



GREENFIELD COMMUNITY COLLEGE

Engineering, Math, Natural & Social Sciences

1 College Drive

Greenfield, Massachusetts 01301

Testimony Submitted for the Subcommittee on Energy and Mineral Resources
Hearing: *American Energy Jobs: Opportunities for Education*. June 24, 2014

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Environmental Science/Plant Biology
Renewable Energy/Energy Efficiency Program Coordinator

Collaborative Workforce Education Programs Can Help Grow Jobs and the Economy

Community colleges provide a demonstrably effective way to educate and train citizens to attain family-sustaining jobs. My testimony speaks to how Greenfield Community College, with crucial workforce development funding and active community business participation, has created a program in Renewable Energy and Energy Efficiency that has become the engine for energy business development in our region.

In the predominantly rural Franklin and Hampshire Counties of Massachusetts, our regional economy is comprised primarily of small businesses and some larger employers in health care, K-12 and higher education, and light manufacturing. Employment opportunities in the energy field include traditional fuels, services and electrical infrastructure/generation. Areas of greatest growth, however, are in energy efficiency, distributed generation and renewable energy technologies. In response to market trends and extensive local employer input, Greenfield Community College (GCC) built a Renewable Energy/Energy Efficiency (RE/EE) program to educate workers in these growing fields. Through individual courses, credentialing exams, certificate or associate's degree options, participants attain necessary knowledge and skill. Extensive collaboration with many stakeholders--businesses, technical high schools, the Regional Employment Board/Career Center, community-based organizations involved in adult basic education and job training, and local agencies--provides pathways into the program and out to employment. A talented workforce supports regional business growth and economic vitality. The GCC program has enabled graduates to start their own businesses or substantially expand existing companies. Our graduates provide many success stories across the broad spectrum of work within the RE/EE field.

Student Expands Solar Company: More Jobs and More Money in the Local Economy

Greg Garrison is President and co-owner of Northeast Solar, a company specializing in residential, commercial and agricultural installations of photovoltaics. He came to the GCC program in 2009 after ending his long-time career in transportation. Despite his extensive financial experience and success, he had no advanced degree or particular background in energy. He was determined to transfer his distribution, management and fiscal talents from the transportation to the energy sector. He completed his associate's degree in RE/EE in 2011 and joined one of our small solar company partners. Within three years, he transformed Northeast Solar from a three-employee residential installer to a thriving business with 14 employees (80% are graduates of the GCC program) and reputation for the highest quality design and installation work. During this time, the company has returned over \$1.4 million to the local economy through direct purchases from local vendors and community program sponsorship. Greg has been instrumental in creating innovative energy financing strategies for businesses and towns and structuring solar investments for homeowners. Northeast Solar recently won 'Solarize' contracts for local towns and is hiring additional staff. The company continues to host interns and hire graduates from our program.

Greenfield Community College: Who We Serve

GCC is the smallest of the 15 community colleges in the Massachusetts higher education system with an enrollment of about 3,000 students. We are fully accredited by the New England Association of Schools and Colleges, and we work closely with bachelor degree granting colleges of the Massachusetts public higher education system, including the University of Massachusetts, and with private colleges and universities, which enables us to offer diverse transfer opportunities to our students. Close to fifty percent of Greenfield Community College students transfer to four-year colleges, and it is Smith College's largest source of community college transfer students. The career programs offered by the College prepare our students to enter the workforce or update their skills, while credit-free workshops and seminars are offered for personal enrichment. Much of the College has recently undergone a multi-million dollar renovation that sets the stage for future developments in learning. Greenfield Community College actively encourages and provides opportunities for leadership and professional development. (www.gcc.mass.edu)

Responsive Workforce Programs Can Help Sustain Industries

Once begun, industries need customer demand, a competent workforce and a strong track record to become established and grow. Effective workforce education programs can help build all three of these. Federal and state policies that provide incentives or other supports for new industries are important in early phases of industry growth. For example, the solar tax credit has made photovoltaic systems financially feasible for businesses and individuals. With

the reduced cost of photovoltaics, these incentives could be phased down over time, but wholesale removal would likely disrupt industry growth. Similarly, expanded tax incentives for energy efficiency (currently capped at \$1,500), could unleash national scale demand for domestic skilled labor to upgrade millions of existing residential and commercial buildings. In our region, we see growth in jobs related to high performance buildings.

In 2006, we learned through a national workforce conference that the U.S. Dept. of Energy predicted explosive growth in the solar photovoltaic (PV) industry. The workforce at the time was underprepared and the speaker predicted that by 2015 a bottleneck in trained installers would thwart growth of the industry. We seized the opportunity to partner with local construction companies and electricians to get ahead of the training curve. The result: two 45-hour courses aligned with the gold-standard industry credential overseen by the North American Board of Certified Energy Practitioners (NABCEP). As with all our technical courses, they have been taught by a professional and current practitioner in the field. Currently our pass rates on the NABCEP Entry Level Exam are 85% and our local solar businesses seek our graduates for internships and employment. This first energy workforce education program informed the key strategic components for subsequent program development that are essential to keep us relevant. (See also 'Strategies for Effective Program Development' on p. 5).

