

# **An Innovative Model for a New Advanced Energy Workforce**

A proposal submitted to the  
**National Science Foundation**  
**Partnerships for Innovation Program**  
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by  
The University of Toledo on behalf of  
The University Clean Energy Alliance of Ohio



## **An Innovative Model for a New Advanced Energy Workforce**

We propose to create a model for developing courses, certification programs, stackable certificates, and associate degree programs throughout the State of Ohio in advanced energy. Ohio universities, under the leadership of the Governor's Energy Advisor, banded together to form the University Clean Energy Alliance of Ohio in 2007 to promote advanced energy research. In addition, the state has leading advanced energy companies and a renewable energy portfolio standard that promise job opportunities for the future. A ready and trained workforce is needed to support renewable energy companies as well as trained and ready trades people to install solar, wind, and other systems. Our vision is to provide the initial impetus and leverage to create training programs statewide. The project involves university research and incubation centers to provide guidance for the development of new courses and programs in anticipation of the development and commercialization of new energy systems (e.g., rooftop building integrated PV systems). Industry participants will provide guidance on the types of skills they need now and are likely to need in the future. The proposal begins with three universities (Toledo, Bowling Green State University and Central State University), four community and technical colleges (Hocking, Lakeland, Owens, and Terra), one statewide organization (University Clean Energy Alliance of Ohio), a state agency (Ohio Skills Bank) and several Ohio companies focused on solar, wind, and advanced nuclear energy. In Years 2 and 3 additional universities, community and technical colleges, and companies will be added in these technology areas and in new technology areas.

Dr. Frank J. Calzonetti, Vice President for Research Development is the PI for this project and The University of Toledo is the lead institution. However, University Clean Energy Alliance of Ohio is a major partner. This statewide organization, housed at The University of Toledo, involves all of the state's research universities, NASA Glenn, Wright Patterson Air Force Laboratory, and the EPA Laboratory in Cincinnati and is in a strong position to make change at the state level. The primary subawardee is Central State University; the PI of that portion of the project is Charles Showell and the coordinator of the CSU nuclear energy convening group will be S. Sritharan.

Intellectual Merit of Project. The intellectual merit of the proposal involves bringing new knowledge on advanced energy technologies to community and technical colleges so that new courses and programs can be developed. The intellectual merit also is in the development of a statewide model for university engagement to transform an "old industrial region" into a leader in a new technology-intensive industry. The project also draws upon the experience of a previously successful PFI project as well as the statewide support of the University Clean Energy Alliance of Ohio.

Broader Impacts of Project. The project aims to take Ohio universities toward a more "developmental role" in transforming the statewide economy and creating high-paying job opportunities. The project involves Central State University, an HBCU, and has special attention for opportunities for participation of underrepresented groups. The results of the project will be broadly disseminated in Ohio and nationally through presentations, press releases, involvement of state leaders, and professional and technical publications.

## **I. Background and Rationale**

### *Overview*

Energy security and global climate change necessitate that the country accelerate the development and deployment of advanced renewable energy systems. Countries in Europe and Asia already have launched programs to move their economies in this direction; even China has a Renewable Energy Law that calls for rapid movement to renewable energy. Although long a leader in advanced energy technology development, the U.S. is significantly behind other countries in renewable energy installations and must now undertake an aggressive program of worker retraining and offer education opportunities for the engineering, design, manufacturing, and construction workers needed to propel the U.S. toward a future with clean, abundant, and domestically available energy. A successful endeavor requires cooperative effort among research universities, community and technical colleges, government agencies, and energy industry sectors.

The University of Toledo (UT) and the statewide University Clean Energy Alliance of Ohio (UCEAO) request National Science Foundation (NSF) support to coordinate and facilitate partnerships between (i) the state's research universities, (ii) the advanced renewable energy industry, (iii) community and technical colleges and (iv) government agencies in order to develop an innovative model for creating new advanced energy workforce training programs for the State of Ohio and the nation. Our project requires close collaboration with industry and university researchers who will provide both information on technology moving from the laboratories into the marketplace and on workforce requirements needed for this transition. Our industrial partners are a critical component because their perceived workforce needs are the basis upon which training programs must be built. Industry will also be a source of integrated training through co-op and internship programs. Community and technical colleges will be instrumental in the design and implementation of new workforce development programs throughout Ohio. The University of Toledo is in an excellent position to lead this effort as it has assisted in developing a photovoltaics industry in Northwest Ohio and has an understanding of the educational requirements to accelerate workforce development. On this latter topic, the university recently developed an undergraduate minor in renewable energy.

UT is uniquely positioned to provide the leadership of this project. First, UT had a successful previously funded NSF-PFI project that helped position Toledo as a national center for solar energy research, manufacturing and use. This success was highlighted by *The Economist*, *Newsweek*, the *Wall Street Journal*, the *New York Times*, and ABC News. Second, UT also has the Wright Center for Photovoltaic Innovation and Commercialization that supports state wide leadership in solar energy. Third, UT has a

dedicated university incubator, the Clean and Alternative Energy Incubator that has spun out several solar energy companies and is a focal point for renewable energy research, technology development and business development in Ohio. Fourth, UT houses UCEAO, the statewide organization formed to promote the state's leadership in advanced energy.

