Introduction

Academic offerings on college campuses pertaining to renewable energy and sustainability have been growing rapidly on a nationwide basis over the past several years. Growth is due to several factors. First is the fact that the new “green economy” has been one of the faster growing segments of the overall economy. According to information from the Brookings Institution (2011), green job growth has outpaced job growth in the greater economy by a 2 to 1 ratio during the recovery from the recent recession, and green jobs have paid on average $7,000 more than other jobs across the greater economy. Secondly, our students more and more are showing greater interest in these topics and are demanding programs and courses that speak to the future of green technology and sustainable practice. Thirdly, many of those in academia who teach in the classroom, develop curricula, and administer programs well understand the imperative to educate our citizenry to meet the demands of a world that is by necessity moving toward renewable resources and sustainable practices as the limits of finite non-renewable resources are inevitably approached.

Dutchess Community College (DCC) in Poughkeepsie, NY has been fortunate to be well positioned to develop and begin to offer a wide variety of new courses and instruction in renewable energy and sustainability in the past several years. Many of the initiatives in these areas have been put in place by means of collaborative team partnerships of various organizations within the college and the local community. These continuing efforts would not have been possible without support for funding of technical equipment, instructor training, and
curriculum development through several educational grants. These grants have included “SUNY GREENS”, the SUNY Clean Energy Technology Training (CETT) Consortium, the Dept of Energy Northeast Photovoltaic Instructor Network, and the Hudson Valley Green Talent Pipeline.

The DCC partnerships have been led by the college’s Office of Community Services and Special Programs, and have included collaborations with academic departments such as Engineering, Architecture, and Computer Technologies (ENACT); the college’s Facilities and Office of Community Relations Departments; Nubian Directions, a local technology, education, and training community resource center, as well as other local business and civic partners.

Educational programs developed to date through these partnerships have included new academic offerings in many areas. In the technology arena, these include: Photovoltaic Systems, Geothermal Technology, Solar Thermal Technology, Building Analyst / Envelope Professional Training, and LED Lighting. Renewable energy updates for existing air conditioning and refrigeration training curriculum, and new availability of renewable energy educational opportunities for existing engineering and sciences courses have also been made available.

Additionally, many students often need to develop the basic mathematics and underlying theory necessary for success prior to enrolling in these technical training courses. Courses that have been designed and developed to support such core competencies include Math for Renewable Energy, Basic Electrical Theory I and II, Fundamentals of Electricity, and a Pre-Geothermal Course.

Courses to support renewable and sustainable curriculum in the more general academic environment have included SUS101: Sustainability Concepts and Applications, Environmental Economics, and Energy Economics and Public Policy.

Some specific examples that highlight the development and implementation of these academic offerings under a collaborative partnership model are enumerated in the following sections below:

**Photovoltaic Systems**

DCC has been offering a credit Photovoltaic Systems course as part of the college’s Electrical Engineering Technician (ELT) Program since 2008. The course curriculum was initially developed in consultation with Hudson Valley Clean Energy, a local PV installation company. Non-credit photovoltaic training courses soon followed, initially including introductory courses aimed at preparation for the NABCEP (North American Board of Certified Energy Practitioners) PV Entry Level Exam, and then continuing with a PV Site Assessor course, and with further plans to offer PV Sales. DCC offers the NABCEP PV Entry Level Exam for students in these courses in partnership with the SUNY Clean Energy Technology Training (CETT) Consortium.

The SUNY GREENS educational grant partnership has enabled support for funding of the technical equipment, instructor training, and curriculum development required for these offerings. Via grant funding, several instructors attended PV “Train-the-Trainer” classes offered through our SUNY Ulster partner. Laboratory equipment obtained through the SUNY GREENS grant has included PV modules and balance-of-systems components, site assessment equipment, meters and tools, a PV stand-alone battery back-up system trainer, and a PV grid-
tie demonstration system that students build in class and tie to the utility grid. Equipment is housed in the “DCC Solar Shed”, which was also purchased through grant funding.

Figure 1: the DCC “Solar Shed”

Figure 2: Students Construct the PV Grid-Tie Demonstration System

The SUNY GREENS grant also enabled the installation of a permanent on-campus pole mounted PV demonstration system that supplies electricity to the utility grid and includes a data logging and communications capability, displaying data about the electricity generated by the system on a publicly available website that is used for educational purposes in a variety of classrooms on campus.

PV equipment and training for instructors has also been provided for the college’s educational partner, Nubian Directions, a local technology, education, and training community resource center that supports job readiness training for the underserved community in the City of Poughkeepsie. Specifically, this equipment and training has enabled Green Technology Readiness Training for Nubian’s Youth Build Program.
Geothermal and Solar Thermal Technology

DCC’s Office of Community Services and Special Programs has partnered with local professionals to offer courses in geothermal and solar thermal technology that lead to the opportunity for students to earn industry credentials. A three day comprehensive IGSHPA (International Ground Source Heat Pump Association) accredited geothermal installer course and a NABCEP solar hot water fundamentals course both allow students to sit for credentialing exams. Equipment for support of these courses was obtained through grant funding, with this
equipment also being utilized to support college credit courses in air conditioning and refrigeration training as well as introductory engineering laboratory exercises.

Figure 5: Solar Thermal Trainer

**Sustainability Concepts and Applications**

The collaborative methods model is perhaps nowhere more evident than in the college’s development of a new credit course in Sustainability. Sustainability can be an exceptionally broad topic, covering such diverse areas as environment & ecology, economics, resource usage, energy production, and social equity. Faculty in the college’s Engineering, Architecture, and Computer Technologies (ENACT) Dept. who were interested in developing this course realized it was unlikely that a single faculty member would have a knowledge and experience base of meaningful depth that would span the entirety of the material envisioned for the new course. Furthermore, in researching course offerings in sustainability at other institutions, it was found that oftentimes the topic was not covered as broadly as DCC’s new course was envisioned, but was covered rather from within only a narrower subset of the overall field.

Thus was born the idea of having the course co-taught by three different instructors, each with a knowledge and experience base of different aspects of sustainability. The ENACT Dept. was already fortunate to have two faculty members with professional expertise in two areas of sustainability: a professor of architecture with LEED Green Building Certification, and an engineering professor with professional work experience in the solar and renewable energy field. Bringing in an outside professional to handle the remaining environmental and societal issues completed the course coverage and has led to a very successful new course offering.
Impact of Programs on the College and Community

The impact of the work produced through these partnerships has included not only new educational and training offerings, but also the development of increased awareness of renewable energy and sustainability concepts within the college and the local community. For example, the welcome page on the campus intranet now prominently displays a link to the on-campus PV demonstration system data portal. Several local architects, engineers, administrators, and teachers have enrolled in these new renewable energy and sustainability courses. Most recently, a new student Sustainability Club has been chartered under the college’s Student Government Association.

Summary

As little as five years ago, little in the way of direct coverage of renewable energy technology and sustainability concepts existed within courses and curriculum at Dutchess Community College. The initiatives created over the past few years, supported by forward thinking grant funding, have dramatically improved that situation. Courses and instruction now flourish in several renewable technology areas, most notably in photovoltaic systems and geothermal technology. New courses and awareness have been added to the more general academic curriculum as well. Implementation of these initiatives has best proceeded in many cases through the use of a collaborative partnership model, involving multiple stakeholders at the college and in the general community.