**MOWER Grant Project Summaries**

**FY 2013 Awards**

## MOWER 13-01: Morgan State University

**Project Title:** Economic Impact of the Proposed Wind Turbines on the Offshore Marine Recreational Fishing Industry Study

**Project Director:** Dr. Mark M. Bundy

**Award:** $184,847.00

**Project Abstract:** Ocean City, Maryland is a relatively small coastal community located along the Atlantic Ocean in Worchester County. It is surrounded by water with the Atlantic Ocean on one side, several coastal bays on the other side and a narrow inlet that separates Ocean City from Assateague Island while connecting the ocean with these coastal bays. The Maryland Offshore Wind Energy Act of 2013 (HB 226) proposes to place a wind turbine farm between 10 and 30 miles off the Maryland coast from Ocean City. While the exact location is yet to be determined, this is an area where recreational anglers frequent.

By creating shade, a surface for growth of food sources and refuge from larger predators, wind turbine structures in open water are generally considered to have a positive impact on fishery populations. Morgan State University Patuxent Environmental & Aquatic Research Laboratory (PEARL) is conducting a regional economic assessment study of the impacts of developing offshore wind turbines on the coastal recreational fishing industry in Ocean City, Maryland. The general approach of this study is to use average angler expenditure and industry costs profiles for each of the various modes of recreational fishing in Ocean City, Maryland. These expenditure and costs profiles will then be used in a regional input/output impact model (IMPLAN®), to generate county level estimates of the economic impact. Changes to the economic model will be driven by estimated changes in fishery abundance of targeted recreational fish species.

This study represents a novel approach to estimating local economic impacts from wind turbines on local recreational fishing industries. It can be used as a demonstration of how similar economic impacts can be determined in other mid-Atlantic regions where wind turbines are being considered. This is a two-year study funded by the Maryland Higher Education Commission and the Maryland Energy Administration with funds from the Maryland Offshore Wind Energy Research Challenge Grant (MOWER).

**MOWER Grant Project Summaries**

**FY 2013 Awards**

## MOWER 13-02: Salisbury University

**Project Title:** Shore Winds: Using Analytics, Simulation Modeling, and Data Visualization to Develop Commercially Viable Decision Support Tools for Predicting and Mitigating Workforce and Supply Chain Barriers to Offshore Wind Energy in Maryland and Beyond

**Project Directors:** Dr. Memo Diriker and Ms. Sarah Bunch

**Award:** $100,000.00

**Project Abstract:** Researchers in the academic and industrial realms still have many innovations to bring to market when it comes to successfully, effectively, and efficiently exploiting offshore wind energy. Based on the experiences of offshore wind producers in Europe and elsewhere, we know that moving offshore wind projects from concept to some level of commercial viability is not easy. The current and projected gaps between total costs and total revenues pose a significant challenge to the long-term commercial viability of offshore wind energy production efforts. One way to reduce these costs ,and improve long-term viability is to identify and reduce the impact of the barriers to local workforce development and to the development of a local supply chain for offshore wind. Using solutions such as data mining, analytics, simulation modeling, data visualization, commercially viable dashboards and decision support tools for mitigating these workforce and supply chain barriers to offshore wind energy will be developed.

This project has five key objectives:

1. Develop a real-time data-driven analytics framework to identify, quantify, and qualify workforce and supply chain barriers to offshore wind energy in Maryland;

2. Use simulation modeling and data visualization to mitigate said barriers;

3. Engage unserved and underserved populations in these activities;

4. Seek replication of project outcomes in other markets through commercialization of the dashboards and decision-support tools that will be developed;

5. Build on the knowledge created to position the commercialization effort to benefit from a university-based venture funding mechanism.

Upon its conclusion, this project will result in the creation of a series of dashboards and decision-support tools that will help enhance the long-term viability of Maryland's emerging offshore wind energy industry. The proximity of Salisbury University to the Ocean City, MD location of the proposed offshore wind energy area and the inclusion of unserved and underserved populations gives this project two unique elements.

