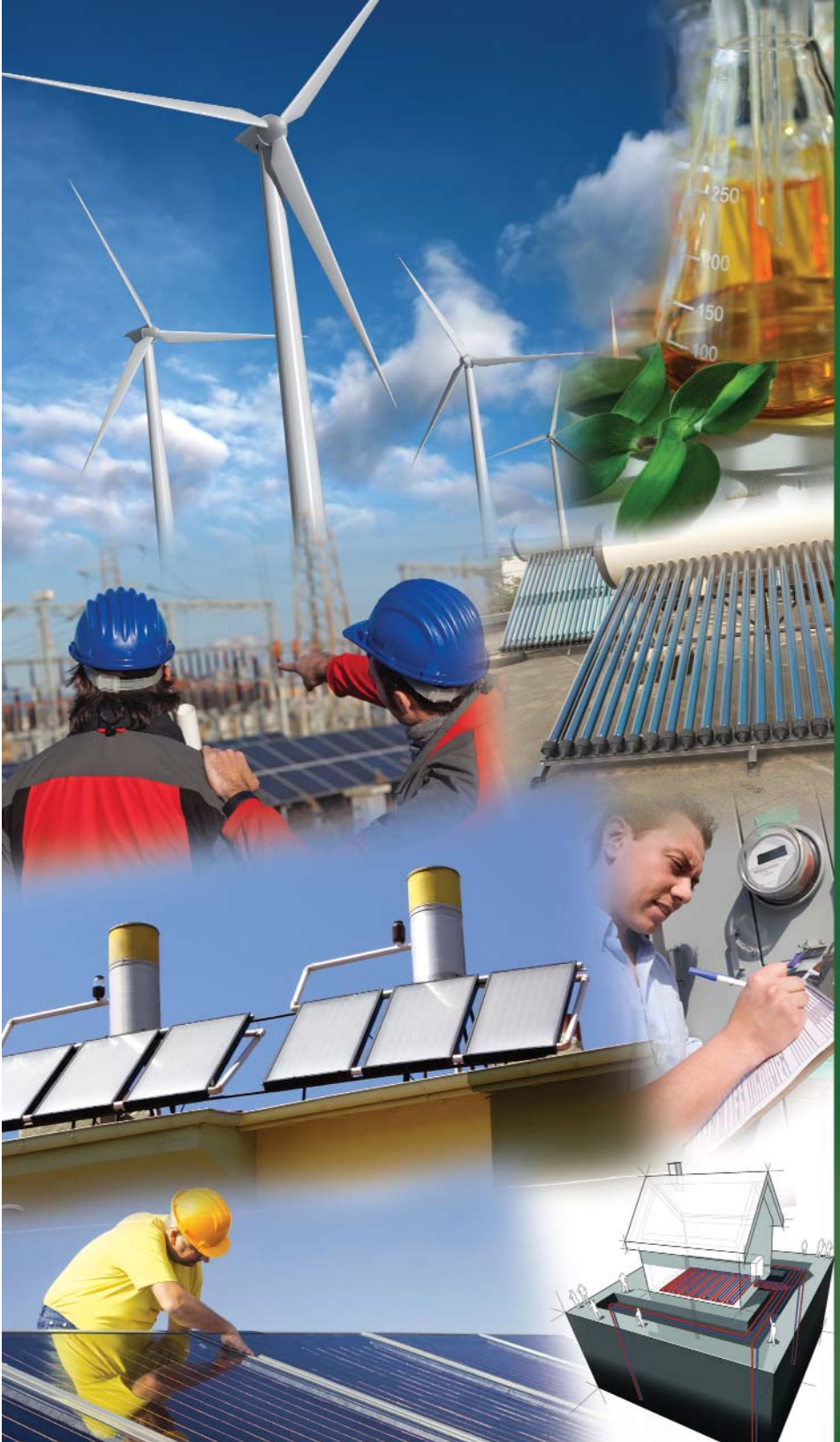

Energy Management & Alternative Energy Programs

BCC

BURLINGTON COUNTY COLLEGE

We Can Get You There.

