

# University-State Partnership to Promote Residential Electric Generation from Solar and Wind Energy in Western Maryland

O. A. Soysal, *Senior Member, IEEE*, H. S. Soysal, C. Godfrey, and T. LaRonde

**Abstract**—A partnership program developed between Maryland Energy Administration and Frostburg State University is described. The main purpose of this partnership is to promote residential electric generation using solar and wind power in Western Maryland. Activities include construction of a grid-tied hybrid demonstration system, development of a knowledge base to assist the local community to develop their own generation systems, development of interdisciplinary curriculum for existing and new courses at FSU, dissemination of the results through outreach programs, and administration of the Maryland State Anemometer Loan Program. The initial reaction and input received from the FSU community and expected outcomes are discussed.

**Index Terms**— Renewable Energy Solar Power Generation, Wind Power Generation, Hybrid generation, Green energy.

## I. INTRODUCTION

Maryland Energy Administration (MEA) and Frostburg State University (FSU) recently initiated a partnership to promote the idea of harvesting solar and wind energy at residential level in Western Maryland. The main purpose of this partnership is to increase public awareness of the benefits of solar and wind energy.

With the funding made available by MEA, FSU will design and build a grid-tied demonstration system to supply a small building on campus. The experience gained over the design, installation, and operation phases will be disseminated to the local community through outreach programs. Frostburg State University will provide assistance to the residents and small business entrepreneurs of Western Maryland who wish to develop such generation systems in their properties.

The following sections describe the scope of activities and expected outcomes of the MEA-FSU partnership.

---

This work was supported by the Maryland Energy Administration under Contracts #2007-02-B043J and #2007-01-B0310.

Oguz. A. Soysal is with Frostburg State University, Frostburg, MD 21532, USA (e-mail: [osoysal@frostburg.edu](mailto:osoysal@frostburg.edu)).

Hilkat S. Soysal is with Frostburg State University, Frostburg, MD 21532, USA (e-mail: [hsoysal@frostburg.edu](mailto:hsoysal@frostburg.edu)).

Crissy Godfrey is with Maryland Energy Administration, Annapolis 21403, USA (e-mail: [cgodfrey@energy.state.md.us](mailto:cgodfrey@energy.state.md.us)).

Tim LaRonde is with Maryland Energy Administration, Annapolis 21403, USA (e-mail: [tlaronde@energy.state.md.us](mailto:tlaronde@energy.state.md.us)).

## II. BACKGROUND

The U.S. Department of Energy (DOE) established Wind Powering America Program (WPA) in 1999 to identify barriers to wind's use and pursue strategies for overcoming them, primarily at the state level. WPA has developed a package of technical assistance and outreach activities aimed at key user communities. WPA has adopted a number of operating principles, including working at the market margins, leveraging and building institutional partnerships; developing innovative pilot applications; replicating successes; utilizing existing national, regional and local expertise; and coordinating with established wind institutional resources.

The Maryland Energy Administration (MEA) was founded in 1991 to advise the Governor on directions, policies and changes in the various segments of the energy market. The *mission* of the Maryland Energy Administration (MEA) is "to maximize energy efficiency while promoting economic development, reducing reliance on foreign energy supplies, and improving the environment" [1].

The MEA's coordination, outreach, and demonstration activities provide a concentrated effort to overcome barriers to and increase awareness of benefits of wind and solar energy, bolster support of related development activities, and implement wind and solar demonstration and pilot projects. In addition, these activities specifically include, but are not limited to, targeting agricultural businesses and rural landowners to foster new investment opportunities and/or simply reduce energy bills.

## III. SCOPE

MEA and Frostburg State University (FSU) started a partnership program in November 2006. The overall purpose of this partnership is to promote the use of solar and wind power in Western Maryland at residential and small business level, targeted but not limited to agricultural and farming businesses. Parallel activities described below will help development of hands-on experience in technical, economic, administrative, and social issues that might arise in design,

installation, and operation of residential generation systems in Western Maryland.