We plan to team initially with selected community and technical colleges that have or are developing workforce training programs in solar, wind and nuclear energy. We will capitalize on their established experience in working with industry to develop new programs that will involve other Ohio universities and additional community and technical colleges. The State of Ohio will collaborate through its Ohio Skills Bank initiative (under the state's Department of Job and Family Services) that ties regional workforce development supply to employer demand for targeted job skills. In order to compete in the knowledge economy, Ohio has a stated goal of providing access to 230,000 more students into postsecondary education programs.<sup>1</sup> As a result of declining numbers of traditional age college students, it is anticipated that, to meet this goal, 180,000 of these students will be adults coming back to Ohio institutions for retraining purposes. The Ohio Skills Bank initiative aims to coordinate demand-driven responsive education and training efforts among Ohio educational institutions within each of the state's twelve economic development regions, as well as across the system. Each region has been charged with using data to identify the employment sectors which offer high growth potential.

Our project will demonstrate how research centers, a supportive state government, industry and community colleges can cooperate to build a highly skilled workforce via a model that can be extended throughout the state and ultimately be exported to other states. The project will also provide information on ways that universities and community colleges can partner to position a region to transform its economy into new rapidly growing technology-intensive industrial sectors. In the first year the project will involve three universities (UT, Bowling Green State University and Central State University); four community and technical colleges (Hocking, Lakeland, Owens, and Terra), two statewide organizations (the University Clean Energy Alliance of Ohio and the Ohio Skills Bank), and companies in wind (EPS, North Coast Wind, and Wire-Net), solar (Xunlight, First Solar, Calyxo USA, ADG) and nuclear energy (First Energy).

### ***Ohio's Leadership and Needs***

With the U.S. economy at its most serious downturn in 80 years, the state of Ohio, historically heavily dependent on the automotive industry and traditional manufacturing, is at the center of this economic storm. Unemployment in Ohio stood at 7.3 percent in October 2008 (Ohio lost 22,100 manufacturing jobs over the past 12

months) and Ohio is fifth in the number of home foreclosures.<sup>2</sup> State leaders recognize the need to transform the economy and are taking aggressive steps in the transformation process. Under the leadership of Governor Ted Strickland, the state is marshalling the resources of the Ohio Department of Development (ODOD) to invest in developing, recruiting and retaining the talent necessary to build an innovation-based economy. These efforts draw on the higher education assets of the Ohio Board of Regents (OBOR), the support of the governor's Energy Advisor and the resources of the state's universities and community and technical colleges. Ohio's \$1.6 billion Third Frontier Project is a national model on ways to build new, competitive industries through investments in university-industry collaborative research and innovation. The General Assembly recently passed a comprehensive job stimulus package that includes \$150 million over three years in advanced energy funding "to use the financial leverage of the Advanced Energy Job Stimulus Fund to build on industrial strengths that will further the economic vitality of Ohio's energy industry, as well as attract investment in building and commercializing technologies to produce cleaner, domestically secure energy." The state's goals are to grow the income of Ohioans, create and retain jobs for Ohioans, and expand productivity through innovation.<sup>3</sup>

The State of Ohio has taken important steps in moving toward national leadership in advanced energy research, manufacturing and technology deployment. Formed in 2007, UCEAO brings together academic and government researchers to build the stronger, multi-institutional research collaborations needed to make Ohio the nation's leader in advanced energy research and discovery. Member institutions are working with Ohio industries and government agencies toward moving advanced energy technologies into the marketplace. Furthermore, with the passage of Senate Bill 221, a comprehensive revision of Ohio's electricity statute enacted earlier this year, the state established a renewable portfolio standard which mandates that 25 percent of the state's electricity be generated through advanced energy by 2025, of which 12.5 percent is to come from renewable sources. SB 221 also has a solar "carve out" and mandates the installation of approximately 800 MW of solar energy by 2025. These requirements for advanced energy installations—along with the rapid growth of new companies—have resulted in an urgent need for a technically trained workforce to manufacture, install, operate and maintain new systems.

Unlike some technology-based market opportunities that require building entirely new core competencies within the Ohio workforce, the underpinnings of this field involve the types of products that Ohioans are uniquely suited to manufacture and produce.<sup>4</sup> Innovative products in renewable energy typically require diligent, skilled manufacturing; workers who have a fundamental knowledge of physical sciences; careful adherence to technological specifications; and innovative approaches to building

best-of-breed products – the type of attributes that made Ohio a leader in the advanced manufacturing field for many decades.

Advanced energy builds upon existing university, government laboratory and industry strengths. This focus makes sense given that advanced energy is growing at rates from 20-30% a year depending on the technology<sup>5</sup>: the industry is innovation-based and benefits by proximity to university researchers, and it has global importance given concerns over energy security and environmental change. Ohio boasts notable successes in research, technology transfer and the incubation of new advanced energy companies.

Higher education institutions are viewed as central in the process of building a new economy with institutional leaders being pro-active in regional development planning, community service, and outreach. In recent decades the importance of universities as critical elements of growing economies has been examined, discussed and widely endorsed (an excellent review article is provided by Benneworth and Hospers, 2007<sup>6</sup>). Indeed, there is a global push for higher education institutions to have economic development as a major element in their mission<sup>7</sup> so that they can support the growth of technologically innovative regions<sup>8</sup>. But most universities only view workforce enhancement as an output of their academic programs and are not as directly engaged as are community and technical colleges.<sup>9</sup> Although much has been written on ways that universities support regional economic development through the attraction and training of talented people, the role of universities in providing a workforce at the technician and associate degree level for technology-based companies in their region is in need of further research and understanding.<sup>10</sup> This project places universities and community and technical colleges in a pro-active position to help transform a regional economy that has suffered severe decline by creating local talent needed for high paying manufacturing and trades jobs.

