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Project-based Learning as a Catalyst for Energy Education at Duke University

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Abstract

The objectives for this session include:

- Describe how project-based learning is being used effectively as a vehicle to engage both undergraduate and graduate students in broad, interdisciplinary energy education opportunities,
- Demonstrate selected examples of interdisciplinary energy education projects using team-based structures and processes, and
- Discuss the lessons learned from the university-wide interdisciplinary implementation of an energy focused program at Duke.

Energy, broadly defined, with its complex interdisciplinary challenges, is an excellent vehicle for project-based learning and engaging students and faculty in non-traditional learning, while advancing solutions to real energy problems. In 2013 Duke University embarked on a journey to implement a university-wide, project-based learning program for interdisciplinary energy education at both the undergraduate and graduate levels. Combined with the launching of a new Energy Initiative and an infusion of resources from a donor, this interdisciplinary team based, project-orientated approach is powering new interest and growth in energy education at Duke University. The vision of the “Bass Connections” program is to create a distinctive new model for education, predicated on collaborative interdisciplinary inquiry that actively engages students in the exploration of big, unanswered questions about major societal challenges.

The Duke University Energy Initiative leads one of five thematic interdisciplinary areas and collaborates across Duke University to engage students interested in learning about energy issues and collaborate with faculty to seek solutions. By implementing this experiential energy education program, Duke aspires to engage faculty, undergraduate and graduate/professional students in teamwork; integrate disciplinary approaches and professional practice; and apply knowledge, research, and skills in problem solving, with engagement from community partners toward making an impact. In the last three years, the energy theme of the Bass Connections program has added 7-8 new energy independent study courses each year and engaged 90 faculty team leaders and contributors and 250 students from across the university.

This innovative energy education program has allowed the Energy Initiative at Duke to:

- engage with students across all Duke’s 6 Schools, increasing the number of students, at all levels of study, exposed to energy issues and problems,

- raise the visibility of energy as an interdisciplinary learning opportunity for research and complex problem solving with faculty and connect faculty to energy problems and research opportunities,
- provide students with an opportunity to engage in relevant energy research activities,
- align non-traditional experiential learning opportunities with the current Energy and Environment Certificate capstone course offering,
- provide increased opportunities for students from different levels and disciplines to explore energy fields and opportunities for future careers, and
- connect the Energy Initiative with outside experts and organizations such that students may work collaboratively to address real energy problems situated in the “real” world giving them a “working” experience.

The following project example involved creating options and opportunities for distributed solar power generation for Duke University employees.

Project description: Rooftop solar prices have dropped precipitously over the past few years, making renewable energy more accessible at the household level. However, market barriers, particularly in North Carolina, continue to prevent many consumers who are ideal candidates for rooftop solar from purchasing and installing a renewable energy system. Consumers also have limited access to third party experts qualified to answer questions and provide guidance throughout the purchase and installation process. Yet, widespread adoption of solar technology has the potential to reduce greenhouse gas emissions, lessen the environmental impact of electricity generation, and increase grid security via distributed generation, and decrease long-term electricity costs for consumers. This project aimed to aid the University in achieving its target emission reductions. These goals were met simultaneously through the creation of a Duke University program that empowers employees to 1) determine if they are an ideal candidate for rooftop solar, 2) make the best decisions regarding rooftop solar installation, and 3) install rooftop solar.

This project experience gave students the opportunity to assess the situation and an opportunity to use research methods including surveys and focus groups to determine demand and negotiate options with outside contractors and building associations as well as internally with University stakeholders about providing services to employees. The created agreements with rooftop solar provides to provide alternative energy solutions and presented options in promotion information sessions and as a result of their work, over 80 University employees had their houses assessed and had rooftop solar installed.

Another example included a project that involved exploring the intersection of energy and peace-building through film with team leaders from the Nicholas School of the Environment and the Duke University Libraries.

Project Description: This project sought to discover the lessons that could be learned about the role of energy resources in post-conflict regions, and how they can be used to promote peace. Using over a decade’s worth of post-conflict environmental assessment film from the United Nations Environmental Program, team members explored the role of energy resources in conflict-affected countries (e.g., Nigeria, Democratic Republic of the Congo, Afghanistan, and

South Sudan). Team members cataloged and described digitized footage, and partnered with the United Nations staff to produce visual outreach and training materials for conflict-reduction, energy resource management, and environmental management. The focus of the films were on energy's role in economic development, environmental management, and peace building, with findings translated into visual materials addressing specific energy issues (e.g., oil and gas, charcoal, hydropower, timber). The project enabled students to meet with experts from the UN environmental program and documentary filmmakers and included a trip to the Environmental Film Festival.

Energy projects have covered a wide range of topics over the last 3 years and projects topics for 2016-17 include:

- Energy and the Environment: Design and Innovation (the capstone course for the Energy and Environment Certificate)
- Energy Data Analytics Lab
- History and Future of Ocean Energy
- Modeling tools for Energy Systems Analysis
- Energy Efficiency in Industry: Corning
- Animal Waste and Global Health
- Developing Departmental Energy Reports and a Carbon Pricing Program for Duke University