The major activities of the partnership program include the following tasks:

- Design and construction of a residential scale solar-wind powered hybrid demonstration system
- Curriculum development and or outreach activities
- Preparation of case studies and technical assistance
- Dissemination of the experience and knowledge base developed throughout the program
- Administration of the Maryland State Anemometer Loan Program

*a) Construction of a residential scale solar-wind powered hybrid demonstration system*

The demonstration system is intended to be an example residential unit affordable for residents, farmers, and small business entrepreneurs. All components must be available in the competitive market accessible to local residents.

Considering the requirements summarized above, a total rated power of approximately 4-kW was selected for the model hybrid system. One wind turbine driving a generator of 1.8 – 2.5-kW rated power installed on a 35-foot tower constitutes the wind part of the system. The solar part of the system consists of ten photovoltaic panels of 2-kW total rated power installed on the roof of the building. Solar and wind generation units will be connected to the 120-V grid via separate inverters for more flexible operation. The layout of the system is illustrated in the symbolic picture shown in Figure 1. The construction and operation of the hybrid demonstration system consists of the following phases:



Figure 1 A symbolic picture illustrating the hybrid system

- Site selection and design of the demonstration system
- Purchase and installation of equipment
- Test and monitor the system performance
- Perform necessary adjustments
- Continue monitoring the system output to record long term statistical data

*b) Curriculum development and Outreach Activities*

The main purpose of the hybrid system described above is to develop curriculum for outreach programs and interdisciplinary courses taught at FSU.

FSU will cooperate with MEA in efforts to expand outreach to additional stakeholder communities in Western Maryland by offering activities such as guided tours, panel discussions, lectures, seminars, and workshops. In addition, FSU will work with other State contractors as well as representatives of the local communities and governments, non-profits, and private companies to disseminate information on wind energy as well as any outreach materials created in conjunction with the FSU wind and solar demonstration project.

FSU will also organize and host a Renewable Energy Symposium and exposition in the spring of 2007. This symposium will enlighten Marylanders to the benefits of renewable energy; allow an opportunity for business dealing with renewable energy products to showcase their technologies, and provide a forum for presenters and participants to discuss barriers to introducing wind energy as a mainstream energy resource to Maryland.

*c) Development of Case Studies and Technical Assistance*

Case studies will be developed to document the construction and performance processes of a wind-solar hybrid demonstration project. The first case study will detail each step of the construction process, which will include preliminary design; procuring equipment; navigating zoning ordinances and local regulatory issues (both for the university as well as local government); public comment or cooperation; utility cooperation; and available financing opportunities (e.g., net-metering). The second case study will monitor data collected through the aforementioned demonstration project (as part of an in-kind match of resources) which will detail the performance of the installed system such as annual kWh generated, wind speeds, wildlife and environmental impacts, and public perception.

*d) Dissemination of the experience and knowledge base developed throughout the program*

The experience gained throughout the program will be disseminated via reports, publications, and web page. The home page created for the project [2] will provide continuously updated information about the progress and experience gained in the program.

The fall Wind Energy Working Group meeting was held on December 13, 2006. The Renewable Energy Symposium will be offered in April 2007.

Two case studies will be finalized and disseminated after the completion of the demonstration system and the Renewable Energy Symposium to evaluate the gained experience and inputs.

*e) Administration of the Maryland State Anemometer Loan Program*

The purpose of the Maryland State Anemometer Loan Program is to provide residents with an opportunity to monitor wind speed at their properties over a period of one year. Collected data is used to analyze the feasibility of a residential scale wind powered generation unit at the particular location.

As part of the MEA-FSU partnership, Frostburg State University administers of the Maryland State Anemometer Loan Program. The program was previously administered by James Madison University (JMU), VA. The project activities consist of evaluation of applications, installation of anemometers, data collection and analysis. After a transition period of six months, the loan program will be completely transferred to FSU by June 30, 2007 and administered through April 30, 2008.

