

New Jersey Innovation Partnership Institute in Clean Energy Technology Stevens Institute of Technology

Program Abstract

As part of its main *strategy for workforce education* in support of talent development and economic growth, the New Jersey Governor's Office of Economic Growth has identified *clean energy technology* as one of four targeted industry sectors that are key to the state's future economic development. With the demand for electric power in New Jersey expected to increase by up to 40 percent by 2019, nuclear power is considered as the most viable large scale, clean energy source needed to meet future electric power needs and ensure meeting the state's targets for reducing greenhouse gas emissions, as recognized in the new state's energy master plan. A large number of highly trained nuclear power engineering and technology graduates will be needed to replace close to 50% of nuclear professionals that are about to retire within the next five years as well as for expansion of nuclear power capacity projected within the near future. In addition, there is a significant demand from the nuclear power industry for entry-level engineers and technicians that have acquired significant practical training and skills through exposure to real world nuclear power engineering and technology thus minimizing their need for further training as they enter the workforce.

In response, Stevens Institute of Technology is establishing and *Innovation Partnership Institute in Clean Energy Technology* with its main focus on nuclear power education and training in this initial phase. As an critical component of the Institute, a *strategic partnership* has been forged which includes: Stevens Institute of Technology, Bergen Community College, Public Service Electric & Gas Co., Erin Engineering Co., and PJM Interconnection.

The proposed program is designed to respond to the educational and workforce challenges above through four main components:

- *A program at the high school level* that will provide a (2+2+2) high school-community college-university pathway leading to a certificate or undergraduate degree with concentration in nuclear power engineering.
- a "*Technician's Certificate*" program to be offered at Bergen Community College,
- a "*Nuclear Power Engineering Concentration*" for students pursuing the Bachelor of Engineering (B.E.) degree in mechanical engineering at Stevens,
- a *continuing education program* for working professionals interested in a career in nuclear power, combined with a licensure preparation program for working nuclear professionals interested in a "Nuclear Plant Operator" license.

The proposed program will be designed to have a substantial practice-oriented component using Stevens' cooperative education (Co-op) program that is supported by a large industrial partnership. The award-winning Stevens' *WebCampus* program will be used to offer appropriate online courses to students during their co-op assignments as well as to working professionals that are interested in career change or advancement. The proposed program components will include competency-based course modules designed to provide participating students with the necessary fundamental knowledge, design

experience, and “hands-on” practical skills needed to meet next generation nuclear power workforce education and training needs.

The proposed program will leverage from several educational initiatives that are ongoing at Stevens. Among them, the *New Jersey Alliance for Engineering Education (NJAE)* is an NSF-funded partnership that promotes the integration of problem solving, innovation and inventiveness within main stream high school STEM curricula, while fostering the cross-fertilization of innovative teaching methods across K-12, college and university level education. This program is developing a model to increase the percentage of students pursuing STEM careers and training via stimulating integrative curricular approach that combines traditional science and mathematics teaching with engineering and technology education, innovation and problem solving, as well as critical workforce skills such as teamwork, critical thinking, analysis, and information synthesis.

Deliverables for the proposed program will include curricula and related educational and training material that will lead to industry-recognized certificate or degree, and will be shared with the Institute partners, other companies in the energy industry as well as appropriate high schools, community colleges and universities statewide and nationwide.

The outcomes from the proposed program will benefit our industrial partners by providing them: (1) the opportunity to recruit co-op students within the program who can be trained and observed, and (2) access to highly trained entry-level graduates and working professionals who will have acquired the skills needed to have a successful career in nuclear power technology.

Broader impacts are: (1) increase the pool of students and working professionals interested in pursuing a career related to nuclear power technology, (2) prepare students and working professionals for a successful career in nuclear power technology, and (3) demonstrate the program as a model for adoption at other institutions statewide and nationwide.

Bergen Community College ITI Project Initiatives

1. Development of a model 2 + 2 pathway for community college students interested in a B.E. in mechanical engineering with concentration in Nuclear Power Engineering.

Bergen Community Colleges A.S. degree in Engineering Science has provided community college students an alternative entryway to a B.E. degree at top tier Universities for more than thirty years. The majority of our Engineering Science graduates go on to complete their BE degree either at Stevens Tech or its public counterpart, NJIT, in two to three years. This alternate pathway allows talented students with financial and/or time constraints to take the bulk of their science and mathematics courses at their local, sometimes more nurturing community college before transferring to a B.E. program. This grant will allow us to improve on these successes by strengthening the existing relationship between the A.S. and B.E. programs and by adding additional nuclear science and engineering topics to the A.S. curriculum.