Index

BCC
BURLINGTON
COUNTY COLLEGE
We Can Get You There.

Energy Management and Alternative Energy Programs: Overview

Burlington County College offers various comprehensive Energy Management and Alternative/ Sustainable Energy Degree Programs.

With the rapidity growing "green" movement, the types of job skills required in today's labor market are rapidly shifting.

There is a growing demand for green jobs. "There are 20,764 companies in New Jersey that are either already performing green functions or may "turn green"….Combined, these industries employ almost 192,000 workers, which is five percent of New Jersey's total employment."[1]

Our faculty is committed to providing both the academic and hands-on experience that will enable students to develop the knowledge and skills necessary for successful employment in the emerging "green" job market.

Please take a moment and peruse this overview booklet. Should you have any questions or need academic guidance, please do not hesitate to contact our office at (609) 894-9311 ext. 1941.

[1]"New Jersey Going Green, A Demand-Supply Analysis of Current and Potential Green Jobs and Green Skills," Division of Labor Market and Demographic Research, New Jersey Department of Labor and Workforce Development, October 8, 2009, p. 5. **http://lwd.dol.state.nj.us/labor/lpa/pub/studyseries/njgreen.pdf**

Introduction

A Growing Need for Skilled "Green" Trained Professionals

Career paths in the "green" jobs market include:

- Building Energy Auditing
- Commercial Building Energy Management
- Energy Systems Design and Installation – Solar Photovoltaic, Solar Thermal, Geothermal Heat Pump, Wind, Biofuels/Biomass.
- Green technologies manufacturing, sales and marketing
- Utilities industry

Career Outlook

Job market research shows that approximately 55% of green jobs in New Jersey are in the area of energy management and efficiency, and are most heavily concentrated in building construction and retrofitting.[2] The Associate of Applied Science in Energy Management degree is designed to prepare students to move directly into this workforce upon graduation.

Approximately 30% of the green jobs in New Jersey are in manufacturing and technical/ professional services areas involving renewable energy technologies, including solar, wind, geothermal technologies, and biofuels/biomass.[3] The Associate of Applied Science in Alternative Energy Technologies degree is designed to prepare students to move directly into this workforce upon graduation.

The types of "green" jobs in New Jersey span the areas of education, business/finance, green collar-building & utilities, legal/regulation, recycling, scientists, engineers, and technicians.[4] The Associate of Science in Sustainable Energy Studies degree is designed to prepare students for careers in sustainable energy and for transfer opportunities to 4-year colleges with sustainability-focused programs.

[2] "New Jersey Going Green, A Demand-Supply Analysis of Current and Potential Green Jobs and Green Skills," Division of Labor Market and Demographic Research, New Jersey Department of Labor and Workforce Development, October 8,2009, p. 6. **http://lwd.dol.state.nj.us/labor/lpa/pub/studyseries/njgreen.pdf**

[3] Ibid, p.6

[4] Ibid, p.20

Associate of Applied Science in Energy Management (AAS.NRG)

Program Description

The Associate of Applied Science in Energy Management degree is designed to prepare students to move directly into the workforce upon graduation. The students will be qualified for entry-level positions in building energy management, including energy auditing, building systems management, and evaluating and recommending appropriate energy management solutions.

Students will be exposed to the theory, materials and equipment necessary to work in the energy management field.

