)

Estimated Grant Funds to be Requested: \$2 Million (\$1M R&DF/ \$1M WCF)

Known Collaborators: Replex Plastics, Energy Focus

Project Summary

Photovoltaic (PV) solar generation represents an excellent opportunity for the State of Ohio, and has been funded extensively by the state for several years. Beyond impressive PV production, many also believe the potential for solar energy in the state is equally impressive. As the *Columbus Dispatch* reported in July 2010, the country with the most solar development in the world is Germany – and it gets less sunlight than Ohio.

To date, funding and research and development in solar energy has predominantly centered on improving PV efficiency. Efficiency is the leading race for all PV manufacturers, in every state, since high initial electric power generation correlates to lower cost of the electricity produced from the PV module. This economic analysis of the modules initial conversion efficiency helps establish the \$/watt-peak “cost” of a PV module and thereby a PV technology. Efficiency is a useful metric, most of all in initial demonstration phases of technology development, such as DOE Technology Readiness Levels (TRL) 1-4, but it does not represent all the critical metrics needed for successful commercialization, nor does it demonstrate the true Levelized Cost of Electricity (LCOE) delivered over the technology’s stated lifetime.

As PV technology approaches true commercialization and appreciable solar power production, critical issues in addition to efficiency are reliability, lifetime, and degradation rate of the PV modules over their stated lifetime. En route to successful commercialization, the technology must be tested in relevant environments, produced in pilot line volumes and tested as a full scale system (TRL5-7). It is at this stage that the product must be evaluated for its reliability, durability and degradation rate to prove it can meet expected lifetimes (typically 20 years at present) with measured total degradation over lifetime (typically 10% degradation over lifetime). It is in the TRL 5-7 timeframe of the technology development and demonstration process that many critical issues can arise, thwarting successful technology insertion.

In this project, we propose to focus on the requirements for PV lifetime, reliability, and degradation rate, which typically lay beyond the initial technology demonstration phases (TRL 1-4). To date, the technical resources and capabilities are not well established or easily accessible to Ohio PV cluster companies and represent a challenge and technology risk for many of the Ohio based PV technologies being developed today. Through the study of PV lifetime and degradation we believe we can dramatically increase PV lifetimes. If we can reduce degradation rates from the typical 0.5%/yr to



GREAT LAKES
ENERGY
INSTITUTE

10900 Euclid Avenue, Olin 305
Cleveland, Ohio 44106-7074
(216) 368-0748
energy.case.edu

0.1%/yr, PV lifetimes could increase from the current 20 years to 100 years of useful life. Such increased lifetime would dramatically change the LCOE of solar PV electricity, representing a great enhancement of PV's economic viability.

This project will thus focus on developing the processes and testing for solar radiation and environmental exposures, and the evaluation and metrology of materials, components, and PV modules before and after these exposures. These post-exposure optical evaluation and thermo-mechanical evaluations will be focused on lifetime and degradation rates of individual degradation mechanisms which can be optical, structural or interfacial in nature. For interfacial degradation processes, such as corrosion, adhesive failure, and fracture, much of the groundwork has already been established in Case Western's Swagelok Center for Surface Analysis of Materials (SCSAM) under prior Wright Project funding. Thus, this funding request will focus on establishing the solar and environmental exposure conditions needed for realistic and accelerated exposure of PV materials, components and modules, and on the necessary optical and electrical evaluations needed to track degradation rates and identify mechanisms. Together, these additions will merge to create the Ohio PV Lifetime and Degradation Center on campus, one dedicated to moving new Ohio PV technology through the technology readiness pipeline to successful commercialization, where it can contribute to our energy solutions.

We intend to partner with Ohio PV companies who have active product development activities at TRL 4-9 and are working to address the product's lifetime, reliability and degradation requirements. In this, we seek to advance the TRL of a number of Ohio PV products enough to facilitate commercialization. We will utilize the Ohio PV-LDC to work with our partners on multiple product lifetime projects, enabling them to access the solar and environmental exposures required with the necessary optical, electrical and structural evaluations. For example, Replex' solar mirrors have very desirable performance, but now require lifetime and degradation studies to further define their weatherability and lifetime in solar applications, and how the front surface and the back surface mirror, and the back surface protection perform under real world conditions. Energy Focus has concentrating PV development efforts that will require reliability and lifetime optimization through the Ohio PV-LDC. In addition, Energy Focus, which has an extensive product line of energy efficient LED lighting products, is developing next generation LED lighting with very similar irradiance and environmental exposure requirements as a solar application. These energy efficient light product development efforts can also benefit from working with Ohio PV-LDC.

