

Findings and
Recommendations

Alignment of Postsecondary Education and Employment

Approved

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by the

Legislative Program Review
& Investigations Committee

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Introduction

STUDY OVERVIEW

Numerous reports have identified an increasing gap in how well Connecticut prepares its workforce for the demands of current and near-future employment. The Legislative Program Review and Investigations Committee voted to conduct a study examining *Alignment of Postsecondary Education and Employment* in April 2009. The focus of the first phase of the study was to determine whether a formal alignment mechanism exists in Connecticut to match the production of skilled graduates from the state's higher education institutions (including public and independent universities, four-year colleges, and community colleges) with the current and projected workforce needs of the state's employers. The study also assessed current workforce supply and employer needs, and reviewed whether pathways exist for technical high school graduates to pursue postsecondary education certificates and degrees.

The briefing report found an overall lack of alignment of postsecondary education and employment for a majority of the occupations examined. (Excluded from this alignment analysis were the many broad college majors that lead to employment in a multitude of occupations.) While some occupations appeared to be particularly well aligned, such as registered nurses, the majority of occupations examined seemed to have an oversupply or undersupply of workers.

The briefing report identified a number of barriers contributing to the misalignment of postsecondary education and employment. An increasing number of new college students are unprepared for college-level work and are enrolled in remedial or developmental courses. This lack of preparedness can be traced back to elementary and secondary schools, where an increasing number of students as young as fourth graders do not score as well in science, math, and reading compared to students in other New England states. Additionally, the briefing report highlighted the difficulties in making accurate projections of demand for particular occupations ten years into the future. Connecticut's system for public higher education was found to be very decentralized, with multiple boards of trustees, and funding allocated directly to the constituent units based largely on enrollment size rather than on results.

Because of the broad nature of the study, the committee decided to examine two areas in depth to see if there were successful state strategies that better align postsecondary education with the needs of Connecticut's employers and that could be applied to other occupational shortage areas. The two areas selected for intensive review were the emerging field of green collar job, and the nursing field because the state had already implemented a number of strategies to increase the number of nursing graduates.

This report recommends potential solutions to overcoming barriers to alignment, drawing on lessons learned from the detailed examination of the strategies used to successfully align postsecondary education and employment in the nursing profession as well as information learned in studying the emerging green collar jobs field.

Green Collar Jobs

Green collar occupations are a less established, emerging field. The following questions were used to review the green collar field:

1. What is *driving* the green movement?
2. How are green collar jobs being *defined*?
3. Who is *developing* the green collar field and where will the job opportunities be?
4. What green collar job education and training is being *delivered*?

Forces driving the green movement within Connecticut include: the American Recovery and Reinvestment Act of 2009; Governor Rell's Executive Order No. 23, which established the Connecticut Energy Sector Partnership and a blueprint for green collar jobs creation; recent Connecticut statutory changes promoting green building code requirements, and implementing green strategies through the Connecticut Clean Energy Fund and the Connecticut Energy Efficiency Fund; and the private sector, establishing and expanding companies and initiatives in the energy sectors.

There are a multitude of green collar job definitions produced by such entities as the U.S. Department of Labor, the Connecticut Department of Labor, Department of Economic and Community Development, and green job study groups and institutes. Definitions of green collar jobs vary widely, depending on who is defining the field, and whether they are focusing on new and emerging occupations such as carbon trading analysts and wind energy engineers, occupations that currently exist and require additional green skills and knowledge, or current occupations that will be in greater demand as they are performed within a green setting.

Green collar job opportunities are developing in Connecticut in a range of occupations, from hydrologists, environmental engineers and natural sciences managers, to builders and sellers of energy related products, energy efficient building construction, and building operations and maintenance. Solar and wind power, and fuel cells are other areas anticipated to offer green collar job opportunities.

Lastly, green collar education and training is being delivered in postsecondary education in the following five ways:

1. offering majors or minors in directly related fields such as environmental science or environmental engineering;
2. offering majors or minors associated with the green movement;
3. establishing centers or institutes directly related to renewable energy, energy efficiency, or other green related areas;
4. certificates in green collar fields; and
5. individual courses to add green collar skills and/or knowledge.