Career Opportunities

- Building Energy Analyst
- Commercial Building Energy Technician (or with experience, Manager)
- Controls-focused Service Technician
- Energy program coordinator
- Lighting specialist

Types of Employers

- Residential energy auditing companies
- Facilities/physical plant departments of colleges, hospitals, government buildings, commercial and industrial facilities
- HVAC controls companies
- Energy equipment and services companies
- Engineering/architecture firms

Program Learning Outcomes

The AAS in Energy Management will provide a course of study in which students will:

- Demonstrate their ability to apply appropriate methods and technology to evaluate energy use and efficiency in an environmentally responsible manner and to specify, design and implement appropriate solutions.
- Demonstrate effective oral and communication skills.
- Discuss and analyze the interrelationship between energy use and economic factors in the context of societal needs and preservation of environmental health.
- Demonstrate the ability to document their analyses and work product.
- Become qualified to sit for industry-recognized certification exams in applicable disciplines, such as BPI Building Analyst.

Associate of Applied Science in Energy Management (AAS.NRG)

GENERAL EDUCATION COURSES

DESCRIPTION	CREDITS
Written and Oral Communications (*ENG 101, SPE 102*)	6
Mathematics (*MTH 130 required*)	4
Arts and Humanities	3
Social Science	3
Natural Science *(PHY 110/111 required)*	4
Additional General Education Requirements (*PHY 112/113 recommended*)	4
Total	**24**

PROGRAM COURSES

COURSE #	DESCRIPTION	CREDITS
SST 100	Principles of Sustainability	3
SST 110	Energy Auditing for Residential Buildings	3
SST 210	Intro to Green (Resource Efficient) Commercial Buildings	3
SST 241	Energy Applications of Programmable Logic Controllers	3
SST 280	Cooperative Education: Energy Management	3
NRG 101	Introduction to Energy Management	3
NRG 112	Commercial Energy Use Analysis	4
NRG 121	Air Conditioning Systems Analysis	3
NRG 123	Energy Control Strategies	4
NRG 124	Energy Efficiency Methods	4
NRG 131	Lighting Fundamentals	3
NRG 141	Energy Investment Analysis	3
Total		**39**

Electives *(NRG 113, NRG 132, NRG 142 or CON 101)* **3-4**

TOTAL REQUIRED FOR DEGREE **66**

NRG courses are offered in conjunction with Lane Community College, Eugene Oregon. The courses are offered by BCC through a curriculum sharing partnership with Lane under the auspices of a Lane NSF grant. NRG courses will be team-taught by Lane and BCC instructors and delivered in a hybrid format.

Associate of Applied Science in Alternative Energy Technologies (AAS.ALT)

Program Description

The Associate of Applied Science in Alternative Energy Technologies degree is designed to prepare students to move directly into the workforce upon graduation.

Students will be exposed to the theory, materials and equipment necessary to work in the alternative energy field.

Career Opportunities

Entry level positions in:

- Energy Systems Design and Installation – Solar Photovoltaic, Solar Thermal, Geothermal Heat Pump, Wind, Biofuels/Biomass.
- Green technologies manufacturing
- Sales representatives/estimators
- Sites surveyors/assessors

Types of Employers

- Residential energy auditing companies
- Facilities/physical plant departments of colleges, hospitals, government buildings, commercial and industrial facilities
- HVAC controls companies
- Energy equipment and services companies
- Engineering/architecture firms

Program Learning Outcomes

The AAS in Alternative Energy Technologies will provide a course of study in which students will:

- Demonstrate their ability to apply appropriate methods and technology to evaluate energy generation needs in an environmentally responsible manner and to specify, design and implement appropriate solutions.
- Demonstrate effective oral and communication skills.
- Discuss and analyze the interrelationship between energy generation, economic factors, societal needs, and environmental health.
- Demonstrate the ability to document their analyses and work product.
- Become qualified to sit for industry-recognized certification exams in applicable disciplines, such as the NABCEP PV Entry Level Exam.