These goals will be achieved by:

- ✓ **Course Alignment** Insuring that the individual science, mathematics and liberal arts courses are aligned with those at Stevens Tech.
- ✓ **Program Articulation** Formalize the alignment process by articulating the A.S. in Engineering Science at BCC with the first two years of the B.E. program at Stevens Tech.
- ✓ **Course Alignment** Where possible also articulate required science, math and liberal arts courses between the colleges. This will benefit students who transfer before they graduate and strong science students who didn't major in Engineering Science while at BCC.
- ✓ **Engineering Core Curriculum courses at the community college** One of the hurdles to this 2 + 2 program is the difficulty transfer students have in graduating on time, due to the Engineering Core Curriculum requirements. This series of courses which develop the foundation of engineering principles start in the freshman year at Stevens. No matter how prepared a transfer student is they always find themselves playing catch up due to the inability to take these courses at the community college. In this initiative, Stevens and BCC faculty will find a solution to this problem either by offering these core engineering courses at the community college or allowing community college students in the Engineering Science Program to take these courses at Stevens or online.
- ✓ **2+2 counselors meeting** Stevens and BCC academic and career counselors will meet semiannually to discuss academic and logistical problems facing the 2 +2 students.
- ✓ **2+2 students will meet with Stevens academic councilors** All 2+ 2 students in the program will meet with Stevens academic councilors as well as BCC councilors semiannually to help keep them on track.
- ✓ **Adding specific concepts in nuclear science and engineering to the Engineering Science curriculum at the community college.** The Stevens and BCC science and engineering faculty will try to find specific points in the community college Engineering Science curriculum to either expand on / or add new material, demonstrations or laboratories in nuclear science. By adding key concepts in the first two years of the program, we hope that those topics we then be better understood when the student covers them in detail at the university level.

2. *Development of a model Certificate program in Nuclear Power Technology at Bergen Community College*

3. Strengthened working relationship between the BCC and Stevens Co-op offices

Appendix A: BCC Engineering Science AS program of Study:

First Semester

<u>CHM-140</u>	<u>General Chemistry I</u>	3
<u>CHM-141</u>	<u>General Chemistry Laboratory I</u>	1
<u>DFT-107</u>	<u>Drafting I</u>	2
<u>MAT-280</u>	<u>Calculus I</u>	4
<u>PHY-280</u>	<u>Physics I</u>	4
<u>WRT-101</u>	<u>English Composition I</u>	3






Total: 17

Second Semester

<u>CHM-240</u>	<u>General Chemistry II</u>	3
<u>CHM-241</u>	<u>General Chemistry Laboratory II</u>	1
<u>CIS-270</u>	<u>Programming for Scientific Applications</u>	3
<u>MAT-281</u>	<u>Calculus II</u>	4
<u>PHY-290</u>	<u>Physics II</u>	4
<u>WRT-201</u>	<u>English Composition II</u>	3






Total: 18

Third Semester

	MAT-282	Calculus III	4
	PHY-291	Physics III	4
	WEX-101	Dynamics of Health and Fitness	2
	Elective	Humanities Elective *†	3
	Elective	Social Science Elective *‡	3

Total: 16

Fourth Semester

	Elective	WEX... Dynamics of Health and Fitness Experience *	1
	MAT-283	Differential Equations	4
	PHY-294	Engineering Mechanics	4
	Elective	Humanities Elective *†	3
	Elective	Social Sciences Elective (Selected from two fields) *‡	3

Total: 15

Degree Total Credits: 66

*General Education Elective.

†HIS-101 History of Western Civilization since the Reformation are recommended.

‡ECO-101 Macroeconomics and ECO-201 Microeconomics and HIS-102 History of Western Civilization since the Reformation are recommended.

NOTE : DFT-208 may also be required to satisfy the drafting requirement of your transfer institution.

Diversity Requirement: In completing the BCC General Education Program, a student must take and pass at least one course in gender studies, non-Western history or thought, and/or cultural diversity. Choose from the following Humanities or Social Sciences Electives: ANT-101; HIS-105; HIS-116; HIS-121; HIS-126; HIS-130; HIS-131; LIT-203; LIT-204; LIT-215; LIT-218; LIT-224; LIT-228; PHR-106; PHR-121; PHR-122; PSY-207; SOC-120; SOC-121; SOC-222.