Two reports provide information on job opportunities in Ohio through advanced energy. Bezdek provided a report encompassing three scenarios ranging from “business as usual” to an “advanced scenario” which would entail aggressive and sustained public policies and favorable market conditions.<sup>11</sup> He predicts an increase in jobs and “economic growth [that] greatly outweigh the projected loss of jobs and income in the electric utility industry caused by reducing demand for power from coal and nuclear plants. A partial switch to cleaner, smart energy efficiency and renewable energy would energize the Midwest economy with hundreds of thousands of new jobs.”<sup>12</sup>

Table 1 gives a comparison of projected employment figures in the U.S. and Ohio for 2006 and projected figures for 2030.<sup>13</sup>

**Table 1. Renewable Energy Industry Employment and Revenue in Ohio**

Industry Sector	Ohio 2006			Ohio 2030		
	Revenues	Direct Jobs	Total (direct and indirect) Jobs	Revenues (advanced)	Business as Usual—Total Jobs	Advanced Scenario—Total Jobs
Wind	\$250M	740	1700	\$7.6 B	2700	51,600
Photovoltaic	\$25 M	200	460	\$1.3 B	5800	23,800
Solar Thermal	\$1 M	10	20	\$28 M	40	570

Notably, Ohio is in possession of a fully developed electric transmission and distribution infrastructure that is important for the installation of wind and solar energy systems.<sup>14</sup> The state is now emerging as a leader in solar energy with a number of companies involved in solar cell production and installation of solar arrays. Toledo itself has the nation’s largest producer of solar cells (First Solar), several other growing solar cell companies (e.g., Xunlight, Calyxo USA) as well as one of the national solar cell arrays installers (ADG). With an 800 MW solar carve out by 2025 Ohio will emerge as an important market for solar energy. Senate Bill 221 is creating interest in wind energy as several companies (including our partner EPS) are now installing wind turbines on-shore in Ohio and are evaluating off-shore installations in Lake Erie. Already there is a need for additional trained workers for the second and third shifts to help install new wind turbines. While the job opportunities in nuclear may not be of the same magnitude, there is a need for technically trained workers in Ohio and other states as employees retire, the need to deal with nuclear waste management and other environmental issues of nuclear energy continues, and as new nuclear generating facilities remains a viable option. With the downsizing of the automotive industry and its supporting manufacturers, Ohio has in place a manufacturing workforce that has the ability to retrain for advanced energy industry needs.

***Summary of the Proposed Effort***

In sum, our project seeks to develop an innovative model for creating a new advanced energy workforce training program and requires close collaboration with industry and university researchers who will provide information on technology moving from the laboratories into the marketplace and outline the workforce requirements needed for this economic transformation. The community and technical colleges will participate in the design and implementation of new workforce development programs throughout Ohio and the state will also collaborate through its Ohio Skills Bank inventory and regional directors. Building from selected community and technical colleges that have active workforce training programs in emerging advanced energy technologies such as solar, wind, and nuclear energy we will expand to include other participants to make

this a true statewide program. The spirit of statewide cooperation evidenced by the creation of UCEAO and the need for new, green collar jobs makes this project timely and of significant state and national importance. Our proposed project will demonstrate how research centers, a supportive state government, industry and community colleges can cooperate to build a highly skilled workforce via a model that can ultimately be exported to other states.

## **II. Goals and Objectives**

This project is designed to be a foundation and model for developing and implementing alternative energy training and curricula in Ohio. It will

1. engage advanced energy industries and the Ohio Skills Bank in the development of job skills criteria and desired educational strengths
2. develop, through a consensus building approach, the focus and knowledge to be acquired at the end of each academic year
3. develop an outline for the content of the various courses and their prerequisites
4. implement the academic programs through the development of course materials, on-the-job training and/or laboratory training, examinations, certificates and degree programs
5. monitor, evaluate and modify educational and training programs as deemed necessary by a collaboration of academic and business professionals
6. disseminate the process and lessons learned to the academic community across the U.S. through presentations at appropriate academic conferences, publications and coverage by national media
7. provide Ohio advanced energy companies with a high quality workforce

## **III. Activities—Specific Objectives**

*Year 1*

**Task 1:** *Develop a consensus of academia and industry experts (Technology Convening Groups) on the skills and knowledge sets which will be needed to qualify for the job opportunities that will arise in the targeted industries.*

Formalize communities of cooperation as “technology convening groups” involving representatives from universities, community and technical colleges, and industry around energy technology areas. These are:

- Solar (UT, Bowling Green State University, Owens Community College, Hocking College, First Solar, Solar Fields, Calyxo USA, Xunlight, Advanced Distributed Generation)
- Wind (UT, Bowling Green State University, Terra Community College, EPS, North Coast Wind and Power, Wire-Net)
- Nuclear (Central State University, UT, Lakeland Community College, First Energy)

Technology convening groups in solar, wind, and nuclear will bring forward the range of positions needed, the technical requirements for the positions, and the magnitude of the need for workers in selected positions. They also will bring forward information on new technologies under development at universities or in industry that may call for certain workforce skills for their manufacturer or installation. Participants in the consensus initiative will be the universities and colleges of the UCEAO, representatives from the manufacturing and installation sectors of these industries, and from Ohio's electric utilities.