Associate of Applied Science in Alternative Energy Technologies (AAS.ALT)

GENERAL EDUCATION COURSES

DESCRIPTION	CREDITS
Written and Oral Communications (*ENG 101, SPE 102)*	6
Mathematics (*MTH 130 required*)	4
Arts and Humanities	3
Social Science	3
Natural Science *(PHY 110/111 required)*	4
Additional General Education Requirements (*EET 121 – Circuits I*)	4
Total	**24**

PROGRAM COURSES

COURSE #	DESCRIPTION	CREDITS
SST 100	Principles of Sustainability	3
SST 110	Energy Auditing for Residential Buildings	3
SST 111	Alternative Energy Sources	3
SST 211	Solar PV Systems I - Theory & Design	3
SST 212	Solar PV Systems II - Construction & Troubleshooting	3
SST 216	Solar Thermal Systems	3
SST 221	Geothermal HVAC Systems	3
SST 226	Small Wind Systems	3
SST 231	Introduction to Biomass & Biofuels Technologies	3
SST 241	Energy Applications of Programmable Logic Controllers	3
SST 282	Co-op Education: Alternative Energy Technologies	3
NRG 141	Energy Investment Analysis	3
EET 225	Wiring-Residential & Commercial Construction	3
Total		**39**
Elective *(SST 232 or CON 101)*		**3**
TOTAL REQUIRED FOR DEGREE		**66**

NRG courses are offered in conjunction with Lane Community College, Eugene Oregon. The courses are offered by BCC through a curriculum sharing partnership with Lane under the auspices of a Lane NSF grant. NRG courses will be team-taught by Lane and BCC instructors and delivered in a hybrid format.

Associate of Science in Sustainable Energy Studies (AS.SES)

Program Description

The Associate of Science in Sustainable Energy Studies degree is designed to prepare students for careers in sustainable energy and for transfer opportunities to 4-year colleges with sustainability-focused programs. It provides a broad exposure to the types and principles of various alternative energy sources within a broader context of environmental, social, cultural, and ethical awareness. Additionally, foundational courses in the natural sciences and applied computer and geospatial technologies provide the basis for future advanced study and specialization.

Career Opportunities

Students generally elect an Associate of Science degree program with the intent of transferring to a 4-year college or university in a related program area. This approach opens many career pathways for the student completing BCC's Sustainable Energy Studies AS degree. The types of "green" jobs in New Jersey span the following areas:[5]

- Awareness/Education: Environmental educators
- Business/Finance: energy forecasting, energy analysts, project/program management, energy managers, environmental underwriting
- Green collar: Building & Utilities
- Legal/Regulation: environmental lawyers/attorneys, environmental protection
- Recycling: waste control, recycling coordinators
- Sales
- Scientists, Engineers, and Technicians: all solar, environmental, and energy engineers and technicians

Program Learning Outcomes

The AS in Sustainable Energy Studies will provide a course of study in which students will:

- Understand and be able to discuss the advantages, disadvantages, drivers and implementation barriers of the various available and potential alternative energy sources.
- Demonstrate effective oral and written communication skills.
- Present cogent and persuasive arguments based on sound analysis of relevant facts and analysis which take into account technical, societal, and environmental factors.
- Analyze and evaluate the proper role of sustainable energy technologies in meeting the current and future energy needs of society in an economically, politically and environmentally viable manner.
- Develop solutions to energy-related issues within a sustainability paradigm.

[5]"New Jersey Going Green, A Demand-Supply Analysis of Current and Potential Green Jobs and Green Skills," Division of Labor Market and Demographic Research, New Jersey Department of Labor and Workforce Development, October 8, 2009, p. 20
http://lwd.dol.state.nj.us/labor/lpa/pub/studyseries/njgreen.pdf

Associate of Applied Science in Sustainable Energy Studies (AS.SES)

GENERAL EDUCATION COURSES

DESCRIPTION	CREDITS
Written Communications (*ENG 101, ENG 102)*	6
Mathematics (*MTH 130 required*)	4
Arts and Humanities *(PHI 101 recommended)*	3
Social Science	6
History (*HIS 101 or 102 U.S. History recommended*)	3
Natural Science *(PHY 110/111 required)* *(BIO 130/131 recommended)*	8
Diversity *(ANT 102 recommended)*	3
Total	**33**