Regional Business and Market Trends Shape Program Design & Ongoing Revision

To identify additional sectors of economic opportunity for our region, we convened a day-long focus group of regional employers including trades-based and construction companies, suppliers, architects, solar companies, energy auditors, government agencies, energy consultants, planners, engineers, utilities, community-based organizations, the Regional Employment Board, university and secondary schools. The focus group engaged in a DACUM (Design a Curriculum) process, run by a professional from PETE (Partner for Energy and Technology Education). The professionals attending assessed that the region was poised for growth in energy efficiency and renewable technologies, the extent of which would depend on federal and state policies. They identified significant educational and training needs for current and projected future employees, and asserted that the existence of a strong worker pool would enhance their ability to deliver better and more services, which support growth of the RE/EE and green construction industry. They identified technical priority areas, such as energy auditing and building science and clarified skills needed across all areas of the industry, such as math, communication, computer skills, science fundamentals, business and accounting.

This focus group transformed into an advisory board who partnered in a three-year workforce development grant. These grant resources catalyzed creation of our 24-course program and supported nearly 500 participants. Our partner-advisors continue to guide our work since the rapid rate of change in the energy industry demands ongoing revision for the program to remain relevant to the needs of our businesses and citizens. (See Attachment 2. Renewable Energy/Energy Efficiency Program Business and Community Strategic Partners. Attachment 3. Collaboration and Partner Activities).

Job creation during the Great Recession: A Workforce Development Success Story

In 2007, GCC and the Franklin/Hampshire Regional Employment Board were awarded a \$371,883 workforce development grant. (See Attachment 1. Fig. 2. Grant Support for RE/EE Workforce Development & Education). The grant was based on close analysis of projected worker shortages in the construction sector combined with the innovative model of public/private partnership that would link training to job attainment and advancement. However, in 2008, the construction sector collapsed and by 2009 was experiencing unprecedented jobless rates. The project was reframed to support unemployed and underemployed construction sector workers in obtaining high-level renewable energy/energy efficiency technical and business skills to take advantage of emerging opportunities (e.g. stimulus-funded incentives) in the building energy industry, and lay the foundation for long-term growth in the regional green economy. The WCTF grant provided resources for curriculum development, equipment and materials purchase, instructor costs, textbooks and resources, administrative coordination and support, outreach and services to special populations, outreach and career coaching, collaboration support, data collection and analysis. The 40+ partners in the workforce development grant had committed to ambitious job creation and employment enhancement goals in 2007. These goals became more ambitious after the economic collapse.

Workforce outcomes exceeded our expectations. From 2007 to 2010, almost 500 people participated in courses or the entire program. More than forty percent of these participants were underemployed or unemployed. Fifty people attained new employment during the grant period, 81 received a wage increase, and 25 earned a promotion. Grant partners sent incumbent workers to upgrade skills and earn additional credentials. Job retention increased by 50% in these companies and organizations. During a time when company closures and job losses were rampant, our partners sustained themselves and some added employees and new services. For a college, community and project of our scale, these were outcomes with significant impact on our businesses, citizens and community. (See Attachment 1. Fig. 1. WCTF Sustainable Practices in Construction Grant: 2007-2010. Employment Goals & Outcomes).

Student Has Impact on the Northeast: Traditional Energy Company Seizes Opportunities in Renewables and Efficiency

Thom Burden had a typical story in 2008. His well-paying job as operations director vanished overnight and left him unemployed in his mid-40s. His search for similar work yielded nothing; he couldn't afford house payments and soon lost his home. His consultation with the local Career Center raised the possibility of a career change and he soon enrolled in the RE/EE certificate program at GCC. Within a year he had added a whole new set of skills to his extensive toolbox and landed an internship with the oldest and largest energy company in our county, Sandri Energy, which serves all of New England. His timing was perfect. The company was interested in exploring energy products and services to augment its traditional oil business. Thom identified growth opportunities in renewable technologies and efficiency

services. A few months later, Sandri hired him as Project Manager in their newly minted Renewable Energy Division. The company has diversified its energy services to include wood pellets, solar heating systems, and photovoltaics and continues to collaborate closely with the college, including hiring interns and graduates.

Student Supports International Energy Companies & Local Manufacturing Jobs

Petra Schweitzer is a native of Germany who has lived in Massachusetts for more than a decade. She worked as a translator with particular focus on helping European businesses understand their target markets in the U.S. Since many German companies are involved with renewable technologies and have local representatives, she decided to pursue more specialized training in this field. Petra enrolled in the RE/EE program and learned energy science and vocabulary. She completed the certificate but continues to take courses to stay on top of research and product development. She translates customer and technical materials for German companies, including Stiebel Eltron, a solar thermal manufacturer that has regional headquarters and an assembly facility that employs local workers.