**Task 2:** *Evaluate current curricula offerings and enhance curricula and training programs to meet the needs determined through task 1*

In partnership with the Ohio Skills Bank program, a comprehensive inventory will be conducted of credit, noncredit and certificate programs in Ohio relating to advanced and renewable energy workforce preparation. The Ohio Skills Bank is already conducting asset mapping and looking at industrial workforce drivers in an attempt to determine where certain workforce skills are most needed; our proposal would build on and support those on-going efforts. A component of this inventory will be the evaluation of programs and courses for delivery options (materials, hands on, distance learning, asynchronous) and the inclusion of internships and co-ops. These inventory and evaluation activities, with the input derived from the consensus developed on the content and training needs to meet the job requirements of the energy industries, will allow the partnership to advance training programs and workforce development in a number of ways:

- Evaluate certification requirements as related to SB221 and state and local installation requirements
- Strengthen existing technical training programs
- Integrate with existing articulation agreements with universities to allow students to transfer into BA programs and convert noncredit courses into credit by examining learning outcomes rather than "seat time"
- Develop agreements with industry partners and design complimentary internship programs
- Evaluate the program's success in graduating students prepared to join the workforce through internship programs aligned with key industrial partners and integrated into the academic learning

**Task 3:** *Develop new curricula and training programs*

In each technical area there will be facilitated sessions led by an experienced professional to bring together industry participants, university participants, and community and technical college participants to review workforce needs, evaluate the

adequacy of existing programs, and to gauge the need for new and expanded courses and programs to support the industry.

- Develop certificate programs in new areas
- Develop new associate degree programs
- Propose new “stackable certificate” programs that will take students from individual credit bearing certificate programs toward completion of the associates degree
- Develop new articulation agreements between community and technical colleges and universities
- Develop new BA and graduate education programs in advanced energy at participating universities including a BA in Alternative and Renewable Energy Engineering Technology (AREET) at Bowling Green State University.

**Task 4:** *Negotiate agreements with participating companies for co-op opportunities and internships.*

To the extent possible and practical, the program will incorporate on-the-job training to enhance and strengthen the students’ skill sets. Manufacturers and equipment installers across the three target industries that were engaged in the earlier project tasks will be asked to participate in the training and education aspects. The potential to coordinate and supplement the training with funding from state and local sources will be examined.

- Develop agreements with industry partners and design complimentary internship and co-op programs

**Task 5:** *Dissemination, Feedback and Evaluation*

- Hold session on the program at the annual meeting of the University Clean Energy Alliance of Ohio
- Advertise and promote courses and programs through media outlets, marketing and other venues

*Year 2*

The second year of the project will begin the stage of bringing the program to statewide distribution. Other universities and community colleges will be invited to participate and visibility will be increased. We intend to include sessions on the program in the October Advanced Energy Tour sponsored by Green Energy Ohio in conjunction with the American Solar Energy Society.

**Task 6:** *New courses at Year 1 community and technical colleges will be introduced to support each technology convening group. Up to three new technical and community colleges in each of the targeted areas of technology will be invited to join the program.*

**Task 7:** *Monthly meetings will be held by each technology convening group to discuss progress with curriculum implementation and the experience of the companies participating in the co-op and internship programs. As more participants are added, these groups will be larger and more visible.*

**Task 8:** *Based on the results of Task 7, curriculum modifications or changes to the co-op and/or internship assignments will be implemented as deemed necessary.*

*Year 3*

New curricula and training programs will enter their second year of implementation. Each technology convening group will issue its report on results, observations and recommendations and submit it to the PI. A compilation of these reports and the reports of Tasks 1 and 2 will be submitted to state agencies that oversee both labor and education in Ohio to promote a statewide system, with state support, for methodology and continued performance. This will provide future sustainability of the entire process in Ohio. The reports will also be reported on at a meeting of the American Council of Renewable Energy's Higher Education Committee and submitted for consideration as a paper for presentation at its national conference.

#### **IV. University Leadership**

The University of Toledo will provide leadership in the solar energy sector (PV and thermal) through its Wright Center for Photovoltaics Innovation and Commercialization. This center is working with industry partners to establish a full value chain by reducing the cost of solar panel production, increasing the efficiency of systems, and reducing the costs of systems components and installations. The industry partners will assist by providing guidance to the community and technical colleges on the training needs for a new workforce that can meet the certification requirements of the state as well as other needs of a growing industry, thus focusing on an often neglected aspect of this transition to a new economy--the need for a new workforce to support the needs of emerging industry.

Bowling Green State University is a partner with UT on its Wright Center for Photovoltaics Innovation and Commercialization and is working with UT on NREL-funded wind energy projects. BGSU will contribute to both the solar and wind areas with particular focus in engineering technology and construction management.

Central State University has an existing program, under the direction of Dr. Subramania Sritharan that provides students with a minor in nuclear engineering offered in conjunction with The Ohio State University and Wilberforce University as well as providing internship opportunities in nuclear power generation. Central also has a proposal to develop a new program in nuclear waste management studies.

## **V. The Partnership**

The University Clean Energy Alliance of Ohio will assist with project oversight and spearhead efforts to bring additional community colleges and additional industry participants into the development model. Operating in conjunction with the state's Ohio Skills Bank regional talent development network and partner colleges and universities, UCEAO will promote career pathways with certificate-granting curricula, "stackable" certificates, and placement programs, internships, co-ops and other techniques that existing workforce training programs have found to be successful.