PROGRAM COURSES

COURSE #	DESCRIPTION	CREDITS
SST 100	Principles of Sustainability	3
SST 111	Alternative Energy Sources	3
SST 211	Solar Photovoltaic Systems 1 - Theory & Design	3
SST 216	Solar Thermal Systems	3
SST 226	Small Wind Systems	3
SST 231	Introduction to Biomass & Biofuels Technologies	3
EET 121	Circuits 1	4
Total		**22**

Electives *(Choose from – CIS 101, GIS 101, GIS 202, PHI 220, NRG 101, NRG 141, SST 110, SST 221)* **12**

TOTAL REQUIRED FOR DEGREE **67**

Course Descriptions

NRG 101: Introduction to Energy Management
This course defines the need for energy management as an integral part of society at all levels. Students will understand basic energy accounting and analysis protocol. The course will also present the various vocational opportunities available to energy management students through lectures, video and guest speakers.

NRG 112: Commercial Energy Use Analysis
Emphasis is on the analysis of energy use in commercial buildings. Topics include utility bill analysis, audit data, identifying energy efficiency measures, use of micro-dataloggers, energy savings and investment calculations, audit report writing. Students will complete a supervised field audit.

NRG 113: Building Energy Simulations
The course covers the variety of computer programs available for analyzing commercial buildings. Topics include BIN methodology, hourly simulations and an overview of current programs on the market such as eQuest. Students perform supervised computer simulations.

NRG 121: Air Conditioning System Analysis
Students will investigate the physical principles of heating, ventilation, and air conditioning systems commonly found in the commercial setting. Topics will include: the energy equation, change of state, and refrigeration. The course will also cover sensible and latent heat equation, psychometrics, heat and cooling load equations, solar effects, effects of thermal mass, central forced air furnaces, SEERs, EERs, AFUEs, fuels, and unitary single zone and multi-zone secondary systems.

NRG 122: Commercial Air Conditioning System Analysis
This course is the second class in a two-course sequence. Students completing this course will be able to identify commercial HVAC system types and the general energy impact of each type. Calculations of system equipment efficiencies will be used to determine EER, SEER, AFUE, COP, combustion and seasonal efficiency in boilers, balance point partial load efficiency, and Bin analysis. Students will investigate HVAC delivery systems that will include fans pumps dampers, control valves, and ducting. The course will require field work where students will identify and perform calculations on equipment through nameplate and manufacturer's data takeoffs.

NRG 123: Energy Control Strategies
Topics include building system control theory and devices, including electric, pneumatic, and digital controls. An emphasis is placed on identifying and understanding control strategies related to energy-using systems and methods to estimate energy savings. Hands-on labs reinforce device identification and students complete an energy efficiency controls calculation project.

NRG 124: Energy Efficiency Methods
A systems approach is used to analyze the input, output, and efficiency of commonplace energy conversion devices. Included are motors, fans, pumps, heat engines, domestic hot water heaters, furnaces, boilers, refrigeration devices, and heat pumps. In so doing students (1) become fluent in the use of the many different units used to denote and measure energy/power (2) learn what quantities need to be measured to determine energy/power in different systems (3) determine the energy/cost savings associated with different efficiency improvement strategies.

NRG 131: Lighting Fundamentals
Topics include assessment of quantity and quality of light, light sources, luminaries, lighting controls, manufacturer lamp and ballast specifications, lighting power density, lighting-HVAC interactions, retrofit opportunities, cost savings analysis, and lighting codes/regulations. Course requirements include a directly supervised lighting audit project.

NRG 132: Lighting Applications
Topics in this course will include a review of terminology and lighting fundamentals. Students will critically evaluate lighting systems, luminaries and associated components; Understand and perform various types of illuminance calculations, including point-by-point, lumen method, and computerized procedures. Students will become familiar with the IES Illuminance selection procedure and IES recommended practices for various space types; Formulate objectives and develop an understanding of lighting applications, issues and concerns. Students will work effectively as a member of a team in the development of lighting.