Nursing Field

The nursing field was chosen for examination because that occupational group had experienced a significant shortage a decade ago and successfully increased supply to address demand. Findings on the strategies used for this successful alignment are described with the possibility that the strategies can be applied to other fields experiencing workforce shortages.

The two sources of information regarding employer need for register nurses showed need for registered nurses. In 2006, Connecticut's labor department projected a need for 1,130 new registered nurses each year through 2016. The Connecticut Hospital Association reported a vacancy rate of 11.6 percent in 2001, although this had declined to 6.6 percent in 2007, and 3.6 percent in 2009 – nearly half of what it had been one year before the economic downturn began.

Various efforts and factors have resulted in better alignment of the nurse supply and demand. Program review committee staff examined ten years of data on students enrolled in Connecticut's nursing programs and found at the lowest point in the 2000-2001 academic year there were 594 graduates of associate or baccalaureate programs leading to eligibility for RN licensure and by 2007-2008 academic year there were 1,118 graduates, an increase of 88 percent. The economic recession may have also contributed to improved alignment. Previous studies indicate that nursing shortages are cyclical and during times of high unemployment, more nurses work in direct patient care, move from part- to full-time employment, or re-enter the workforce.

Multiple strategies were adopted in Connecticut in reaction to the impending nursing crisis and the response included both public and private entities. These included: the aggressive pursuit of federal, state, and private funding to provide tuition assistance; student advising and targeted student tutoring; beginning new nursing programs or expanding existing ones; and collaboratively partnering between nursing programs and hospitals and other health care institutions in the state.

A key action taken by the legislature to address the nursing shortage was the creation of the Allied Health Workforce Policy Board under P.A. 04-220. The board is charged with conducting research and planning activities related to the allied health workforce. This provided a formal mechanism for information to be exchanged and shared among parties working toward common goals.

Based on the success of the Allied Health Workforce Policy Board, PRI staff found the board structure could be used as a model for other targeted shortage areas. The advantages of this model include:

- making decisions collaboratively;
- acting as a clearinghouse for individual pilot or creative projects being implemented by colleges, universities, or other organizations;
- allowing for creativity at the local/regional level, with ideas shared and dispersed; and
- having the ability to propose legislative and non-legislative solutions as one voice.

Recommendations to Address Barriers to Alignment of Postsecondary Education and Employment

The briefing report identified a number of barriers contributing to the misalignment of postsecondary education and employment that related to: elementary and secondary school students in the knowledge/talent pipeline; postsecondary education institutions; workforce demand projections; and state agency organization, programs and policies. PRI staff recommends potential solutions to overcoming the barriers, drawing on lessons learned from a detailed examination of the strategies used to successfully align postsecondary education and employment in the nursing profession as well as information learned in studying the emerging green collar jobs field.

Research methods. Program review committee staff conducted interviews with staff from: the State Department of Education (SDE); the Departments of Higher Education (DHE), Labor (DOL), Economic and Community Development (DECD), and Consumer Protection; and the Office of Workforce Competitiveness (OWC). Interviews were also held with college administrators and faculty at the University of Connecticut, the Connecticut State University System, and the Connecticut Community College System. On-site visits were made to: Central, Eastern, and Southern Connecticut State Universities; and Asnuntuck and Manchester Community Colleges, including a visit to the middle college, Great Path Academy, located at Manchester Community College. As part of the in-depth examination of nursing, information was collected from the University of Connecticut, the three universities in the Connecticut State University System with nursing programs, the Connecticut Community College System, the Connecticut Hospital Association, the Board of Examiners for Nursing, the Connecticut League for Nurses, and the Allied Health Workforce Policy Board. The in-depth examination of green collar jobs included interviews with representatives from the Connecticut Clean Energy Fund, Gateway Community College's Center for a Sustainable Future, Office of Workforce Development at the Interstate Renewable Energy Council (IREC), the Unit Coordinator for Trade Technologies for Connecticut Technical High Schools, and California Community Colleges' Centers of Excellence for Economic and Workforce Development.