The functionality of the proposed model will depend on the collaboration of partners in a dual level of "convening technology groups": (1) industry and community colleges and (2) research universities and (3) industry. UCEAO and the Ohio Skills Bank will act as the coordinating units and communication hubs. A general assumption is that, regardless of the specific alternative energy industry sector or product, many of the same foundational skills and tools are necessary. Industrial partners will provide information on the special skills and requirements they desire in the workforce.

The convening technology groups will continually analyze the needs of industry and evaluate the ability of training programs to meet those needs before issues become critical. Training program "career pathway" charts will provide students with a visual pathway for their continuing progress, whether that means certification and licensure or advanced certifications, associate or other degrees. The continuing analysis of the workforce itself also goes beyond manufacturing, installation, operation and maintenance skills to produce the necessary supervisors and managers for the future.

Technology convening groups of education and training partners will meet monthly by conference call to look at what works and what does not, to redesign programs and make sure that pathways exist for workers to move along a continuum. These meetings will help programs in different places fit together for the benefit of the students and could involve concurrent or dual enrollment programs. Partners will augment the benefit for students by creating "stackable certificates" that could lead to an advanced associate degree. For example, a partnership among employers, Terra State Community College and WSOS Community Action, a four-county social services agency, has created the Wind Turbine Technician Certificate at two levels, both of which lead to an advanced level associate degree.

Quarterly meetings with researchers and partner industries will examine the technologies moving into the public domain so that community colleges can prepare programs to respond to workforce requirements. Semi-annual meetings with all partners will assess progress in meeting the needs of industry and provide plans for

meeting future needs. Sessions at the annual meeting of UCEAO will bring this information to a broader community of those involved in research and technology development in advanced energy in Ohio.

## **VI. Senior Institutional Administrator and Management Plan**

As required by the NSF for this program, the senior institutional administrator will be Frank J. Calzonetti, Vice President for Research Development at The University of Toledo. Dr. Calzonetti was the PI on an earlier PFI award (“Northwest Ohio Partnership on Alternative Energy Systems” 0227899) that successfully brought visibility and expanded programs to Toledo’s solar energy cluster. That project also conducted numerous outreach activities for students, the community and government officials. Examples of these activities included presentations to civic groups, an installation at the local children’s science museum, a public television program, press releases, and the installation of several PV arrays around the city and on the UT campus. Owens Community College, a partner in this proposal, was instrumental in developing workforce training programs in the earlier effort; those programs have been continued with state support.

Norman J. Stevens, P.E., Co-Director of the Wright Center for Photovoltaic Innovation and Collaboration (PVIC) at The University of Toledo will convene the photovoltaic group. He has more than 35 years experience with the electric utility industry and, as co-director of the PVIC, is responsible for leading the initiative to work with state agencies, industry and advocacy organizations on the commercialization of solar photovoltaic technologies, including determining emerging workforce requirements and training needs.

Robert Kozar will spearhead the wind group. He has over twenty years of experience working for NASA Glenn and now reports jointly to the UT Vice President for Research Development and the Dean of the College of Engineering to lead UT’s wind energy projects. He served as the Director of NASA Plum Brook Station that housed a series of wind machines in the 1970’s and 1980’s.

Dr. Subramania Sritharan will spearhead the nuclear energy group. He has had over twenty years of experience in Water Resource Management. Currently he is the Chair of Water Resources Management and Director of the International Center for Water Resources Management at Central State University.

As shown in the organization chart, the project will be managed by a PI, a Project Coordinator and Team Leaders in each of the technology convening groups (wind, solar PV and nuclear energy). The PI will be responsible for guiding the collaboration efforts and will spearhead contacts with additional industrial partners. Additionally, the PI

will, in cooperation with team leaders, oversee the hiring and management of consultants in Tasks 1 and 2, work with the team leaders in developing surveys, participate in projects meetings across all three industry sectors, coordinate and monitor the progress throughout the project, and report on its achievement.

Team leaders will conduct the day-to-day operations of their groups, working closely with both the academic and industrial participants to assure that they are active and fully engaged in the program; they will submit and tabulate surveys and prepare the written reports. Semi-annual meetings will bring all partners together to examine technological advances and future training needs so that advanced energy developments can be brought quickly to the marketplace without a lag in the expertise necessary for manufacture, installation and maintenance.

The project will be provided with additional oversight and support from a subcommittee aligned with University Clean Energy Alliance of Ohio. Each technology area will have convening technology groups chaired by a co-PI who will work to develop new courses, certificates, and programs to support workforce training for the industry. The roles and responsibilities of the PI, the project manager, the co-investigators, and the oversight subcommittee are described below. Our plan is also to have frequent reports on the progress of the project with the project to have a featured session in the annual meetings of the University Clean Energy Alliance of Ohio.

Jane Harf, Director of UCEAO, will assist with project oversight and provide linkages between technology convening groups, ODOD, community colleges and industry. Her position within UCEAO also has her making frequent visits throughout the state to universities, businesses, and community and technical colleges. In her capacity at Director of UCEAO, she is in a position to expand programs in additional sites and recruit additional businesses into the partnership.

Oversight Committee. The Oversight Committee will provide independent evaluation, direction, and support for the project and will be closely aligned with UCEAO. The Committee includes two members of the UCEAO Board of Directors from a university not participating the project, one representative from a federal laboratory affiliate of UCEAO, one representative from the Ohio Energy Office, one business representative, and two members from community and technical colleges. The Chair of the Oversight Committee will be a member of the Board of Directors of UCEAO and will report activities to the full Board of UCEAO quarterly.