Strategies for Effective Program Development Can be Applied to Other Regions and Sectors

- Curriculum co-created with employer, faculty & student input
- 28-credit certificate validated by industry team to ensure credential of employment value
- Curriculum based on fundamental science principles, quantitative reasoning, business skills and up-to-date technical skills
- Courses aligned with available certification pathways (e.g. NABCEP, BPI)
- Certification exams offered for credential attainment
- Instructors drawn from industry
- Multiple access pathways into the program; e.g. courses can be taken for credit or credit-free
- Flexible scheduling to accommodate diverse student needs
- Certificate program can be started in any semester and completed in one year.
- Certificate participants can transition seamlessly to 60-62 credit Associate's degree at any point.

Pathways into training & employment: Vocational-Technical High School Partners

Community colleges actively cultivate '2 + 2 + 2' pathways, linking with area high schools to add an associate's degree credential to a high school diploma and position students for successful transfer to achieve a four-year degree. Because energy careers are so technology based, we particularly emphasized partnership with our two vocational-technical high schools. Technical high school instructors completed courses at the college and then revised their shop curricula to integrate RE/EE technologies relevant to their students, such as photovoltaics for electricians and heat pumps for HVAC/plumbers. The extensive shop facilities at the Franklin County Technical High School are made available for hands-on training as part of some RE/EE college courses. The college also invested grant funds in building additional training infrastructure, the Clean Energy Instruction Center and a training roof, on the high school campus for both GCC and FCTS students. (See Attachment 1. Fig. 3).

Return on Investment: Training and Education Pay Off – What it Takes

For the past seven years, we have witnessed high rates of job placement and educational advancement for participants in the RE/EE certificate and associate's degree programs. Hundreds of participants benefitted from a relatively small investment and current students continue to benefit from the program built during the workforce development grant period. Our employment success from 2007-2010 highlights the critical elements needed to bring workers and employment opportunities together. Although every community will have different economic character, businesses, culture, values and institutions, many of these elements are common to any workforce education effort.

- Diverse business partners willing to participate and incentives for their time: These activities could include providing input on skill and knowledge gaps, sending employees for training, hosting interns, hiring graduates, collaborating on grants, offering field learning sites, providing expertise as guest speakers or instructors. Grant funds that paid for employee training time, courses, and internship stipends helped compensate businesses for the time they invested.
- Regional Employment Boards / Career Centers use public workforce funds to help unemployed citizens find economic advancement: Many public funds exist to help unemployed individuals find new employment through retraining. Career Centers provide job search support services and updated employment listings. Career counsellors can identify good candidates for employment in the energy sector and direct them to available workforce education programs.
- Energy practitioners to design and teach courses: Current professionals know their field and know what skills and knowledge are needed to enter and advance in that field. Technical workforce programs must tap local professionals to provide instruction to ensure that students are ready for employment

when they finish. Practitioners often benefit from working closely with experienced faculty to deliver course content effectively.

- Funding to support curriculum development/ revision & administrative needs: Relevant and effective curriculum and programs take skill and time to develop and administer. Active and collaborative partnerships are particularly time consuming to facilitate.
- Affordability is still an obstacle. Subsidized courses transform the workforce: Grants that support student tuition and fees expand participation and workforce outcomes exponentially.

Changes in the Energy Field Represent Opportunities Going Forward

Since the inception of our RE/EE program, many changes in technology, policy, finance, the economy and other arenas have shifted the employment landscape. To stay relevant, workers, businesses and our program will need to adapt continually to this rapidly changing environment. Technologies are becoming cheaper and integrated into standard building strategies. High performance buildings are in great demand and can be constructed for little or no additional cost as compared with standard approaches. State mandates are driving tighter building codes, solid waste management procedures, water management designs and municipal energy planning. Municipalities, institutions and businesses are hiring program managers to cut energy costs and improve the bottom line. Air source heat pumps are poised to revolutionize heating and cooling in the Northeast and geothermal has become more popular in commercial construction. These changes represent opportunities for our businesses and our citizens. Success in the energy sector requires that workers understand fundamental scientific and technological principles. Community colleges are ideally suited to provide citizens in our service areas with the capacity for life-long learning, critical foundational knowledge and technical skills needed for specific fields.

Attachment 1. Figures.

**Figure 1. WCTF Sustainable Practices in Construction Grant: 2007-2010.
Employment Goals & Outcomes**

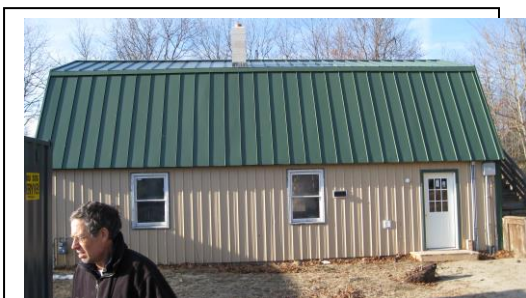
Final Report submitted to Massachusetts Commonwealth Corporation, June, 2010.