Information on relevant majors, programs offered, student enrollment, graduation rates, and passing rates on licensure exams were analyzed. Information relevant to the alignment of postsecondary education and employment was also gathered via a survey that was completed by 14 members of the Connecticut Conference of Independent Colleges. Questions encompassed a broad range of areas including remedial coursework, new additions and discontinuations of programs, placement rates post-graduation for nurses and engineers, and ways the Connecticut Department of Labor workforce shortage projections are used.

Best practices found in the literature were also reviewed and incorporated into recommendations to address various barriers, especially those pertaining to challenges regarding lack of preparedness of high school graduates for postsecondary education, delivery of remedial coursework, and retention of college students.

Report organization. Section I presents an in-depth examination of green collar jobs including information about: what is driving the green movement; how green collar jobs are defined; who is developing the green collar field and where the job opportunities will be; and what green collar job education and training is being delivered. Section II describes the results of an in-depth examination of the nursing field and identifies successful strategies that were used to increase the number of students entering nursing programs, which could also be used for other occupational shortage areas. The last section, Section III, recommendations potential solutions to overcoming barriers to the overall alignment of postsecondary education and employment, drawing on lessons learned from the detailed examination of the strategies used to successfully align postsecondary education and employment in the nursing profession as well as information learned in studying the emerging green collar jobs field.

GREEN COLLAR JOBS

This section describes the emerging field of green collar jobs and how education is aligning with the needs of the new field. The information is organized into answering the four “D’s” of the green collar field:

- What is **driving** the green movement?
- How are green collar jobs **defined**?
- Who is **developing** the green collar field and where will the job opportunities be?
- What green collar job education and training is being **delivered**?

Figure I-1 provides a roadmap for this section’s information on the four D’s of the green collar field. The green movement in Connecticut is being driven by a confluence of forces including an array of grants stemming from the American Recovery and Reinvestment Act of 2009, Governor Rell’s Executive order establishing a blueprint for green collar jobs creation, a host of green-related statutory changes, and the private sector. This section will also describe the multitude of green collar job definitions and inherent challenges in defining an emerging field. The efforts of the many agencies, organizations, and companies working to develop the green collar field are described, and projections of where future job opportunities will be are given. The section concludes with an overview of the roles of the public postsecondary institutions, independent colleges and proprietary schools, and technical high schools in delivering education and training to prepare individuals for green collar jobs.