The partners in this team include Cleveland-based Case Western Reserve University (CWRU), Replex Plastics (Mount Vernon, OH; PV and Mirrors), and Energy Focus (Solon, OH; PV and LED Lighting). Case Western Reserve is one of the nation's leading independent research universities, ranking in the top 50 of all national colleges and earning \$345 million in annual sponsored research. CWRU currently pursues multiple research & development projects intended to enable the transition to sustainable energy, including multiple solar projects.

This proposal team, with Ohio Third Frontier support, will have the expertise and capacity to build this new center, which will allow it to further support the already large investment Ohio has made in PV research. By focusing on the degradation and sustainability of PV, this project will take a new angle to improving overall effectiveness and PV life. From this innovation arises not only competitive advantage, but expedient advantage that can complement the efforts of several other states – while keeping Ohio's distinctiveness in the solar field. New commercial products and services built from this project will meet the ultimate goals of both the Third Frontier and the State of Ohio: to create green jobs and industry that allow Ohioans to lead the transition to alternative energy.

Sincerely,

Roger French

F. Alex Nason Professor, Materials Science and Engineering
Case Western Reserve University

Great Lakes Energy Institute @ CWRU

OTFPVP 11-232

CoreTech Consulting, LLC

102 Oak St.
Swanton, OH 43558

September 10, 2010

The Ohio Department of Development
Technology and innovation Division

Re: Letter of Intent to submit proposal
Ohio Third Frontier Photovoltaics Program
FY11 OTFPVP

Please be advised that this Company, as lead applicant, intends to submit a proposal pursuant to the Ohio Third Frontier Photovoltaics Program RFP.

Lead Applicant: CoreTech Consulting, LLC

Address: 102 Oak St.
Swanton, OH 43558

Phone: 419-345-0803

Contact: Thomas J. Sheperak, CEO

e-mail address: tsheperak@roadrunner.com

Proposed Project Title: Rapid atmospheric deposition of PV materials

Estimated Grant Funds to be requested: \$1,000,000 (FY11 OTFPVP)
\$ 500,000 (WCF – Wright Capital Funds)

Collaborator: Dr. Michael Heben
Wright Center for Photovoltaic Innovation and Commercialization
The University of Toledo
2600 Dorr St.
Toledo, OH 43606

See attached Summary of Project

CoreTech Consulting, LLC

By: _____
Thomas J. Sheperak, CEO

Rapid atmospheric deposition of PV materials

Summary of Project

This project will be conducted at the Wright Center for Photovoltaic Innovation and Commercialization at the University of Toledo (PVIC). The purposes of this project are to: (1) optimize the operating parameters of the EnergyBeam Platform™ technology which has been adapted to deposit CdTe and CdS under atmospheric conditions, (2) develop an effective manufacturing process associated with the use of this technology, (3) adapt this technology for the atmospheric deposition of other photovoltaic materials including CIGS and amorphous Silicon onto substrates such as metallic foils and plastic materials; and (4) verify the reduction in deposition costs calculated to be in the range of 50% reduction.

The Project will require materials handling and analytical equipment to be owned by PVIC and funded with the WCF. The Project will span 3 years; however, since this project is multifaceted in its purposes, its first and second phases, optimization and development of an efficient manufacturing process for CdS and CdTe deposition, will be completed in 18 months and phase 3, adaptation of this technology to other PV materials and substrates will be undertaken in the next 18 months.

The Lead applicant is the inventor and developer of the EnergyBeam Platform™ technology and its adaptation to the atmospheric deposition of PV materials. The Collaborator is a recognized expert in the photovoltaic field and is a principal at the PVIC.

DMS Technology, Inc.