**MOWER Grant Project Summaries**

**FY 2013 Awards**

## DMCR 12-07: University of Maryland

**Project Title:** Reliability and Failure Mechanisms of Offshore Wind Energy Systems (ROES)
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**Project Directors:** Dr. Aristos Christou and Patrick McCluskey

**Award**: $215,398.00

**Project Abstract:** The State of Maryland is committed to offshore wind energy as demonstrated by the recent passage of the Maryland Offshore Wind Energy Act of 2013. The University of Maryland College Park (UMCP) proposes to leverage its extensive expertise in renewable energy, reliability, physics of failure, materials corrosion environmental induced degradation, and power electronics. The GROE team proposes to carry out research in the area of reliability of grid interconnected wind energy conversion systems (WECS). The proposed project addresses both topic areas 4 and 7, in the area of interconnect studies and impact of the marine environment on WECS mechanical and electronic equipment. The key contribution of the research are the proposed reliability studies based on the marine environmental effects within the proposed tasks by addressing the key degradation mechanisms *(corrosion and environmental stress degradation)* at the device, component and systems level.

The innovative contribution of the research are the robust reliability prediction models to be developed for comparison, and defining the WECS reliability block diagrams in a rigorous way, using available reliability data from similarly-rated wind turbines (WTs) and other relevant marine and electrical industries. Physics of Failure predictions will be validated with accelerated stress testing in a marine environment. This project will develop physics-of-failure based protocols for assessing the reliability of electronic and mechanical equipment in marine environments. This protocol will include modeling the fundamental device and packaging mechanisms that cause failures, and providing design recommendations for improved reliability.

The purpose of the research is not only to derive individual WT failure rates but to provide a means of comparison of the relative reliabilities of various devices and components in the building blocks. Analysis of WT sub-assemblies is performed to identify criticality, to improve system availability and maintainability. The models must include the important failure mechanisms such as corrosion, stress corrosion cracking, erosion-corrosion and fatigue-corrosion, and must also be tied to the degree of complexity of WT systems. The developed reliability models will provide the clear identification of required changes to any proposed WT system design. The power converters used in wind turbines and to connect them to the grid contain electronic hardware that is susceptible to a number of failure mechanisms that are accelerated in marine environments.

**MOWER Grant Project Summaries**

**FY 2013 Awards**

## MOWER 13-08: University of Maryland

**Project Title:** The Maryland Offshore Wind Farm Integrated Research

**Project Directors:** Dr. James Baeder

**Award**: $554,025.00

**Project Abstract:** The University of Maryland College Park (UMCP), in partnership with Bowie State University (BSU) and Frostburg State University (FSU), propose to help the State of Maryland establish itself as a leader in offshore wind (OSW) energy through the *Maryland Offshore Wind Farm Integrated Research (MOWFIR*) project. The Maryland Offshore Wind Energy Research Challenge Grant will provide the critical seed funding to integrate extensive existing expertise in renewable energy, rotary aeromechanic systems, prognostics and health monitoring, and wind forecasting meteorology into a cohesive research team focused on developing technological solutions to OSW deployment needs.

The proposed initial two-year multi-disciplinary research and education program will consist of eight integrated research tasks that address important OSW energy problems in two transformational thrust areas, as identified by the Department of Energy (DOE): refined wind resource characterization for next-gen prognostics and health management; and innovative wind turbine aeromechanics to aid energy capture. A world-class team of eight faculty researchers from three diverse universities in the State of Maryland has been assembled to guide six graduate and two undergraduate students to carry out the research tasks. The results from these research tasks will put the researchers involved in MOWFIR in a better position to compete for future DOE and industry funding so that it can continue and grow beyond the completion of the proposed research.

Academically, a new undergraduate/ graduate class will be introduced in the fall semester of 2013 (Wind Energy Theory) with more specific OSW focused courses to be developed at a later date. Moreover, MOWFER will provide leadership, technology solutions and business and academic linkages to support Maryland's deployment of OSW energy technologies. It will leverage the internationally recognized faculty and facilities of CALCE, AGRC, UMERC, SERF, and WISE (these Centers have existing annual non-OSW research funding in excess of $15M). MOWFIR plans to seek funding to supplement the State's contribution from other stakeholders, including public utilities, the Federal government, the State of Maryland, corporate partners, foundations, the University of Maryland Small Business Development Center Network, the Maryland Clean Energy Center, and the Business Coalition for Maryland Offshore Wind Energy and its partner organizations to assist the State of Maryland in the creation of a thriving OSW energy industry.