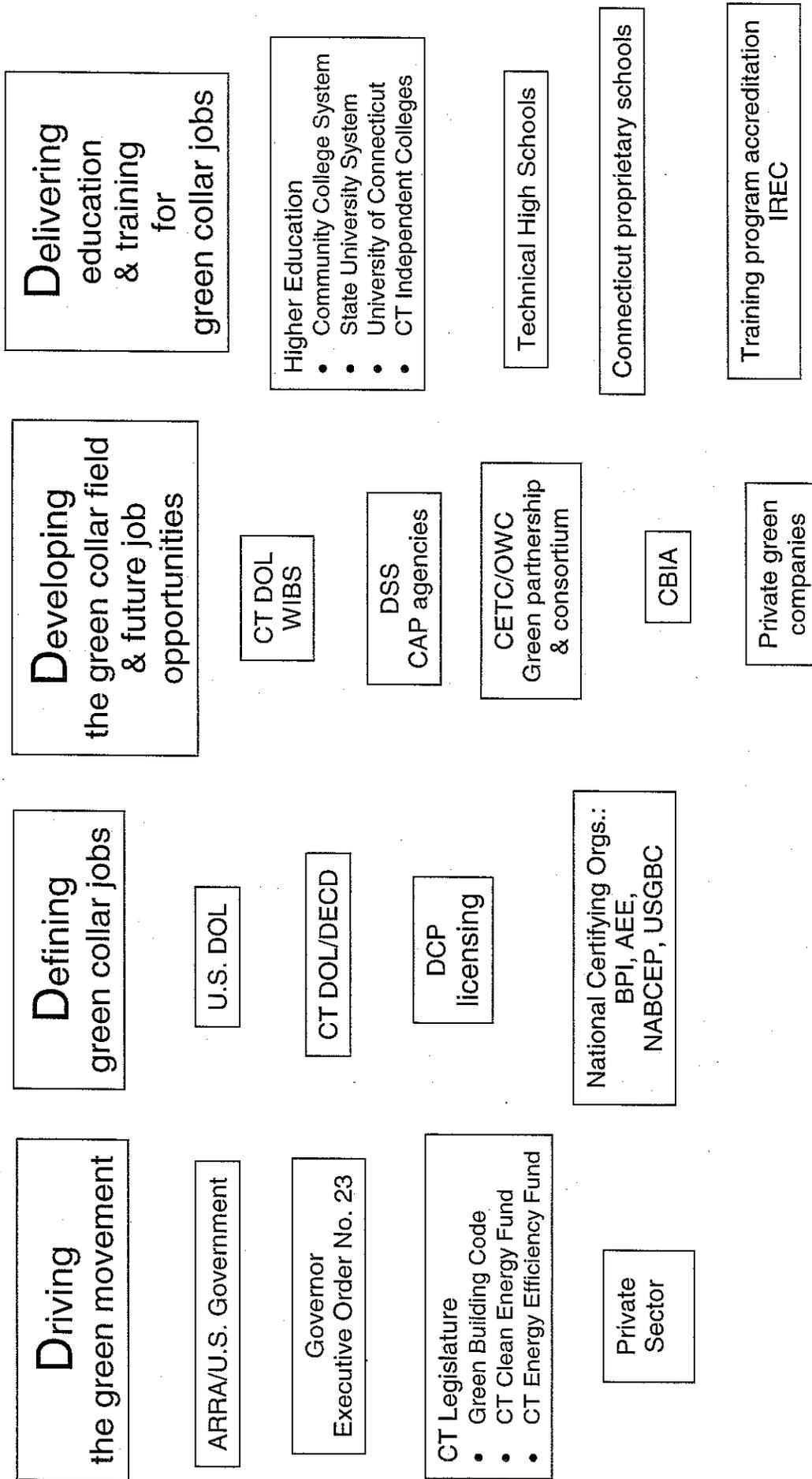
What is Driving the Green Movement?

The first “D” is understanding what is *driving* the green movement. One of the driving forces of the green movement within Connecticut and nationally, is the *American Recovery and Reinvestment Act of 2009 (or ARRA)*. Federal stimulus funding from ARRA is expected to deliver an influx of at least \$50 billion nationally to the energy efficiency and renewable energy sectors and create 500,000 green jobs by the end of 2010.¹ Another driving force is *Governor Rell’s Executive Order No. 23*, which established a blueprint for green collar jobs creation. The executive order calls for a number of efforts including the establishment of a Green Collar Jobs Council – subsequently renamed the Connecticut Energy Sector Partnership – and an Energy Workforce Development Consortium, to advise the partnership on current and future workforce needs of energy-related companies in the state.

Yet another driving force of the green movement within the state are *recent Connecticut statutory changes* promoting green building code requirements, and implementing green strategies through the Connecticut Clean Energy Fund and the Connecticut Energy Efficiency Fund. The *private sector* also plays a role in driving the green movement, establishing and expanding

¹Preparing the Workforce for a “Green Jobs” Economy, research/brief from the John J. Heldrich Center for Workforce Development, February 2009.

Figure I-1. The Four D's of the Green Collar Field



companies and initiatives in the energy sectors, and leading the way internationally in the commercial fuel cell industry.

American Recovery and Reinvestment Act of 2009 is driving the green movement. The American Recovery and Reinvestment Act of 2009 (ARRA) is a national effort to create or save jobs, jump start growth and transform the economy for the 21st century. Federal stimulus funding from ARRA is expected to generate many green collar jobs. To date, Connecticut has been awarded \$120,767,152 in stimulus funds for green efforts; four other grant applications totaling \$13,637,680 are pending. Because they are such a significant driver of the green movement, each of the ARRA grants pertaining to green collar jobs is now briefly described.

ARRA Green Grants Awarded. The recent federal stimulus funding will directly impact the available green workforce supply in Connecticut. Table I-1 shows a sample of jobs to be created from the federal American Recovery and Reinvestment Plan as projected by the University of Massachusetts-Amherst Department of Economics and Political Economy Research Institute.