Campus Co-Investigators. At each campus will be a responsible co-investigator who is responsible for the progress of the project and the completion of project deliverables.

Convening Technology Groups. Each technology area will have a coordinator and a working group of industry, university and community and technical college to provide information on the current and project workforce needs of the industry and guidance on the development of new courses to support this need. These will be individuals who have intimate knowledge of the technology and are in close communication with state leaders and industry organizations involved in promoting the industry.

Project Coordinator. Margaret Traband will manage the budget, maintain the Website, organize teleconferences and quarterly and annual meetings and be a primary point of contact for the project.

## **VII. Related Activities of Partners**

Ohio higher education institutions have already taken steps to prepare the workforce for the renewable energy industry. For instance, the NSF-PFI funded “Northwest Ohio Partnership in Alternative Energy Systems” provided funds to Owens Community College in 2003 to design and deliver a solar panel installer certificate program. The University of Dayton (UD) and Wright State University (WSU) have received OBOR approval to offer a joint Master of Science in Engineering in Renewable and Clean Energy, effective beginning in 2009, in collaboration with Central State University (CSU) and Air Force Institute of Technology (AFIT). Central State University will offer courses for this program on its campus. The community colleges participating in this model development are already conducting several specialized training courses and offering specialized programs. Owens offers a 40-hour class to train those interested in becoming a PV installer and its graduates are eligible to sit for the North American Board of Certified Energy Practitioners Entry Level Certificate Program exam. Hocking offers an Associates Degree program in Advanced Energy and Fuel cells, and Terra has designed a Wind Turbine Technician Certification Program being designed in cooperation with BGSU. Lakeland has an Associates degree program for nuclear technicians where First Energy pays student tuition and provides job placements. Central State cooperates with Lakeland in providing African-American students or students from other underrepresented groups to Lakeland and assists in recruiting high school students for the program. Our project builds upon the experiences gain in these programs to provide expanded and new offerings on those relationships and expertise to create a vibrant set of training programs across the state.

## **VIII. Innovation Outcomes and Evaluation**

This proposal is designed to be a model for the analytical and deliberative processes which can be followed through collaboration to provide educational programs focused on the needs and objectives of emerging industries. The intent is to develop educational and training objectives and approaches that are focused and have a consistency needed

to produce graduates holding certificates and degrees and whom industry will find capable and productive installers, technicians, designers, and managers in fields which are emerging and to some degree undefined. We also plan to increase the participation of students from underrepresented groups in these programs. Assessment and monitoring of success in reaching the project objectives will be measured in a number of ways:

- Engaged Organizations

It will be an objective to engage two to five companies from each industry in the program, including a minimum of one company active in the design and manufacturing of the technology and one company active in the installation and maintenance of the equipment. Similarly, two to five institutions currently offering academic courses which they plan to evolve into certificate and/or degreed programs will participate. The core working group of industry representatives and academia in each technology sector (wind, solar PV and nuclear energy) will number from four to six.

- Programs

The number of programs to be modified or developed will be determined based upon the outcomes of Tasks 2 and 3 to provide the measure by which the program will be able to gauge its success in producing the academic component.

- Program Distribution

This objective is long-term in nature; during the third year of the project we expect to see the beginnings of this process. The measure will be a comparison of the offerings at the start of Year 2 and the completion of Year 3.

- Students

During year one of the project, a survey of participating university and community colleges will be made to determine the participation in the courses being offered at that time; this survey will set the benchmark. Follow-up surveys will be taken at the end of Years 2 and 3 to gauge the rate at which student participation has increased paying particular attention to enrollment of students from underrepresented groups. These surveys will be compared against the job creation projections of Task 1 to gauge the progress made in producing the number of trained workers needed. Each participating university and college will report on the number of students enrolled in courses associated with the certificate and degreed programs at the beginning of each academic term and those successfully completing the courses to determine progress in student attraction, retention and achievement.

- Companies

The companies participating in the program will be the focus (“control group”) for measuring success in this area. They will be surveyed as to the number offering internships at the beginning of Years 1, 2 and 3. Other companies in Ohio engaged

in manufacturing and support services for the wind, solar PV and fuel cells industries will also be identified and surveyed.

- Internships

The surveys conducted to determine the number of companies offering internship programs will also obtain data on the number and types of internships being offered by each company.

- Certifications and Employment

A survey will be taken of the participating universities and colleges at the end of Year 1 and at the end of each successive academic term during the project period to determine the number of students participating in certificate and degree programs who express a moderate to strong interest in working in the wind, solar PV or nuclear fields and their eventual achievement in obtaining certification in their chosen area. The “control group” of companies will be surveyed once a year to determine the number of graduates hired from participating universities and colleges and as a percentage of total hiring. Similarly, an attempt will be made to gather the same information from other companies in the same industry not involved in the project.

The results of these measures will provide information to be used to modify the academic programs and internships to improve on meeting their objectives. They also will provide evidence of the programs value as a model to be used to develop students for jobs emerging in other industries.