Outcome Measure	Goals	Actual
• Number of Enrolled Participants	240	475
• Number of Unemployed/Underemployed Participants	90	218
• Number of Incumbent Participants	150	257
• Number of Participants Completing Training*	192	419
• Number of Participants Attaining a Skilled Credential	55	82
• Number of Participants Receiving a Wage Increase	120	81
• Number of Participants Receiving a Promotion	40	25
• Number of Participants Attaining New Employment	25	50

Fig. 2: Grant Support for Renewable Energy/ Energy Efficiency Workforce Development & Education

- \$371,883 Workforce Development Trust Fund (WCTF) grant from the Massachusetts Commonwealth Corporation to fund program development and subsidize participants
- \$60,000 from Hudson Valley to enhance solar PV training & earn Interstate Renewable Energy Council (IREC) accreditation for solar training, including mock roof construction (photo below).
- The USDOL Mass. Community College Workforce Development Transformation Agenda:
 - \$21,000 renovation of GCC’s Clean Energy Instructional Center housed and shared with the Franklin County Technical High School (photo below)
 - \$8,000 used to apply for IREC Accreditation for Solar PV & Building Analyst training

Fig. 3: Franklin County Technical School (FCTS), Turners Fall, MA.



Clean Energy Instruction Center for energy auditor education and training.



Mock Roof for Solar Thermal and Photovoltaic (PV) installation instruction.

Attachment 2. Renewable Energy/Energy Efficiency Program Business and Community Strategic Partners

RE/EE Company or Organization	Relationship	RE/EE Company or Organization	Relationship
Western Mass. Electric	Advisory; grantor	Renewed by the Sun (PV)	Student Intern Mentor
Northeast Solar PV	Advisory, hires grads, interns	Farnum Insulators	Student Intern Mentor
Coop Power (member-based coop)	Advisory Board; GCC supports Pathways out of Poverty Program; Intern site	Sandri Energy Companies	Mutually Advisory, hires grads, takes interns; Major donations
Center for Ecological Tech	Advisory	Turnkey Builders	Student Intern Mentor
Coldham & Hartman Architects	Advisory and Internship site	Pioneer Valley Reg Plan	Advisory; Internship; Advised their Sustainability Planning
Berkshire PV Systems	Intern Mentor and advisory	Spirit Solar	Student Intern Mentor
Integrity Devel & Constr	Advisory	Cozy Home	Intern Mentor and advisory
Palmeri Electric	Advisory	Austin Design	Intern, hired grad and advisory
Pioneer Valley PV	Student Intern Mentor	Center for New Americans	Mutually Advisory
Beyond Green Construct	Advisory, hires grads, interns	Cowls Building Supplies	Advisory
Thayer Street Associates	Advisory	Craig Builders	Advisory
Rice Oil Co.	Advisory; Major donations	Deerfield Valley Heating and Cooling	Advisory
The Solar Store	Advisory and supplies	Don Campbell Associates	Advisory
Stiebel Eltron, Inc.	Student Intern Mentor	E.W. Martin Electric	Advisory
Powerhouse Amherst	Student Intern Mentor	F.W. Webb Corporation	Advisory
Community Action	Hired grads; Advisory	Hap Inc.	Advisory
United Brotherhood of Carpenters and Joiners	Advisory	Home Builders Association of Western Ma	Advisory
Upward Bound	Outreach	International Language Institute	Advisory
350.org	We hosted annual meeting	Kosmo Solar	Advisory
Renaissance Builders	Advisory	Kraus Fitch Associates	Advisory
Mount Grace Land Trust	Outreach and collaboration	Mowry and Schmidt	Advisory
Natural Siding Associates	Advisory	Northampton Plumbing Supply	Advisory
Northeast Biodiesel	Advisory	Northeast Sustainable Energy Ass	Advisory
		Alpha Stone Concrete	Advisory
Rugg Building Solutions	Advisory	Rural Development Corporation	Advisory
Sean's Customs	Advisory	Stiebel Eltron, Inc.	Advisory; Field Trip Site
The Literacy Project	Advisory	W Mass Green Consortium	We sit on their board



Renewable Energy/Energy Efficiency
Education & Workforce Development
Division of Community Education &
Division of Math, Science, Business & Information
Technology

Attachment 3. Collaboration & Partner Activities

Diverse team within Greenfield Community College:

- Division of Community Education / Workforce Development brings extensive employer networks & experience in developing responsive programming
- Academic departments (science) develop credit-bearing courses & pathways in higher education
- Development staff participate in program design & pursuit of funding opportunities
- Administrators & faculty pursue institutional initiatives that support program vision
- Students help determine efficacy, priorities and emerging goals

Regional Career Center / Regional Employment Board (REB)

- Network with existing workforce training infrastructure and capacity
- Recruit underemployed and unemployed citizens into family-sustaining career pathways
- Build strong base of workers to grow and attract RE/EE industries
- Leverage existing state and federal worker training programs

Local businesses / employers/ trade organizations: Grant partners advisory group & ongoing communication

- Local job forecasting to set program priority linked to real jobs
- Employer training needs & specific input on curriculum & program components
- Training & education for incumbent workers (e.g. trades people, employees)
- Internship & entry level employment opportunities
- Recruit experienced industry instructors to teach technical courses

Technical & Comprehensive High Schools

- Support professional development opportunities for high school & college faculty
- Leverage resources for equipment & materials to integrate RE/EE into vocational curriculum.
- Collaborate on creating articulated courses between HS and CC
- Create seamless pathways for students to transition to CC programs

Community-Based Organizations (e.g. Adult Basic Education)

- Community organizations include: Center for New Americans, The Literacy Project
- Integrate with existing community training capacity to make training truly accessible
- Build needed support structure to create educational advancement & career pathways
- Outreach and support for at-risk youth to reengage with formal education
- Green Careers Coach works directly with clients and teachers at REB and community organizations

State-wide with community colleges:

Goal: Accelerate state-wide development of a world class “green” workforce so that residents can take advantage of and help grow the emerging green economy.