A timeline for the tasks outlined above is shown in Table-1. The Maryland State Anemometer Loan Program may be renewed after May 2008.

**Table 1 Timeline of Program Activities**

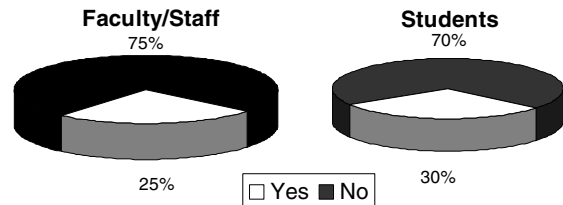
	Construction of Hybrid System	Outreach and Technical Assistance	Anemometer Loan Program	Case Studies
11/06	Design system and order equipment	Working Group Fall Workshop	Shadow JMU team during the installation of anemometers	Draft Case Study 1
12/06				
01/07	Site preparation	Curriculum Development	Transfer methodology for ranking applicants and manage the application process	
02/07	Installation, tests, inspection utility contracts	Working Group Spring Workshop		
03/07	Monitoring, data collection, and maintenance	Renewable Energy Symposium	Complete transfer to FSU	
04/07		Dissemination of acquired knowledge to Western Maryland through Media, Web, and open house presentations		
05/07				
06/07				
07/07	Case Study 1			
08/07		Case Study 2		
09/07				
10/07				
11/07				
12/07				
01/08				
02/08	Case Study 2			
03/08				
04/08	Case Study 2			
05/08				

**IV. PUBLIC PERCEPTION AND OPINIONS**

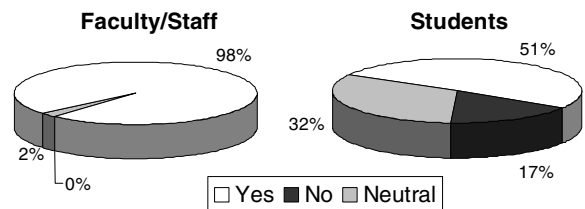
Since the objective of the partnership is to increase public awareness of the benefits of wind and solar energy and promote the idea of distributed electric generation by residential hybrid systems, public cooperation is crucial for the success of the program. Immediately after the official start of the program, the Frostburg State University community has been informed about the purpose and expected outcomes through information meetings, e-mails, and the Internet. The public opinion about use of wind and solar energy as well possible impacts of the project on FSU and Western Maryland was sought by a survey distributed to faculty, staff, and students electronically as well as hard copy. In total 158 responses were received to the survey, with a distribution of 16% faculty, 12% staff, and 72% students.

Figure 2 shows the awareness of the respondents about federal and state initiatives available to Marylanders and their willingness to learn more about solar and wind energy. The charts indicate that the majority of the respondents are currently not aware of the available incentives. Faculty and staff are more interested in learning about the possible residential use of solar and wind energy compared to students. The results of this first survey will be used in the future for comparison to assess the change in public awareness throughout the program.

*Question: Are you aware of the federal and state initiatives available to Maryland residents to harvest renewable energy in their homes or farms?*



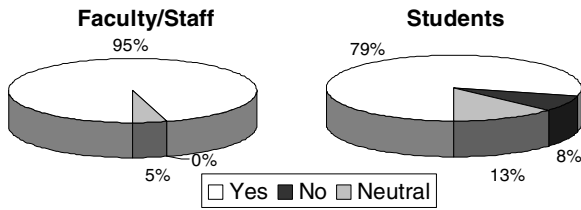
*Question: Are you interested in learning more about using solar and wind power in your residence*



**Figure 2** Public awareness of federal and state renewable energy incentives available in Maryland and willingness to learn more.

The preliminary perception of the respondents about the effectiveness of solar and wind energy for electric production in Western Maryland is shown in Figure 3. The responses show that the common belief in wind is stronger than solar energy in the region.