NRG 141: Energy Investment Analysis
Topics include: interest, simple payback and life-cycle cost analysis, time value of money, cash flow equivalence, cost-benefit analysis, effects of tax credits, depreciation, inflation and/or escalating fuel costs on energy investments, and cost estimating procedures. The emphasis will be on analysis of energy investments using spreadsheets to consider total cost-benefits over the life of the investment.

Course Descriptions

NRG 142: Energy Accounting
Course will include review of energy units, data gathering for energy accounting utility rates and schedules, energy data organization, adjusted baselines, cost avoidance, load factor, data analysis, data presentation, use EPA's Portfolio Manager software.

SST 100: Principles of Sustainability
This course is designed to provide the fundamentals of sustainability principles and practices for entry level students as well as under- and unemployed adults who are in job transition from non-environmental sectors seeking grounding in sustainability principles. It covers basic sustainability principles relative to population issues, climate change, renewable energy, consumption, ecosystem threats, transportation, green design and construction, biodiversity and environmental justice. Throughout the course, emphasis is placed on assisting students in exploring green employment opportunities.

SST 110: Energy Auditing in Residential Buildings
The instructor will assist students to understand single-family buildings and how they interact with the internal systems/loads and external loads/impacts. There will be one class trip as part of this course. This course is essentially divided into 3 sections: Building Science and Building Systems, Energy Auditing Practices and Procedures, and Economics of Energy Upgrades.

SST 111: Alternative Energy Sources
This course is an introduction to electrical energy generation and its impact on the environment and society. Various energy alternatives such as solar, wind, geothermal, ocean and fuel cells are examined, along with the positive and negative aspects of each.

SST 210: Introduction to Green (Resource Efficient) Commercial Buildings
The focus of the course is to illustrate that an efficient building is above all economically prudent. In addition to the fiscal value inherent to managing energy and resource consumption, there is significant environmental, social and political value – all of which are explored in greater depth. The course seeks to provide several points of view on some critical topics – allowing for further debate within the classroom. Scientific and technical considerations are balanced by behavioral and social aspects when issues such as efficiency, conservation, and resource management are addressed. The material in this course will be valuable to current facility managers, business owners, and operations & maintenance staff who may be considering energy upgrades – through an audit or commissioning process. Additionally, this course lays a strong foundation for students who are interested in entering the emerging field of energy management. Several career paths are discussed when we cover resource management.

SST 211: Solar PV Systems I: Theory & Design
This course provides an introduction to solar PV systems, including industry overview and trends, systems types & applications, theory of operation, systems design, and economic analysis, In conjunction with the follow-up course SST 112 (Solar PV Systems Construction & Troubleshooting), these two PV systems courses (plus pre-requisites) are designed to provide the student with the necessary knowledge and training to successfully sit for the NABCEP (North American Board of Certified Electrical Practioners) PV Entry Level Exam. Both courses will have a strong hands-on component.

SST 212: Solar PV Systems II: Construction & Troubleshooting
This course follows PV 111 "Solar PV Systems Theory & Design." Picking up where the prior course leaves off, the focus of this course is installing and integrating system components, troubleshooting and commissioning the system, and system maintenance. The students will install a functioning 1 kW system on a simulated roof and residential electrical panel area. At the end of this second course, the student should have the necessary knowledge and training to successfully sit for the NABCEP (North American Board of Certifiied Electrical Practioners) PV Entry Level Exam.

SST 216: Solar Thermal Systems
Topics include the basics of solar hot water heating, solar thermal collectors and their installation procedures, and hot water storage techniques. System site analysis will be covered and students will be introduced to the various uses of solar hot water including air, water, and radiant floor heating. Information will be provided on unvented hot water systems including categories and regulations. Plumbing layout and installation procedures will be covered. Control of solar thermal heating systems will be covered as well as basic solar thermal economics. Hands-on laboratory work is integral to learning of principles and practice of techniques.