- Share best practices, curricula, policies and procedures: maximize resource productivity
- Collaborate on funding applications
- Engage in coordinated policy initiatives to advance funding opportunities for education & training
- Reach out to new collaborators to promote program expansion and improvement

Renewable Energy/Energy Efficiency (REE)

THE CERTIFICATE	Renewable Energy/Energy Efficiency
THE PROGRAM	Provides students a comprehensive introduction to renewable energy and energy efficiency; provides students with the knowledge and skills needed for entry-level employment opportunities in the renewable energy/energy efficiency field without the general education requirements of the associates degree; provides students already employed in the trades with knowledge and skills relevant to specific renewable energy/energy efficiency technologies, as well as broader understanding of the scientific, economic and political context of the industry; and provides students with the knowledge and skills needed for continued learning and education in the renewable energy/energy efficiency field, including transfer into the associate's degree program.
YOUR NEXT STEP	Take appropriate industry exams based on your course work. Find employment in the renewable energy/energy efficiency field e.g., green building, energy auditing and/or solar. Continue academic studies in a degree program.
PROGRAM COORDINATOR	Teresa Jones, Office: S414, (413) 775-1462, jones@gcc.mass.edu

Total Credits: 28-29

Program Requirements	
SCI 120 Sustainable Energy: Theory and Practice	4
SCI 126 Residential Energy Efficiency and Energy Auditing	3
One 3-credit course coded: ACC, BUS, CIS, or ECO	3
BUS 102 Career Planning and Job Search Skills ①	0-1
Program Electives	
Any 11 credits of courses from the Program Electives list below ② ③	11
Open Electives	
Any 7 credits of courses coded: ACC, BIO, BUS, CHE, CIS, ECO, EGR, EVS, GEO, MAT (3-4 credits), PHY, PSJ, SCI, ENG 101, ENG 103, or ENG 105 ② ③, other than a developmental course (see page 29) MAT 105, MAT 106, and MAT 116	7

PROGRAM ELECTIVES

SCI 110 Community Energy Solutions1	SCI 129 Fundamentals of Wind Energy3
SCI 112 Fundamentals of Electricity3	SCI 130 Extreme Insulation Retrofits3
SCI 114 Residential Construction Fundamentals3	SCI 131 Introduction to Piping2
SCI 116 Introduction to Geothermal Heating and Cooling1	SCI 132 Introduction to Home Heating and Cooling3
SCI 118 Greenhouse Gas Assessment and Carbon Cap and Trade1	SCI 133 Introduction to Architectural Modeling2
SCI 119 Introduction to Global Warming3	SCI 134 Building with Earth, Straw, Wood, and Stone3
SCI 121 Introduction to Photovoltaic (Solar Electric) Technology3	SCI 135 Green Careers Exploration and Career Skill Building3
SCI 122 Solar Domestic Hot Water1	SCI 136 Applied Residential Energy Auditing3
SCI 123 Passive Solar Technology1	SCI 137 Permaculture Design4
SCI 124 Energy Conservation and Efficiency1	SCI 221 Photovoltaic (Solar Electric) Installation ④3
SCI 125 Sustainable Landscape Design3	SCI 227 Sustainable Design and Green Building Practices3
SCI 127 Introduction to Sustainable Design and Green Building3	SCI 228 Photovoltaic Technical Sales and Marketing
SCI 128 Solar Thermal Systems3	SCI 293/294 Internship in Renewable Energy ⑤1-6

Course requirements and electives to be chosen after consultation with faculty advisor and in consideration of the requirements of the transfer institution and student's professional goals.

To plan certificate or degree completion, see the course descriptions in the catalog beginning on page 125 or at <http://www.gcc.mass.edu/academics/catalog/courses/>, which specify the planned semester(s) in which the course is to be scheduled.

For a list of courses that can be taken online, refer to pages 162-163.

- ① Not required for students who have taken BUS 224.
- ② Depending on your academic background and work experience, you may need to take additional courses as prerequisites or co-requisites (concurrent enrollment).
- ③ These courses may have additional prerequisites. Please consult the course catalog.
- ④ A student concentrating in photovoltaics may qualify to take the North American Board of Certified Energy Providers (NABCEP) Basic Knowledge in Photovoltaics exam.
- ⑤ Internships may be taken as Science Electives or as General Electives in consultation with faculty advisor. No more than six total credits of internship may count toward this certificate.