Question: Do you think wind energy may be efficient in our region?



Question: Do you think solar energy may be efficient in our region?

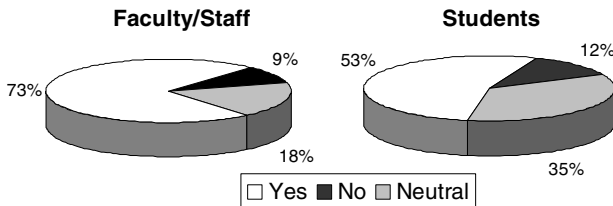


Figure 3 Public perception about solar and wind energy in Western Maryland

As seen in Figure 4, 99% of faculty and staff think that FSU should develop expertise and experience on solar and wind energy. The ratio is 71% among the students, 25% are neutral and 4% do not think FSU should develop such expertise.

Question: Do you think FSU should develop expertise and experience to assist residents who wish to generate their own electricity from sun and wind?

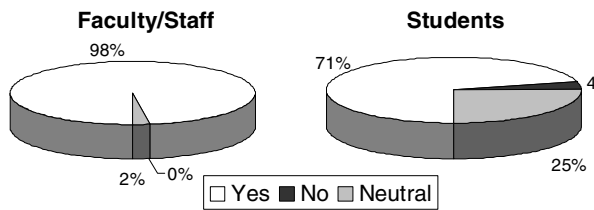


Figure 4 Public opinion about development of expertise at FSU on residential use of solar and wind energy

The public acceptance of a demonstration system on FSU campus is reflected in the charts shown in Figure 5. Apparently, faculty and staff are more receptive to the idea of building a demonstration system on campus.

Question: Would you like to see a demonstration system supplying a small building on FSU campus powered by a small wind turbine and solar panels

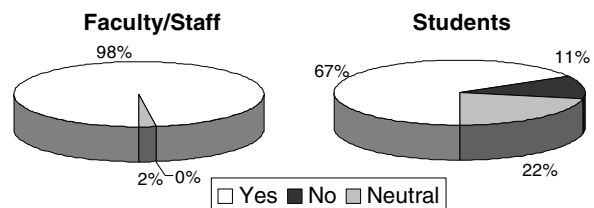


Figure 5 Acceptance of a demonstration system on campus

Figure 6 shows the opinion about the overall impact of the system on FSU. Faculty and staff unanimously think that the partnership will have positive impact while a group of students are neutral. Only one student expects a negative impact.

Question: What do you think about the possible overall impact of this project at FSU?

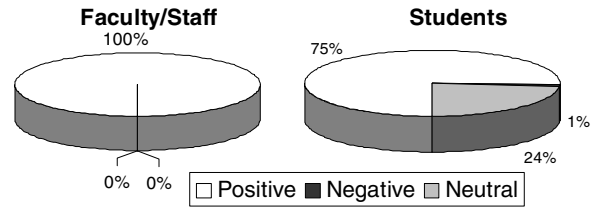


Figure 6 Public opinion about the possible impact of the program on FSU

The following free response questions were included in the survey:

- Do you feel this project would benefit FSU? If so, how? If not why?
- Do you feel this project would benefit Western Marylanders? If so, how? If not why?

The free responses on the expected benefits of the project for FSU concentrate are combined and summarized below. Unedited free responses can be seen at [2].

Question: Do you feel this project would benefit FSU? If so, how? If not why not? (Summarized answers)

- Learning and training opportunity for students
- Interdisciplinary learning
- Enhancement of the reputation of FSU
- Influence on prospective students, help recruitment
- Integration of research and application for the benefit of the area and students
- Bringing attention to the resources and expertise available at FSU
- Allowing FSU to play more of a part in the community
- Helping the FSU community to learn more about viability of renewable clean energy
- Creating more positive relationship with local residents by supplying information and possibly save them money while conserving our natural resources
- Possibility for surrounding residential and business communities to partner with the university for small scale units off campus designed and installed by students, giving them practical experience

Free responses to the question about the possible impact of the project on Western Maryland are combined and summarized below. For unedited version of the responses please visit <http://www.frostburg.edu/renewable>.