Table I-1. Projected Green Collar Investments and Jobs	
Strategy	Sample Jobs
Building Retrofitting	Electricians, Heating/Air Conditioning Installers, Carpenters, Construction Equipment Operators, Roofers, Insulation Workers, Carpenter Helpers, Industrial Truck Drivers, Construction Managers, Building Inspectors
Mass Transit/Freight Rail	Civil Engineers, Rail Track Layers, Electricians, Welders, Metal Fabricators, Engine Assemblers, Bus Drivers, Dispatchers, Locomotive Engineers, Railroad Conductors
Smart Grid	Computer Software Engineers, Electrical Engineers, Electrical Equipment Assemblers, Electrical Equipment Technicians, Machinists, Team Assemblers, Construction Laborers, Operating Engineers, Electrical Power Line Installers and Repairers
Wind Power	Environmental Engineers, Iron and Steel Workers, Millwrights, Sheet Metal Workers, Machinists, Electrical Equipment Assemblers, Construction Equipment Operators, Industrial Truck Drivers, Industrial Production Managers, First-Line Production Supervisors
Solar Power	Electrical Engineers, Electricians, Industrial Machinery Mechanics, Welders, Metal Fabricators, Electrical Equipment Assemblers, Construction Equipment Operators, Installation Helpers, Laborers, Construction Managers
Advanced Biofuels	Chemical Engineers, Chemists, Chemical Equipment Operators, Chemical Technicians, Mixing and Blending Machine Operators, Agriculture Workers, Industrial Truck Drivers, Farm Product Purchasers, Agricultural and Forestry Supervisors, Agricultural Inspectors
Source: University of Massachusetts-Amherst Department of Economics and Political Economy Research Institute (PERI), "Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy," September 8, 2008.	

Table I-2 shows the anticipated green skills training for new and current workforce members expected as a direct result of ARRA green grants awarded. Training ranges from explaining the new green building code to current building officials, to the creation/expansion of certificates in such areas as solar energy technologies and precision manufacturing.

Table I-2. ARRA Green Grants Awarded to Connecticut	
Grant	Direct Impact on Green Collar Jobs/Training
<p>State Energy Program (SEP)</p> <ul style="list-style-type: none"> • \$38,542,000 • U.S. Dept. of Energy • Approved: 4/1/09-3/31/12 • Applicant: OPM 	<ul style="list-style-type: none"> • Supports energy efficiency/renewable energy programs/initiatives • Will include training of building operators and building officials in new green building code • Also includes building code update incorporating new Connecticut requirements for residential buildings and commercial buildings
<p>DSS Weatherization Assistance Program</p> <ul style="list-style-type: none"> • \$64,310,502 • U.S. Dept. of Energy • Approved: 4/1/09-3/31/12 • Applicant: DSS 	<p>Authorizes OWC and Connecticut Community College System (CCCS) to assist DSS in the provision of weatherization training services with the involvement of the Regional Workforce Investment Boards and Jobs Funnel programs. Training and Technical Assistance will include:</p> <ul style="list-style-type: none"> • Statewide lead safe training on new DOE minimum standards • Energy auditor certification training (one to two-day courses) • Also short-term on-the-job training for crews, energy auditors, and subcontractors • Two-week core competency training includes safe work practices, building evaluation, and measurement
<p>Energy Efficiency & Conservation Block Grant</p> <ul style="list-style-type: none"> • \$9,593,500 • U.S. Dept. of Energy • Approved: 8/1/09-7/31/12 • Applicant: OPM/Energy Management Unit 	<ul style="list-style-type: none"> • Used to provide sub-grants to 143 local Connecticut governments not otherwise eligible for direct formula grants • Minimum of \$25,000 per municipality, increased depending on population • Funding must be used in a manner that is consistent with the state's energy policy framework (C.G.S. Sec. 16a-35k), P.A. 08-98, and Governor Rell's Connecticut's Energy Vision Plan
<p>SOAR (Sustainable Operations: Alternative and Renewable Energy Initiative)</p> <ul style="list-style-type: none"> • \$2,000,000 • U.S. Dept. of Labor • Approved: 2/15/09-2/14/12 • Applicant: Connecticut Community College System 	<p>Creates eight certificate programs (for credit) at the state's community colleges:</p> <ol style="list-style-type: none"> 1. Sustainable Facilities Management 2. Sustainable Landscape Ecology & Conservation Technician 3. Building Efficiency & Sustainable Technologies Certificate/Sustainable Facilities Management 4. Alternative Energy Transportation 5. Clean Water Treatment 6. Solar Energy Technologies 7. Alternative Energy Systems 8. Sustainable Energy Certificate <p>320 students will earn a CCCS Sustainable Operations Certificate in one of these eight areas and:</p> <ul style="list-style-type: none"> • 85% of SOAR students will enter employment • Regional Coordinators will work with 900 clients/students, train 350 One-Stop and high school counselors • 20 college instructors will receive professional development training, and will train 800 students annually