Liberal Arts Option: Renewable Energy/Energy Efficiency (LRE)

Satisfies MassTransfer Block ①

The Liberal Arts option described below is one focused way to complete the Liberal Arts degree at GCC. By taking courses listed in this specific option, students complete courses that will help develop 100 and 200 course level knowledge and skills in a particular field. Students are advised to work closely with their GCC advisor to select the specific courses that will help meet their specific career or transfer goals. (Note: Students who complete this option will graduate with a diploma that reads “Associate in Arts in Liberal Arts”.)

THE DEGREE	Associate in Arts in Liberal Arts
THE OPTION	Provides students with the knowledge and skills needed for entry-level employment opportunities in the renewable energy/energy efficiency field; provides students already employed in the trades with knowledge and skills relevant to specific renewable energy/energy efficiency technologies, as well as broader understanding of the scientific, economic and political context of the industry; provides students with a general education background combined with a comprehensive introduction to renewable energy/energy efficiency and technical and general electives with course work geared toward transfer requirements for a four-year Baccalaureate program.
YOUR NEXT STEP	Take appropriate industry exams based on your course work. Find employment in the renewable energy/energy efficiency field, e.g. green building, energy auditing and/or solar. Continue academic studies in a four-year Baccalaureate program.
OPTION ADVISOR	Teresa Jones, Office: S414, (413) 775-1462, jones@gcc.mass.edu

Total Credits: 60-62

Option Requirements

English Composition/Writing

ENG 101, 103, or 105 English Composition I	3
ENG 112, 114, or 116 English Composition II	3

Behavioral and Social Sciences

Select one of the following 9-credit options:	9
EVS 101 Environmental Studies: Issues in Sustainability	
One of the following: ANT 103, ANT 104, ECO 101, ECO 102, POL 101, PSY 101, or SOC 101	
One 3-credit course coded: ANT, ECO, EVS, HSV, POL, PSJ, PSY, or SOC	
or	
ECO 113: Environmental Economics	
Two of the following: ANT 103, ANT 104, ECO 101, ECO 102, EVS 101, POL 101, PSY 101, or SOC 101	

Humanities and Fine Arts

One 200-level course coded ENG	3
One course coded HIS	3
One 3- or 4-credit course coded: AHS, ART, ASL, DAN, ENG, FLK, FRE, GGY, HIS, HUM, LAT, MUS, PCS, PHI, SPA, or THE, other than a developmental course (see page 29), English Composition I and English Composition II	3-4
PCS 101, 131, or 141	3

Natural or Physical Science

BIO 120 Introduction to Environmental Science	4
SCI 120 Sustainable Energy: Theory and Practice	4
SCI 126 Residential Energy Efficiency and Energy Auditing	3

Mathematics/Quantitative Reasoning

Any course coded MAT other than a developmental course (see page 29), MAT 105, and MAT 106 ②	3-4
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Additional Requirements

One 3-credit course coded: ACC, BUS, CIS, or ECO	3
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Option Electives

Any 12 credits of courses from the Science Electives list on next page ③	12
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Open Electives

Any 4 credits of courses coded: ACC, BIO, BUS, CHE, CIS, ECO, EGR, EVS, GEO, MAT, PHY, PSJ, or SCI, other than a developmental course (see page 29) and MAT 116 ②	4
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(Option Electives and Notes continued on next page)

Liberal Arts Option: Renewable Energy/Energy Efficiency (LRE)

Satisfies MassTransfer Block ^①

(Continued from previous page)

SCIENCE ELECTIVES

SCI 110 Community Energy Solutions	1	SCI 129 Fundamentals of Wind Energy	3
SCI 112 Fundamentals of Electricity	3	SCI 130 Extreme Insulation Retrofits	3
SCI 114 Residential Construction Fundamentals	3	SCI 131 Introduction to Piping	2
SCI 116 Introduction to Geothermal Heating and Cooling	1	SCI 132 Introduction to Home Heating and Cooling	3
SCI 118 Greenhouse Gas Assessment and Carbon Cap and Trade	1	SCI 133 Introduction to Architectural Modeling	2
SCI 119 Introduction to Global Warming	3	SCI 134 Building with Earth, Straw, Wood, and Stone	3
SCI 121 Introduction to Photovoltaic (Solar Electric) Technology	3	SCI 135 Green Careers Exploration and Career Skill Building	3
SCI 122 Solar Domestic Hot Water	1	SCI 136 Applied Residential Energy Auditing	1
SCI 123 Passive Solar Technology	1	SCI 137 Permaculture Design	4
SCI 124 Energy Conservation and Efficiency	1	SCI 221 Photovoltaic (Solar Electric) Installation	3
SCI 125 Sustainable Landscape Design	3	SCI 227 Sustainable Design and Green Building Practices	3
SCI 127 Introduction to Sustainable Design and Green Building	3	SCI 228 Photovoltaic Technical Sales and Marketing	3
SCI 128 Solar Thermal Systems	3	SCI 293 or 294 Internship in Science	1-6

Course requirements and electives to be chosen after consultation with faculty advisor and in consideration of the requirements of the transfer institution and student's professional goals.

Please note that transfer to many four year colleges and universities may require the completion of four semesters of World Languages. Four sequential semesters of World Language classes from GCC will fulfill any UMass, Amherst language requirement.