2905 Westcorp Boulevard
Suite 220
Huntsville, Al 35805
Telephone (256) 536-4346
Fax (256) 536-8642
e-mail: spraharaj@aol.com

Company Name and Address:

DMS Technology, Inc.
P.O. Box 451 WBB
Dayton, OH 45409-0451
Tel: (937)229-2328

OTFPVP 11-233

***Note:** DMS Technology, Inc. is currently looking for a permanent place of business at the IDCAST Building in Dayton, Ohio and is planning to move when the requirement is imminent. However, we have on-going business in the State of Ohio. The relevant Tax IDs have been established. The income from Ohio in 2009 was \$172780 whereas that for 2010 so far is \$131983.*

Contact Person:

Dr. Georges Nehmetallah
Tel: (937)305-3411 (Cell)
Email: nehmetgt@notes.udayton.edu

Applicable Ohio Account Numbers:

OH Dept of Taxation Withholding Acct No. – 53 004724
OH Dept of Job & Family Services Acct No – 1430864-00-3

Propose Project Title

**“ADVANCED SOLAR TECHNOLOGY UTILIZING
NANOPARTICLES IN ORGANIC PHOTOVOLTAICS”**

FUNDS

Estimated Grant Funds - \$1,000,000 (for one area of work)
Estimated Capital Funds - \$250,000 (from the State of Ohio)
Anticipated Cost Share - \$1,000,000 (from DMS Technology, Inc.)

Known Collaborators (currently) University of Dayton

Summary Page

Advanced Solar Technology Utilizing Nanoparticles in Organic Photovoltaics

Statement of the problem or situation that is being addressed.

Current generation of photovoltaic cells operate with a lower efficiency than the allowed theoretical limit. The proposed technology is expected to increase the efficiency with a novel approach.

Statement of how this problem or situation is being addressed.

The approach is to tackle the losses and increase performance by a three pronged attack on the problem. The proposed technology will use (a) low cost organic photovoltaics, (b) transparent metals with their high conductivity and high transmittance, and (c) plasmonic nanoparticles to increase light scattering/trapping and absorption inside the active layer of the PV cell. This project is a collaboration between DMS Tech and the University of Dayton.

Commercial Applications and Other Benefits.

Areas for potential use and commercialization of the proposed research:

- 1) The “super” photo voltaic cell (PVC) will be of use in the manufacture of solar panels. These solar panels will be used on residential and commercial rooftops for solar energy harvesting. The cost of generating solar energy will be dramatically reduced (we estimate by an order of magnitude) by the use of this technology.
- 2) The “super” PVC will be used by the warfighter as a lightweight, man-portable power source for night vision, radios, and other powered equipment.
- 3) Space-based satellites, probes, Space Station, and future crew-launch vehicles will achieve higher efficiency to potentially increase other useful payloads onboard.



September 10, 2010

Ohio Department of Development
Technology Division
77 South High Street, 25th Floor
Columbus, OH 43215-6130

Re: Letter of Intent – Ohio Third Frontier Advanced Energy Program

This Letter of Intent is to submit a proposal under the current Advanced Energy solicitation which closes on October 7, 2010. Given below is the information requested in the RFP.

Applicant Name:	MetaMateria Technologies LLC
Address:	1275 Kinnear Rd. Columbus, OH 43215
Phone:	614-340-1690
Fax:	614-487-3704
Contact Name:	Dr. J. Richard Schorr, President
Email:	jrschorr@metamateria.com
Project Title:	Higher Performance PV Solar Cells Using Nanomaterials
Estimated Grant Funds:	\$750,000
Collaborators:	The Ohio State University, Industrial Partners TBD

If additional information is needed, please contact us.

Sincerely,

A handwritten signature in black ink, appearing to read "Richard Schorr", written in a cursive style.

J. Richard Schorr
President

Higher Performance PV Solar Cells Using Nanomaterials

Summary

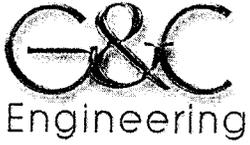
Demand for renewable energy photovoltaics (PV) is substantial and is growing at more than 40% per year. Worldwide production in 2007 was 3,800 MW, up 50% since 2006, making it the fastest growing renewable energy source, which has led to lower systems costs. Because solar energy is readily available and does not cause the environmental problems of fossil fuels, it deserves to be a major focus. Ohio has a long history of successful companies along the value chain of PV technology, including module fabrication, glass and polymer materials. Recognizing this, a Wright Center for Photovoltaic Innovation and Commercialization (PVIC) received \$18.6 million in 2007, involving some 20 organizations from academic research to manufacturers and users of PV systems.