SST 221: Geothermal HVAC Systems
This course covers the design and installation of geothermal heat pump (GHP) heating and cooling systems. Topics include the principles of geothermal heat pumps and geoexchange, system sizing based on residential heating and cooling requirements, system economics, determining proper type of geothermal loop system, installation and maintenance of ground or water source-coupled heat pumps, and proper operation of and maintenance/ troubleshooting of systems components.

Course Descriptions

SST 226: Small Wind Systems Topics include the principles of wind energy, electricity fundamentals for power generation technology, performing a wind energy site assessment, safety requirements, system design selection, adapting the mechanical and electrical design to site requirements, installation of subsystems and components, system checkout and inspection, and maintenance and troubleshooting. The economics of wind energy systems is also covered.

SST 231: Introduction to Biomass and Biofuels Technologies
This is a survey course designed to acquaint the student with the current state of science and technology for the generation of energy from biologically-derived sources, as well as with specific activities and opportunities in the New Jersey region. Topics covered include: sources of biomass feedstock, transesterification and biodiesel fuel, fermentation and ethanol fuel, anaerobic digestion and biogas, thermal chemical energy transformation processes, and advanced biofuels.

SST 232: Techniques in Biomass and Biofuels Production
This course will familiarize students with the production techniques for various biofuels and provide knowledge of biomass utilization methodologies. Students will obtain hands-on experience with the biological, chemical, and engineering aspects of biofuels production equipment. Among the techniques that may be offered during a particular semester (as equipment availability and community and student interest demand) are biodiesel, bioethanol, biogas, producer (syn) gas, biochar, and/or advanced biofuels. Biomass pretreatment, materials balance, co-product utilization and pollution prevention are explained.

SST 241: Energy Applications of Programmable Logic Controllers
This course teaches the fundamentals of programmable logic controllers, which are used extensively in commercial and industrial system control applications. Although exercises will be directed toward energy management and efficiency applications wherever appropriate, this course provides a sound grounding in the fundamentals of PLC's suitable to many applications. It will provide the foundation and necessary background for the student to be able to understand, design, modify, troublshoot and maintain many industrial/commercial applications. Laboratory sessions are an integral and essential part of the course. The use of programmable logic trainers with industrial-quality lab hardware and computers with PLC programming software provide a realistic and interactive learning experience.

SST 280: Cooperative Education – Energy Management
This course provides relevant field experience that integrates theory and practice while providing opportunities to develop skills, explore career options and network with professionals and employers in the energy management field.

EET 121: Circuits I
This course focuses on the basic principles of direct and alternating current and on the properties of passive electrical components. It covers atomic theory, current, voltage, resistance, resistive networks, network theorems, work, power capacitance, inductance and transformers. Laboratory exercises include building circuits from schematics, using laboratory equipment to make measurements, and to verify theory. Circuit analysis software is used to simulate and verify the laboratory analysis where appropriate. *PREREQUISITES*: MTH095 Intermediate Algebra.

EET 225: Wiring: Residential and Commercial Construction
This course covers the knowledge and practice of methods used in the installation of residential and commercial electrical systems, with particular emphasis on the specific requirements and examples involved with sustainable energy technologies – solar PV and thermal, geothermal heat pump, and small wind. Safe working practices are emphasized at all times, with reference to and emphasis on the National Electrical Code.

Additional Resources

Sustainability and Alternative Energy Associate Degree Programs
www.bcc.edu/green

Burlington County College
www.bcc.edu

For more information, contact
Dr. Bob Brzozowski, Project Director
at **rbrzozow@bcc.edu** or **(609) 894-9311, ext. 1941**

BURLINGTON
COUNTY COLLEGE

We Can Get You There.

July 2011