To plan certificate or degree completion, see the course descriptions in the catalog beginning on page 125 or at <http://www.gcc.mass.edu/academics/catalog/courses/>, which specify the planned semester(s) in which the course is to be scheduled.

For a list of courses that can be taken online, refer to pages 162-163.

- ① See pages 39-41 for the specific requirements of the MassTransfer policy.
- ② Recommended: MAT 107.
- ③ Up to three credits of internships may be taken as a SCI elective and up to six credits as any additional elective in consultation with faculty advisor. No more than six credits of internships may count toward this degree.



Certificate in Renewable Energy/Energy Efficiency (REE)

28 Total Credits

Suggested Solar Photovoltaic (PV) Concentration

NABCEP "Certificate of Knowledge Exam" – Eligibility to sit

Required Courses:

SCI 120: Sustainable Energy: Theory and Practice	4 credits
SCI 126: Residential Energy Efficiency and Energy Auditing	3 credits
Any course coded BUS/ECO/ACC	3 credits
<i>(The program strongly recommends BUS 111: The Contemporary Business World)</i>	

Required Elective:

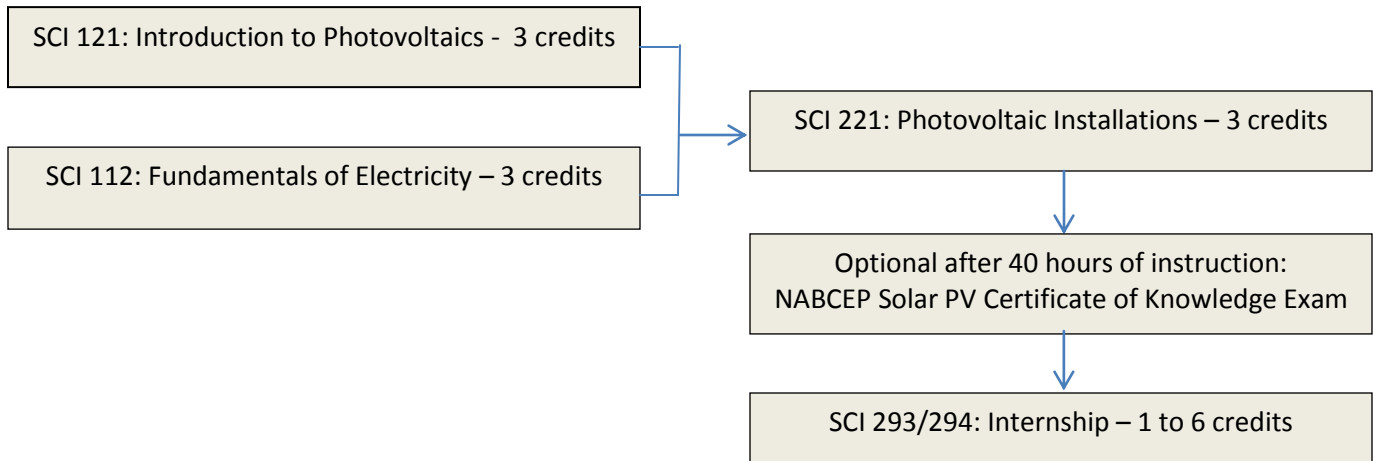
MAT 105: Introductory Algebra or satisfactory test placement required	3 credits
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Highly recommended but not required:

MAT 106 intermediate Algebra	3 credits
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Solar PV Concentration Electives:

(at least) 9 credits



Other Electives: Courses taken from the list on the reverse side of this sheet.

28 Total Credits

Notes:

NABCEP is the North American Board of Certified Energy Practitioners - (www.nabcep.org) Students are eligible to sit for the "Certificate of Knowledge," a written exam proctored by GCC, after 40 hours of instruction. We recommend, however, that they complete the sequence of PV courses described above. GCC's latest pass rate for the NABCEP was 80%, higher than the national average.



Certificate in Renewable Energy/Energy Efficiency (REE)

28 Total Credits

Suggested Energy Efficiency Concentration

BPI "Small Homes" Certification Written & Field Exams – Eligibility to sit

Required Courses:

SCI 120: Sustainable Energy: Theory and Practice	4 credits
SCI 126: Residential Energy Efficiency and Energy Auditing	3 credits
Any course coded BUS/ECO/ACC	3 credits
<i>(The program strongly recommends BUS 111: The Contemporary Business World)</i>	

Required Elective:

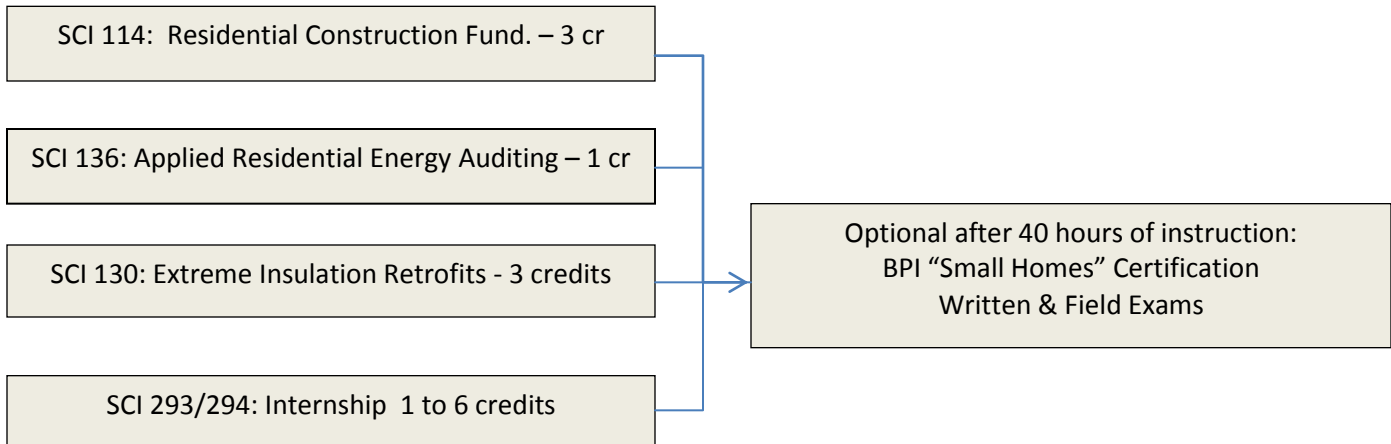
MAT 105: Introductory Algebra or satisfactory test placement required	3 credits
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Highly recommended but not required:

<i>MAT 106 intermediate Algebra</i>	<i>3 credits</i>
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Energy Efficiency Concentration Electives:

(at least) 9 credits



Other Electives: Courses taken from the list on the reverse side of this sheet.

28 Total Credits

Notes:

BPI is the Building Performance Institute – (www.bpi.org) Students are eligible to sit for written and field exams to earn certifications within BPI’s Small Homes Model. We recommend, however, that students complete the full sequence of courses described above before testing. Students completing this concentration are positioned to seek an entry-level position as an energy auditor, or to continue studies in energy efficiency remediation, environmental studies, or public policy.

Recent Renewable Energy Graduates at Work



Marcello Rossi

Here are the photos of my 5.1kw PV installation. My Cadmus MassCEC inspection was Rated "Excellent." Don Fontaine, my former classmate, was the licensed electrician. On this, my first PV contract, design and installation. I was officially given "Expedited Installer Status" yesterday and now I can do more than one installation at a time under the MassCEC rebate program. I am now a PV installer and have started my own renewable energy design and installation company "AMERICAN EARTH KEEPERS." I'm working in the Springfield, MA area. Thank you for everything you taught me.

Brandon Shantie After 15 years as a full time cook and part time tradesman I moved to Western Massachusetts for a change in careers and life direction. I was working for a weatherization company in Shelburne Falls when I was given the opportunity to take the Lead Safe Training course at the GCC Main Street campus and was inspired by the active classroom environment to return to school. I was intrigued by the RE/EE program where I could receive an Associates Degree in conjunction with many certifications pertinent to a variety of careers in the renewable energy field. I was apprehensive about how I would do taking on a full course load. I found teachers and staff at GCC to be both helpful and understanding of the challenges of returning to school. During my tenure at GCC I have completed an internship with Powerhouse, an energy consulting firm in Amherst that performs HERS ratings and home energy audits. This internship has led to paid work with the same company. During my daily work I am constantly reminded of all the pertinent information that the RE/EE program has taught me. The fundamentals of renewable energy taught by Teresa Jones, the practice and application of energy calculations and building science knowledge taught Peter Talmage and Jeremy Toal, and the perspective of importance of the work to be done taught by Bill Gran in his Global Warming class has given me the everyday tools I need at my job.



Jonathan Walsh:

Since graduating a few years ago I worked full time for Northeast Biodiesel as Project Coordinator and have recently taken a job at Stiebel Eltron. I finally have a solid career in renewable energy and just wanted to let you know it worked out for me. Thanks for everything



Anne Harris came to GCC with a Bachelor's Degree from The College of the Atlantic and a BPI certification. She was working as a carpenter but needed more comprehensive skills and was interested in Building Science. She is now a building analyst with SEVCA Weatherization in Westminster Vermont. " My position is part of program by Efficiency Vermont, which offers direct installation of electrical efficiency measures to low income households that apply to be weatherized by SEVCA. I may occasionally help out on audits as well."



Jamie Cross graduated from GCC in December, 2011 with an A.A., Option in RE/EE. He transferred to Illinois State University which had just created a B.S. degree in Renewable Energy/Energy Efficiency (rare at that time). Jamie selected the economics track because of his interest in energy management and business. After a fabulous summer trip to Germany with classmates and a professor, Jamie will begin the Master's program in Project Management at Illinois State where he will also be a teaching assistant. Jamie shared that his rigorous courses at GCC set him up for success at Illinois State, and that, "It all came together when I did my internship at Sandri." Jamie completed a summer internship as part of his RE/EE program at GCC. (Sandri is a regional fuel distributor and energy services company with 400 employees and a headquarters in Greenfield that has launched a new Renewable Energy Division managed by a GCC RE/EE graduate, Thom Burden.)