

**Project Name**

Integration of Virtual and Real Equipment Learning Tools Related to Sustainability Education

**Principal Investigator** Mark A. Bremer

**Campus** SUNY Polytechnic Institute

**Year of Project** 2013

**Tier** Tier Two

**Project Team**

- Philip Hofmeyer, Morrisville State College
- Ibrahim Yucel, SUNYIT
- Christopher Urban, SUNYIT
- Kenneth T Waight III, MESO Inc.
- Xinchao Wei, SUNYIT
- Glenn E. Van Knowe, SUNYIT
- Robert Keesee, University at Albany
- Brian Hong-An Tang, University at Albany
- Elizabeth Rossi, SUNYIT
- Suzanne Tulino, New York State Office of Children and Family Services (OCFS)

**Overview Summary**

Development of a portable, reusable solar/wind power plant as a learning tool to address sustainability issues. Creation of related virtual - real activities/exercises that would be appropriate to support undergraduate sustainability and alternative energy related courses, and support K-12 outreach and at-risk youth programs.

**Outcomes Summary**

MESO's game for "Green Energy Builder" is available at [http://web.cs.sunyit.edu/~randazt/iitgProject\\_12/](http://web.cs.sunyit.edu/~randazt/iitgProject_12/) and the final report details the resulting course curriculum <http://commons.suny.edu/iitg/integration-of-virtual-and-real-equipment-learning-tools-related-to-sustainability-education/>

## **Project Abstract**

**Instructional Technology Innovation:** Our project will focus on integrating a set of virtual exercises with real systems learning tools to address alternate energy and sustainability issues in both formal and informal educational settings. In this research effort, students are placed in decision-making roles by simulating real-world situations using computer-based, immersive learning interactive case studies created in the IITG project entitled Development of an Interactive Case Study Capability. These exercises will be modified and integrated with hands-on experiences that involve using functional solar, wind, and hydro power equipment. The equipment will be designed and set up to optimize educational and training purposes. In this way the hands-on activities will reinforce and apply concepts learned using the virtual exercises. Both individual virtual immersive learning and hands-on activities have been shown to increase interest and learning for students. However, integration of the virtual with real equipment specifically designed to work together to address targeted science concepts is not widely available. It is envisioned that this developed capability can be modified to fit most grade levels.

**Background & Significance:** Instruction in mathematics, science, technology, and engineering areas often suffers from a lack of realistic applications for students to learn key concepts while being motivated in interdisciplinary education. The interactive case study tool developed in the first phase of the project provides a potential remedy for these shortfalls. In some disciplines, the virtual case studies represent how the information is actually used in the real world. But for others, there is need to provide hands-on experience to complete the cycle of learning. In this case, the virtual sustainability exercises will be modified and enhanced to integrate a small wind and solar power system that can be assembled and disassembled by students. The platform will be portable for use both on and off campus for undergraduate courses and K-12 outreach programs. In addition, detailed plans for construction would be created so that such a portable instructional aid could be constructed at other SUNY sites.

**Major innovation advantages:** Our interdisciplinary approach provides a dynamic educational framework that will capture the interest of students and instructors at many educational levels. The interactive case study exercise and real-world tools will be designed so they can be easily modified for diverse educational levels, subject matter and objectives.

**Collaboration:** Our project will involve collaboration among sustainability, renewable energy, computer science, outreach scientists, and educators to develop, use, and assess the tools. Sustainability expertise will be provided by PI Mark Bremer of SUNYIT. Specific renewable energy expertise will be provided by Co-PI Phil Hofmeyer of Morrisville State College. The computer science and programming needs of the project will be provided by faculty in the Information Sciences and Technology (IST) department at SUNYIT and MESO, Inc., of Troy NY. Use and educational assessment will be done by 1) SUNYIT educators in Civil/Environmental Engineering and Electrical Engineering Technology, and 2) SUNYIT staff in K-12 outreach programs, 3) Morrisville State College educators in the Renewable Energy Training Center, 4) University at Albany, SUNY educators in Atmospheric and Environmental Sciences, and 5) staff at New York State Office of Children and Family Services (OCFS) Taberg Residential Center for Girls.

### **Project Objectives/ Milestones:**

The goal of the project is to create an integrated combination of virtual/real sustainability-related activities that would be appropriate to:

- (1) support SUNY-wide undergraduate sustainability and alternative energy related courses;
- (2) support SUNYIT and K-12 outreach programs both on and off campus;
- (3) enhance Morrisville State College Renewable Energy Training Center courses;
- (3) address motivation and teaching science to high-risk young people as part of a cooperative effort with the New York State Residential Center for Girls in Taberg, NY; and
- (4) support SUNY-wide sustainability programs.

The objectives and milestones of the project are to:

- (1) Assemble a portable wind turbine that can be integrated with the portable solar power roof (roof already constructed using NYSERDA funds at SUNYIT);
- (2) Design an integrated combination of sustainability related virtual - real activities/exercises appropriate to meet goals of the project;
- (3) Modify as needed the interactive case study exercise that would help a student learn scientific theory and concepts related to sustainability of energy, water and other resources;
- (4) Create tools to assess educational value and investigate pedagogical strategies that would allow for more effective use of interactive case study approaches for various instructional elements, e.g. teaching basic concepts, decision-making strategies, and testing of student learning objectives;
- (5) Combine tools within a kiosk environment to enhance the renewable energy technology demonstration (solar, wind, and hydropower) 350-foot sustainability path on the campus of SUNYIT (project currently under construction using SUNY RF Sustainability Fund - anticipated completion in May, 2013);
- (6) Assess the educational utility of the developed learning tools in SUNYIT, Morrisville State College, and University at Albany, SUNY undergraduate sustainability and alternative energy related courses and SUNYIT K-12 outreach programs; and
- (7) Make learning tools adaptable so other SUNY campus faculty can use them and/or create their own tools using the developed tools as a template via the SUNY Learning Commons.

Tasks: The goals and objectives would be accomplished in seven tasks during the 2013-2014 school year:

- Task 1) Assemble a portable wind turbine, integrate it with the portable solar power roof, and install laptop computer and display monitor;
- Task 2) Design a set of integrated sustainability related virtual - real activities/exercises;
- Task 3) Modify, as needed, the interactive case study exercise;
- Task 4) Create tools to assess educational value of method;
- Task 5) Combine tools and second display monitor within a kiosk environment;
- Task 6) Assess the educational utility of the developed learning tools; and
- Task 7) Make learning tools adaptable SUNY wide.

### **Reports and Resources**

- [Final report](#)
- [Project website](#) with links to virtual exercises, minutes of calls/meetings, work plans, collaborator info
- ["Green Home Energy Builder" virtual game](#)
- [Press release](#)
- [CIT 2014 presentation](#)
- [Mid-project report](#)
- [Project update](#)
- [Project outcomes report](#)

### **Discipline Specific Pedagogy**

- STEM

### **Instructional Design**

- Online Education

## **Instructional Technologies**

- Open Educational Resources (OER)