

Building an Ecosystem for a Bachelor of Science General Engineering with Alternative Energy and Power Generation Option

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ABSTRACT

In the 2010 Fall Semester Penn State Hazleton implemented a new *Bachelor of Science in General Engineering with Alternative Energy and Power Generation Track* program. This new program will prepare graduates to enter the job market in the alternative and renewable energy sector as well as the power generation industry. Graduates of this program will have the critical knowledge and skills needed to begin their careers in this growing field. The program's goals are to provide graduates with the background, knowledge, and skills necessary to be successful in the contemporary power generation sector while being able to lead the industry toward becoming more environmentally-friendly by using alternative and renewable energy technologies. During the first year of this program's implementation, it has undertaken a number of initiatives to prepare a program friendly environment (ecosystem) for the new degree. These initiatives are being done to shorten the implementation cycle of the new program. Partners in the ecosystem that can influence or impact the program were identified. Initiatives were undertaken to establish partnerships with the entire ecosystem. The paper describes the activities and initiatives undertaken to build a mutually beneficial partnership. In addition the expected contributions of each ecosystem partner and the subsequent benefits to them are presented.

Keywords: Ecosystem, Engineering Education, Alternative Energy, Sustainable Energy

1. INTRODUCTION

The Bachelor of Science with Alternative Energy and Power Generation option program [Grebski et. al., 2010] cannot be successful in isolation. Every engineering program has a number of stakeholders who will impact the program's success. Those stakeholders create an *ecosystem* where each member benefits and contributes simultaneously. Normally it takes decades for an ecosystem to develop. The authors of this paper have undertaken a number of initiatives which are geared toward a rapid creation of an ecosystem for the *Bachelor of Science in General Engineering with Alternative Energy and Power Generation Track* program at Penn State Hazleton.

Identification of Ecosystem Partners:

Partners in the ecosystem that can influence or impact the program were identified. Those partners are

– Local/Regional Industries and Organizations

- Local Area Business Incubator Center
- School Districts within the Penn State Hazleton Service Area
- Penn State Alumni Association
- University Relations Office at Penn State Hazleton
- Local Communities

- Energy and Sustainability Educational and Training Programs in Northeastern Pennsylvania
- National Industries/organizations
 - Selected industries nationally
 - Relevant organizations
- Government agencies
 - Federal, State and Local Governments
- International collaboration
 - Engineering Programs with a similar focus in other countries

Initiatives have been undertaken to establish partnerships with the entire ecosystem.

2. Establishing a Working Relationship with Ecosystem Partners

After the partners of the General Engineering degree were identified, communication and ongoing relationships were established. Partners and their relationship to the program are as follows:

2.1 Local/Regional Industries and Organizations

- Local Industry

Local industry is the most important component of the General Engineering degree ecosystem. This degree relies on local industry to provide internship opportunities for students, opportunities for joint research projects for students and faculty, employment for future graduates, and information/feedback on current industry practices [Grebski and Cai, 2010a-b]. On the other hand local industry relies on the General Engineering degree to provide a qualified work force as well as technical expertise of the Penn State Hazleton faculty and students. In order to provide for good communication and interaction between local industry and the new General Engineering degree program, an Industrial Advisory Committee was established. This fifteen member Industrial Advisory Committee is comprised of senior level management employees with technical backgrounds from within the Penn State Hazleton service area. This Industrial Advisory Committee meets monthly and coordinates the interaction between the newly established Bachelor of Science in General Engineering program and industry partners.

- Local Area Business Incubator Center

Local Area Business Incubator Center is providing a nurturing environment for new start-up companies in the Penn State Hazleton service area. Any new start-up companies can lease office and/or manufacturing space for up to two years at rates significantly below marketplace rates. In addition it provides technical, legal, accounting, and clerical services to their clients. This business incubator center is targeting technology and manufacturing businesses. The newly implemented Bachelor of Science in General Engineering program can provide much needed technical support to start-up companies. Student design projects, student/faculty research projects, and internships can be critical for the success of new start-up companies. On the other hand the local business incubator center can become a testing field and provide valuable industrial experience for faculty and students. An ongoing working relationship with the Business Incubator Center has been established and Penn State Hazleton engineering faculty and students have been engaged in providing technical support to start-up companies.

- School Districts within the Penn State Hazleton Service Area

The new Bachelor of Science in General Engineering (BS GE) program has already established a working relationship with the Hazleton Area School District and Partners in Education [Grebski and cai, 2011]. This BS GE program is providing enrichment opportunities for PreK-12 student and teachers and sparking interest in STEM concepts as well as sustainable energy. During the academic year there are three to four “Day at the Hazleton Campus Workshops” for elementary, middle school, and high school students. At the workshops

engineering faculty and students provide hands-on activities related to STEM and sustainable energy. Penn State Hazleton Campus and BS GE faculty have also conducted Engineering Summer Camps for junior and senior high school students which focus on engineering and STEM concepts. Penn State Hazleton Campus also offers in-service training for teachers. In-service teacher training programs focusing on promoting alternative energy and STEM concepts have also been offered. The engineering faculty has developed a series of hands-on experiments to be used by teachers of PreK-12 students. Teachers can borrow the necessary materials and equipment from Penn State Hazleton. Materials and equipment are available on a rotating basis for use in the teachers' classrooms. BS GE program relies on local school districts to provide prospective students for the Bachelor of Science in General Engineering with Alternative Energy and Power Generation Track. BS GE program has also teamed up with the Energy Industry Partnership to conduct day long workshops which have provided presentations focused on alternative energy. These workshops have been conducted in twenty schools (reaching five thousand students) throughout Northeastern Pennsylvania.