Question: Do you feel this project would benefit Western Maryland? If so, how? If not why not? (Summarized answers)

- *Attracting creative thinkers about energy to the region*
- *Promotion of engineering education in this area*
- *Potential to reduce pollution from coal burning generation*
- *Creating alternatives for reducing cost and increasing competition*
- *Providing more cost effective solutions for energy needs and reduce the energy cost*
- *Learning opportunity for the region's public schools*
- *Will benefit primarily individuals, not some large corporate company that installs large units that interfere with natural beauty of Western Maryland*
- *Provide the area residents with a cheap, clean, and alternative resource to using coal*
- *Will forward the message "We, as Western Marylanders, are taking action to become more environmental friendly through our research to, and application of renewable energy."*

The free responses included very few negative reactions to the project regarding impacts on FSU and region. The concerns raised in the surveys are quoted below:

Concerns (unedited)

- *"If the only thing that makes alternative power affordable is subsidies, as is currently the case in wind generation, then we are just fooling ourselves that it is less expensive since taxpayers in general are funding that affordability."*
- *"Wind turbines impact our wildlife for which renewable energy from this source kills and maims birds and bats so necessary to our environment"*
- *"I feel that turning over to wind power, although it may seem like a good idea, will ultimately hurt the campus. I believe this because the wind-power is not sufficient enough to make much of an impact at all. All it is going to do is take up space and take away from the campus' natural beauty. If I was looking at Frostburg as a freshman it would be kind of unusual to drive by and see beautiful mountains, trees, plants, and then a windmill. I wholeheartedly disagree with this whole operation! I feel that it will ruin Frostburg's natural beauty (one of the main reasons that freshmen decide to come here and I decided to live here). And while one windmill might not seem like too big of a deal, keep in mind that the only way this project would be effective and useful is to make hundreds of windmills to generate enough electricity to power maybe a hundred houses or so. So why build one windmill (which won't accomplish anything) and ruin the natural beauty that has made Frostburg so unique for years."*

## V. EXPECTED OUTCOMES

The partnership established through two projects involving multiple activities is expected to result in a broad range of outcomes. The first public reaction collected from the survey results indicated strong community support to the planned activities. Comments and suggestions made in free responses and individual communication inspired additional new directions supporting the initial scope and expectations of the project.

The primary outcome is obviously a knowledge base to provide the local community with unbiased information about residential hybrid generation systems. Currently no such system is in operation in the region. While commercial literature and technical support services are available for design and installation, there is no working example proving the feasibility and cost effectiveness of residential hybrid systems. The construction of a demonstration system will provide first-hand experience and will allow collection of actual energy data. The survey responses show that the community is under an impression that wind would be more efficient than solar energy in the region. However, no long term data is available for Western Maryland to estimate the possible energy output from neither small wind turbines nor photovoltaic panels. A mathematical model developed to estimate the energy output based on wind speed and solar radiation measurements considering local constraints will help in finding an economic composition of solar and wind generation. Consequently, technical and financial decisions may be more realistic resulting in significant savings in individual investments and state financial incentives.

The educational outcomes from FSU perspective include development of interdisciplinary curriculum for existing or new courses. The project activities will provide real-life examples for faculty members and students to develop wide variety of projects. A "Renewable Energy Center" that will be created at FSU as one of the requirements of this partnership will establish a common platform for multidisciplinary research.

The mission statement of Frostburg State University emphasizes the responsibility of the university in the economic development of the region. One of the major expectations from this partnership is enhancement of the relationships with local community. In the case the model system proves to be cost effective, members of the local community would be more interested in building similar systems in their properties to reduce their energy cost. Joint projects may be developed to design and install such systems for small business entrepreneurs and farmers.