### **VIII. Program Dissemination**

Information on the project will be disseminated throughout Ohio and at national venues. There will be a highlighted session on the project at the annual meeting of UCEAO that attracts university and industry researchers from throughout the state as well as leaders from state government and industry. By holding a session on this project at the annual meeting, it will be possible to increase the statewide understanding of the program, recruit additional universities and businesses to participate in the program, and to receive feedback on ways to modify the program for the future. The program will be integrated with the Green Energy Ohio Advanced Energy tours and presentations will be submitted to the American Council of Renewable Energy’s Higher Education Committee.

<sup>1</sup> Ohio Board of Regents Strategic Plan, page 23; posted at <http://www.uso.edu/strategicplan/downloads/documents/strategicPlan/USOStrategicPlan.pdf>]

<sup>2</sup> CBSnews.com, accessed 12/4/2008,  
<http://www.cbsnews.com/elements/2008/02/12/business/map3823166.shtml>

<sup>3</sup> Ohio Department of Development, 2008, Ohio, Home of Innovation and Opportunity, p. 2.

<sup>4</sup> See, e.g., [www.appolloalliance.org](http://www.appolloalliance.org), as an example of unionized manufacturing labor organizing itself in an effort to tackle alternative energy technologies.

<sup>5</sup> Lorenz, Pr; Pinner, D; Seitz, T, June 2008. "The Economics of Solar Power." *The McKinsey Quarterly*.  
[http://www.mckinseyquarterly.com/The\\_economics\\_of\\_solar\\_power\\_2161](http://www.mckinseyquarterly.com/The_economics_of_solar_power_2161)

<sup>6</sup> Benneworth, P. and G-J Hospers, 2007. "Urban competitiveness in the knowledge economy: Universities as new planning amateurs." *Progress in Planning*, Vol. 67, pp. 105-197.

<sup>7</sup> Gunasekara, Chrys, 2006. "Reframing the Role of Universities in the Development of of Regional Innovation Systems." *Journal of Technology Transfer*. Vol 31, pp. 101-113.

<sup>8</sup> Mayer, Heike. 2006. "What is the Role of Universities in High-tech Economic Development? The Case of Portland Oregon, and Washington, D.C." *Local Economy*. Vol. 21, pp. 292-315.

<sup>9</sup> Stepping Higher: Workforce development through employer-higher education partnership, CBI on Higher Education, October 2008, p. 20.

<sup>10</sup> Boucher, Gerry, Cheryl Conway, and Els Van Der Meer. 2003. "Tiers of Engagement by Universities in their Region's Development." *Regional Studies*, Vol. 37, pp. 887-897.

<sup>11</sup> Bezdek, Roger H. *Defining, Estimating, and Forecasting the Renewable Energy and Energy Efficiency Industries in the U.S. and in Ohio*. Boulder, Colorado: The American Solar Energy Society and Washington, D.C.: Management Information Services, Inc., November 2007.

<sup>12</sup> Ibid, p. 10.

<sup>13</sup> Ibid, data from charts on pages 78, 113, 122, 123.

<sup>14</sup> Ford, Mike, "West Ohio prime spot for wind turbines." The Delphos Herald. Published: Saturday, August 2, 2008. Accessed online 12/9/2008  
[<http://www.delphosherald.com/2008/08/02/west-ohio-prime-spot-for-wind-turbines/>]

## *Academic Institutions*

### **Bowling Green State University**

Wayne Unsell

Dean, College of Technology

Bowling Green State University is a partner with UT on its Wright Center for Photovoltaics Innovation and Commercialization and is working with UT on NREL-funded wind energy projects. BGSU will contribute to both the solar and wind areas with particular focus in engineering technology and construction management.

### **Central State University**

Dr. Charles H. Showell Jr.

Dean, College of Business and Industry

Clark Fuller

Assoc Dir, Sponsored Prog.

Subramania I. Sritharan

Chair, Water Resources Management and

Director, International Center for Water Resources Management

As a public historically black university in the State of Ohio, Central State University (CSU) offers a unique opportunity for students. Minorities, especially African Americans, are woefully underrepresented in the sciences, technology, engineering, and mathematics (STEM disciplines). This nationwide lack of STEM professionals from the minority community is a long-term issue that requires a comprehensive approach.

With its involvement in the Partnerships for Innovation (PFI) program, CSU will seek to utilize the resources and facilities of its International Center for Water Resources Management (ICWRM) to incorporate a nuclear waste management studies capability at CSU. While collaborating with UCEAO member institutions and nuclear industrial partners, CSU will utilize its capabilities in groundwater processes, geo-chemical modeling, water quality and remote sensing to build a comprehensive program to study nuclear waste management. The two end goals will be to contribute towards (1) the science core of environmental management associated with nuclear waste management, and (2) the larger initiative of diversifying the nuclear waste management workforce through curricular development and career offerings.

Central State University, along with the University of Dayton, Wright State University, and the Air Force Institute of Technology will also join forces for a two-year master's program in clean and alternative energy.

### **Hocking College Energy Institute**

Jerrold (Jerry) Hutton MEd. ABD

Hocking College

Dean Advanced Energy and Transportation

Hocking College Energy Institute offers two Associate Degree programs:

Advanced Energy & Fuel Cells and Automotive Hybrids & Fuel Cells.

Graduates of these programs are employed in various areas of the energy field including hydrogen storage, advanced battery development, solid oxide fuel cell production, proton exchange fuel cell membrane, corrosion, cryogenics, fleet technicians, automotive service technicians, sales and marketing of vehicular diagnostic equipment, and vehicular laboratory technicians.