For long term commercial success, the cost of power produced from solar cells needs to drop below that of fossil fuel-generated electricity. While the cost for solar is declining continuously as technology improves efficiency and manufacturing lowers costs, today growth is stimulated by government subsidies, which will likely be eliminated, or reduced, in the future. Solar photovoltaics also needs flexibility for packaging for many applications.

Third Generation solar cells are expected to overcome cost and technical issues associated with existing commercial systems. Many approaches are being examined; however, it is generally recognized that nanomaterials will be one of the keys to successful development of these products. Nanomaterials are shown to increase efficiency by enhancing the conversion of incoming solar energy. Funding from this 3rd Frontier Advanced Energy Program will help accelerate the commercial development of solar cells and application of nanotechnology for other solar applications.

The proposed program will focus extending the performance of polymer based photovoltaics that are already under development at MetaMateria and The Ohio State University. These developments are expected to represent a test bed for using nanomaterials to enhance efficiency of solar cells across many PV materials platforms. Engineered nanoparticles, for instance, are regularly prepared as liquid dispersions and used for cost-effective preparation of self-assembled thin films, which have been demonstrated to improve performance. These nano-dispersed films can be tailored to create transparent window layers or to increase light scattering inside the PV cell to improve collection efficiencies.

MetaMateria and Ohio State are PVIC members who will be teaming with others to take advantage of on-going technology development needed to bring to the market new solar cell products designed to optimize the cost effectiveness of solar cells. We plan to work with end users to facilitate demonstration and commercialization of the technology.



Glovon & Clovon Engineering Consulting, LLC

Engineering, Manufacturing & Energy Solutions

10979 Reed Hartman Hwy. Suite 331D, Cincinnati, Ohio 45242. Phone: 513-745-0186 / Fax: 513-201-3020

E-mail: uagomuo@gncengr.com : www.gncengr.com

LETTER OF INTENT FOR FY2011 OHIO THIRD FRONTIER PHOTOVOLTAIC PROGRAM

Lead Applicant:

Uche Agomuo

OTFPVP 11-235

Glovon & Clovon Engineering Consulting LLC,

10979 Reed Hartman Highway, Suite 331D

Cincinnati, Ohio 45242

Phone: 513-745-0186

Mobile: 513-254-7124

E-mail: uagomuo@gncengr.com

Proposed Project title: Low Cost Transparent Polymer Film For Replacement of ITO in Organic Solar Cells

Estimated Grant Funds to be requested is \$700,000

Known Collaborators:

Co-PI: Professor J. O. Iroh

University of Cincinnati

Project Summary

Funds are requested to manufacture a low density, transparent hybrid polymeric films for replacement of tin-doped indium oxide, ITO, a major component of solar cells. Thermoplastic polymer films are known to possess low density, high toughness, high flexibility and are easy to carry. Ladder and semi-ladder polymers possess additional advantages of high thermal, oxidation and environmental stability. Additionally, polymeric materials are easily tailored to meet the requirements of complex usage conditions requirement.

We propose to produce optically transparent retractable, roll-on-roll conformal film based on hybrid polymeric film containing zinc oxide, titanium dioxide, conductive carbon materials (both 2D and 3D carbon fillers), respectively.

A novel in-situ reactive chemistry technique capable of incorporating well dispersed surface functionalized nanofillers into an appropriate polymeric matrix, developed by the collaborating Co-PI would be used to produce the proposed optically transparent film. Film casting will be performed by a modified solution casting method, followed by curing at test temperatures ranging from 120°C to 180°C.

Flexible and retractable organic polymer solar cell containing the proposed optically transparent polymer electrode will be constructed, demonstrated.

The proposed research will have high impact in the sustainable energy engineering and technology. The state of Ohio in particular and the nation in general will benefit by having the capability to manufacture an important sustainable energy device of high national interest locally. Local workforce knowledgeable in the manufacture and maintenance of components for solar cells will be trained, and important high technology jobs will be created for residents of the State of Ohio.