Administration of the State Anemometer Loan Program will allow Western Marylanders take advantage of this

opportunity to collect wind data in their properties. This will also enhance the Western Maryland wind database.

## VI. CONCLUSIONS

The partnership established between Maryland Energy Administration and Frostburg State University involves several parallel activities to promote development of residential power generation from wind and solar energy in Western Maryland. Case studies based on the hands-on experience gained during the design, installation, and operation of the hybrid demonstration system will include technical, economic, administrative, and social issues associated with grid-tied residential electric generation systems.

The FSU community has shown an excellent support for the program appreciating the visible benefits to the university and region. Many faculty, staff and students made useful comments and suggestions to add value to the overall program.

The knowledge base developed throughout the activities will help in making better decisions in design of hybrid generation systems and investment planning. Especially, the model will provide actual data on the cost-effectiveness of solar and wind powered generation in Western Maryland.

The model hybrid system will be a live example for faculty and students to develop interdisciplinary projects. The partnership overall is expected to enhance the interactions between FSU and local community.

## VII. REFERENCES

- [1] Maryland Energy Administration, Home Page, <http://www.energy.state.md.us/>
- [2] Frostburg State University Renewable Energy Home Page, <http://www.frostburg.edu/renewable>

## VIII. ACKNOWLEDGMENT

The authors thank Dr. Jonathan Gibraltar, President of Frostburg State University, Mr. Stephen Spahr, Vice President for Economic Development and Government Relations at FSU, and Mr. Frederick Davis, Director of Maryland Energy Administration for their support and guidance. The valuable input and support of Frostburg State University community is also acknowledged and appreciated.

## IX. BIOGRAPHIES



**Oguz A. Soysal** received the B.Sc., M.Sc., and Ph.D. degrees from Istanbul Technical University, Turkey. In 1983 he joined ABB-ESAS Power Transformer Company (Istanbul, Turkey) as an R&D engineer. From 1986 to 1993 he worked for Black-Sea Technical University, Turkey. In 1987 he visited The Ohio State University (OSU) as a Post Doctoral Scholar, and in 1991-1992 he spent a sabbatical leave at the University of Toronto. Between 1993 and 1997 he has been with Istanbul University, Turkey, and Bucknell University, Lewisburg, PA, USA. He joined Frostburg State University in fall 1998. Currently, Dr. Soysal is Chair of the Physics and Engineering Department and he is teaching electrical engineering courses. His research interests include power engineering, renewable energy, and electrical engineering education.



**Hilkat S. Soysal** received a Law degree from University of Istanbul, Turkey. She practiced law in private companies and two state universities as a counselor. In 1993, she joined Istanbul University College of Engineering as a Lecturer. While teaching law courses for undergraduate engineering students, she completed her graduate study in the Marine Engineering program and received a M. Sc. degree in 1996. Between 1997 and 2000, she took various MBA, Computer Science, and engineering courses at various institutions. Since fall 2000, she has been working as an part time faculty at the Department of Physics and Engineering at Frostburg State University.



**Crissy Godfrey** graduated from the University of Maryland, College Park and is currently doing graduate study at the Johns Hopkins University on Environmental Science and Policy. Her employment experience included the Cadmus Group Inc., D&R International, Southern Maryland Electric Cooperative and the Maryland Energy Administration. She is currently working for Maryland Energy Administration as Program Manger, Wind and Climate Change. Her special fields of interest include wind and energy efficiency.



**Tim LaRonde** has more than 20 years of experience in managing energy projects. Tim has been the Solar Programs Manager since 2000. He has had experience with many solar projects including their development, funding and implementation. Mr. LaRonde has successfully administered the first two funding cycles of the Maryland Solar Energy Grants Program. He has also successfully administered the State Agency Loan Program (SALP) for more than 14 years. Tim is also involved in a number of additional energy related activities including development of program regulations, energy analyses, grant writing, and policy recommendations.