Table I-2 Continued. ARRA Green Grants Awarded to Connecticut

Grant	Direct Impact on Green Collar Jobs/Training
<p>SMART (Skills for Manufacturing and Related Technologies) Initiative</p> <ul style="list-style-type: none"> • \$2,191,400 • U.S. Department of Labor • Approved: 4/1/08-3/30/11 • Applicant: Connecticut Community College System 	<p>Creates/expands three community college certificate programs, with target of 331 students achieving credentials:</p> <ul style="list-style-type: none"> • Pre-Manufacturing Certificate program • Level One Precision Manufacturing Certificate program • Level Two Precision Manufacturing Certificate program (offering specialties in precision machining and computer numerical control technologies, welding technology, and electronics control technology, and featuring a paid internship)
<p>“Making ‘Green’ Real” Grant</p> <ul style="list-style-type: none"> • \$3,999,923 (\$250,000 for CT) • U.S. Department of Labor • Approved: 12/1/09-5/31/11 • Applicant: Vermont Department of Labor (on behalf of Northeast Research Consortium) 	<ul style="list-style-type: none"> • Includes 6 New England states plus New York and New Jersey; Vermont will lead the consortium • Purpose: create a regional infrastructure to allow businesses and workers who employ, train or work in energy efficiency and renewable energy fields, to have access to reliable information • Consortium’s work to be conducted in four phases: <ul style="list-style-type: none"> ○ Creating clear definitions and coding tools ○ Demand analysis estimates including 6-12 month vacancy projections ○ Use and extension of current labor market information tools, data collections and databases ○ Creation of electronic and other dissemination tools including green job banks
<p>Green Capacity Building Grant YouthBuild Bridgeport</p> <ul style="list-style-type: none"> • \$59,894 • U.S. Department of Labor • Approved: 12/1/09-11/30/10 • Applicant: The Workplace, Inc., Bridgeport 	<ul style="list-style-type: none"> • Intended to build the green training capacity of current DOL grantees • Goal: train 20 students (17-24 years old) currently enrolled in project prepare for careers in emerging energy-efficient green building construction and retrofit industries • Successful completion of the program will qualify graduates for Carpenters Union, Local 210 apprenticeship programs • Will also train five local instructors by trainers from the Home Builders Institute
<p>Green Capacity Building Grant YouthBuild Hartford</p> <ul style="list-style-type: none"> • \$69,933 • U.S. Department of Labor • Approved: 12/1/09-11/30/10 • Applicant: Co-Opportunity, Inc., Hartford 	<ul style="list-style-type: none"> • Intended to build the green training capacity of current DOL grantees • Goal to train 20 students (17-24 years old) currently enrolled in the YouthBuild project prepare for careers in deconstruction (dismantling buildings with goal of preserving reusable materials and reducing landfill needs) • Also certify 2-3 YouthBuild instructors as trainers for deconstruction, and provide internships to 3 YouthBuild students

Source: PRI staff analysis of federal green grant applications.

Pending ARRA Green Grants. There are also several ARRA grant applications pending notification that would also have a direct impact on green collar jobs/training should they be awarded to Connecticut. Table I-3 shows the pending ARRA green grants for Connecticut, featuring aspects of the grants that, if awarded, would impact green collar jobs/training.