At the Hocking College Energy Institute students receive a hands-on education that enables them to practice safety procedures, fuel compression and cryogenics of hydrogen, natural gas, and liquid propane gas. Students also learn about the construction, installation, modification and testing of multiple types of advanced energy apparatus. This extensive curriculum allows students to be ready to enter into the exciting and evolving energy industry.

The college also offers a 40-hour, hands-on training course on solar photovoltaics design and installation that prepares individuals to sit for the North American Board of Certified Energy Practitioners (NABCEP) Entry Level Certification exam.

### **Lakeland Community College's Nuclear Engineering Technology Program**

Donald J. Anthan

Dean, Mathematics & Engineering Technologies Division

In 2002, Lakeland Community College (Lakeland) collaborated with FirstEnergy to develop a two-year Associate of Applied Science Degree Program in Nuclear Engineering Technology (NUET). The program was designed to provide graduates with the necessary technical skills for immediate employment in a nuclear power plant. To date, 100% of Lakeland's graduates have been employed by FirstEnergy in key positions, including electrical and mechanical maintenance, operations, radiation protection, and chemistry. The program also provides a strong foundation in mathematics, science, and general education courses enabling graduates to pursue their education in the future.

In 2006-2007, the program was accredited by the Technology Accreditation Commission of the Accreditation Board for Engineering and Technology (TAC/ABET), making it the only TAC/ABET accredited Nuclear Engineering Technology Program in the Great Lakes Region.

### **Owens Community College**

Joseph P Peschel

Programmer, Customized Training, Workforce and Community Services

Owens State Community College currently has three courses in solar including: Solar Fundamentals of Solar Hot Water Heating, PV Basics - design and installation of solar electric technology systems, and PV Certification – preparation for NABCEP certification exam. Owens also has 14 courses relating to energy efficiency and construction.

### **Terra Community College**

Bruce A. Meyer, Dean

Technology and Work Force Development

Terra currently offers a class in Renewable Energy and a class in Sustainable Architecture within our Architecture and Construction degree. We are finalizing a Wind Power Certificate to be offered at Terra. In collaboration with Owens CC, Terra is offering a Photovoltaic class this Spring. The class will be located in Sandusky County.

With the help of this grant, Terra will create additional awareness and understanding of alternative energy in our service area by promoting, educating and establishing new training knowledge regarding the alternative energy field. The classes and training will be credit and non credit with the majority leading towards a certificate that can be stacked and applied to an associate degree.

### ***Industry (Private Sector) Partners***

Advanced Energy Generation

John Witte

Vice President of Operations

Engineered Process Systems

Michael D. Spacek

Director of Energy Services

FirstEnergy

Daniel T. Culliton  
Manager, Fleet HR Support

First Solar

Communications have been under way with David Eaglesham, VP for Technology. Because of travel and communication conflicts over the holidays, their commitment letter was not received in time to be included in the file.

North Coast Wind and Power

Tom Williams

Solar Fields (Calyxo)

Norman Johnston  
Vice Chairman

Wire-Net (Great Lakes Wind Network)

Ed Weston  
Director, Great Lakes Wind Network

Xunlight

Matt Longthorn  
Vice President of Corporate Development and Strategies

***State Government: State of Ohio***

Ohio Board of Regents

Linda Stacy  
Regional Director, Ohio Skills Bank

***Non Profit***

University Clean Energy Alliance of Ohio

Jane Harf  
Director

Award Date: July 15, 2009  
Award No. IIP-0917981  
Proposal No. IIP-0917981

Dr. James P. Trempe  
Senior Director  
The University of Toledo  
2801 W Bancroft St., MS 944  
TOLEDO, OH 43606-3390

Dear Dr. Trempe:

The National Science Foundation hereby awards a grant of \$599,901 to The University of Toledo for support of the project described in the proposal referenced above as modified by revised budget dated May 26, 2009.

This project, entitled "PFI: An Innovative Model for a New Advanced Energy Workforce," is under the direction of Frank J. Calzonetti, Jane Harf, Mary Waldock.

This award is effective August 1, 2009 and expires July 31, 2012.

This grant is awarded pursuant to the authority of the National Science Foundation Act of 1950, as amended (42 U.S.C. 1861-75) and is subject to Research Terms and Conditions (RTC, dated July 2008) and NSF RTC Agency Specific Requirements (dated July 2008) available at <http://www.nsf.gov/awards/managing/rtc.jsp>.

This award is made in accordance with the provisions of "Partnerships for Innovation (PFI)", NSF 08-583.

The Foundation authorizes the awardee to enter into the proposed contractual arrangements and to fund such arrangements with award funds up to the amount indicated in the approved budget. Such contractual arrangements should contain appropriate provisions consistent with Articles 8.a.4 and 9 of the NSF Grant General Conditions (GC-1) (dated 6/1/07) or Articles 5 and 40 of the Research Terms and Conditions (dated July 2008) and any special conditions included in this award.

The attached budget indicates the amounts, by categories, on which NSF has based its support.

Please view the project reporting requirements for this award at the following web address  
[\[https://www.fastlane.nsf.gov/researchadmin/prsLoginHome.do?awdID=0917981\]](https://www.fastlane.nsf.gov/researchadmin/prsLoginHome.do?awdID=0917981).

The cognizant NSF program official for this grant is Sara B. Nerlove, (703) 292-7077.  
The cognizant NSF grants official contact is Stephanie Gorman, (703) 292-4809.

Sincerely,

John C. Robey  
Grants and Agreements Officer