- Penn State Alumni Association

Alumni especially engineering alumni provide an opportunity for student mentoring and student career guidance. Engineering alumni already provide valuable feedback on program and course content as well as other curricular issues. Penn State Hazleton campus maintains close contact with engineering alumni through an annual meeting where students present their capstone design projects in front of the engineering alumni. A joint social gathering including dinner follows the student presentations. Alumni are updated about the BS GE program through the Penn State Hazleton newsletter as well as the annual alumni breakfast where the status and initiatives of the program are presented by the engineering faculty.

- University Relations Office at Penn State Hazleton

University Relations Office coordinates ongoing fund raising for the program. It is also involved in promoting the program and solicits/coordinates equipment donations from industry. During the 2010 academic year the University Relations Office coordinated equipment and cash donations totaling \$300,000.

- Local Communities

BS GE program is becoming a regional resource center for energy saving and sustainability for the general public and regional firms. Annually Penn State Hazleton sponsors Community Day which showcases the BS GE program, student projects, and research accomplishments. There are also hands-on activities and information on energy efficiency and sustainable energy.

- Energy and Sustainability Educational and Training Programs in Northeastern Pennsylvania

BS GE program provides a regional leadership role in workforce development related to energy efficiency and sustainability. The program has established a working relationship with the following programs

- Associate Degree in Engineering Technology program at Luzerne County Community College in Nanticoke, Pennsylvania.
- Northeast Pennsylvania Tech Prep Consortium
Luzerne County Community College and Tech Prep programs provide technician and installer training which complements the BS GE program and provides continuing education and advancement for installers and technicians.

2.2 National Industries/Organizations

Mutually beneficial initiatives will be undertaken to develop partnership with selected industries and organizations nationally. The industry/organization will provide internships, sponsored research

projects/senior design project. The university will provide the industry/organization partners with an access to relevant university research facilities, faculty and student resources.

2.3 Federal, State and Local Governments

BS GE program at Penn State Hazleton maintains a close working relationship with federal, state, and local governments, for example

- Pennsylvania Technical Assistance Program (Penn TAP)

Penn TAP provides technical expertise to local industry. Faculty and students from the General Engineering program have served as consultants.

- Northeastern Pennsylvania Industrial Resource Center (NEPIRC)

NEPIRC provides technical support to manufacturing companies. Penn State Hazleton faculty and students serve as consultants.

- Ben Franklin Partnership

Ben Franklin Partnership provides funding for research and development. General Engineering faculty and students serve as consultants.

- Energy Industry Partnership

Energy Industry Partnership coordinates visits to PreK-12 school by the engineering faculty.

- Northeast Pennsylvania Tech Prep Consortium

Northeast Pennsylvania Tech Prep Consortium coordinates workforce development and provides funding for outreach to high schools within its service area.

Cooperation with federal, state, and local agencies provides the General Engineering program with opportunities to receive funding for workforce development and PreK-12 educational outreach.

2.4 Engineering Programs with a Similar Focus in Other Countries

Since engineering is a global profession, international cooperation is essential in order to provide opportunities for collaborative international projects, student exchange, and recruitment of international students. BS GE program at Penn State Hazleton is in the process of establishing international collaboration with the following schools.

- Universidad Catolica de Santa Maria-Arequipa (University Catholic of St. Mary/UCSM in Arequipa, Peru)-In the Process.

UCSM and Penn State Hazleton have begun discussions related to joint faculty research and publications, exchange of students, joint undergraduate student research, and 2+2 curriculum articulation.

- Universite D'Artois-IUT Bethune (Bethune, France)-In the Process

The College of Engineering has already established cooperation with The Pennsylvania State University. Preliminary discussions related to this cooperation were made at the European Conference on Alternative Energy hosted by the Universite D'Artois in October 2010. Initial topics for consideration were exchange of students and joint undergraduate student research.

The articulation agrees will focus on the following items

- Faculty Exchange
- Joint Faculty Research and Publications
- Exchange of Students

- Exchange of Scholarly and Pedagogical Materials
- Joint Undergraduate Student Research
- 2+2 Curriculum Articulation
- Recruitment of International Students

BS GE program at Penn State Hazleton has initiated discussions with the University of Artois-Bethune to provide an internship opportunity in the summer of 2012. International collaboration of this type will allow the BS GE program to stay current with global industrial practices in the alternative energy field.

3. Preliminary Effects of the Ecosystem Initiative

The initiatives for rapidly building the ecosystem for the *Bachelor of Science in General Engineering with Alternative Energy and Power Generation Track program* at Penn State Hazleton are already having a positive impact on the program. The most noteworthy results are

- In-kind and cash donations totaling \$300,000 which has been coordinated through the University Relations Office
- Internship opportunities and summer employment for students
- Initiation of the articulation agreement process with two universities abroad (Universite D'Artois-IUT Bethune (Bethune, France) and Universidad Catolica de Santa Maria-Arequipa (Arequipa, Peru).
- Applied student research projects for the Hazleton Area Business Incubator Center and local industry
- Joint projects between Penn State Hazleton engineering students and local high school students

It has been proven that the creation of an *ecosystem* has had positive effects on *Bachelor of Science in General Engineering with Alternative Energy and Power Generation Track program's* growth and potential.

4. Conclusions

This paper has focused on the building of an ecosystem for a newly implemented Bachelor of Science in General Engineering with Alternative Energy and Power Generation Track at Penn State Hazleton is presented. Initiatives to build such a system have been taken and positive impacts have been observed. Evidence has shown that the program has been promoted significantly through the efforts and initiatives of the ecosystem and the program has been beneficial for all ecosystem partners.

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