Activities would range from training building analysts and clean water technicians, to increasing members of the green construction trade. A more complete description of awarded and pending ARRA grants to Connecticut is found in Appendix A.

Table I-3. Pending ARRA Green Grants for Connecticut	
Pending Grant Application	Direct Impact on Green Collar Jobs/Training if Awarded
<p>CT Green Jobs Partnership (SESP)</p> <ul style="list-style-type: none"> • \$3,360,000 • U.S. DOL • Approx. 1/1/10-12/31/12 • Applicant: CETC 	<ul style="list-style-type: none"> • Building Analyst Training at the CT Community Colleges, (100 candidates over three years) • Green Manufacturing –Lean/Green (30 to get certificates) • Clean Water Technicians (65 certified at Wastewater Technician Level III), by Goodwin and Gateway Community College • Municipal Building Officials Training in RE/EE Inspection for 180 <ul style="list-style-type: none"> ○ via Institute for Sustainable Energy at ECSU—half-day workshops for building code officials
<p>Energize CT! A Statewide Energy Training Partnership</p> <ul style="list-style-type: none"> • \$2,210,800 • U.S. Department of Labor • Approx. 1/1/10-12/31/12 • Applicant: CT Energy Workforce Development Consortium 	<ul style="list-style-type: none"> • Train 766 workers in three growing occupations: <ul style="list-style-type: none"> ○ Solar PV/solar thermal/geothermal installers ○ Diesel engine mechanics ○ Energy efficiency building managers
<p>Pathways Out of Poverty</p> <ul style="list-style-type: none"> • \$3,066,880 • U.S. Dept. of Labor • Approx. 1/1/10-12/31/12 • Applicant: Capital Workforce Partners WIB 	<p>Place 350 Hartford residents in jobs in the green construction and sustainable energy generation industries</p> <ul style="list-style-type: none"> • CCSU’s Institute for Technology and Business Development to give orientation to emerging green economy, and introduction to sustainable energy generation • Other postsecondary institutions will provide green-focused certificate and degree programs that participants will access via individual training accounts • Three labor partners to provide green construction training and assist with subsequent placements: <ul style="list-style-type: none"> ○ New England Laborers’ Training Academy ○ Ironworkers Local #15 Apprenticeship Program ○ Finishing Trades Institute of Southern New England
<p>“Green-up Bridgeport” Pathways Out of Poverty</p> <ul style="list-style-type: none"> • \$5,000,000 • U.S. Department of Labor • Approx. 1/1/10-12/31/12 • Applicant: The Workplace, Inc., Southwestern CT’s WIB (Bridgeport) 	<ul style="list-style-type: none"> • Focus on entry level green skills in established occupations that are projected to have increased demand • Education and training offered by ECSU, CCSU, Gateway CC, Housatonic CC, Norwalk CC, and U. of Bridgeport • Serve 600 participants in beginning education and training activities
<p>Source: PRI staff analysis of federal green grant applications.</p>	

Executive Order No. 23 is driving the green movement. The executive order regarding green collar jobs, which was issued on February 2, 2009, specifies the need to design initiatives and

programs to spur the growth of green collar jobs in Connecticut and directs such planning to begin in four ways.

First, the commissioners of DECD and DOL are to plan for the development and growth of green industries and green jobs, in coordination with the executive director of the Office of Workforce Competitiveness (OWC), the commissioners of SDE, DHE, and DEP, and the chancellor of the community college system. Developed June 2009, the plan was presented to the Connecticut Employment and Training Commission.

Second, CETC was to create and chair the Green Collar Jobs Council, which is composed of representatives from: the Departments of Education, Higher Education, Environmental Protection, Labor, and Economic and Community Development; the newly created Energy Workforce Development Consortium; and representatives from business and industry.² The council name was subsequently changed to the Connecticut Energy Sector Partnership in order to better position the state for federal funding (ARRA) opportunities.

The Connecticut Energy Sector Partnership structure (Figure I-2), which was distributed at the first meeting of the partnership (August 20, 2009), recognizes the need for collaboration by the many state agencies and organizations involved in the initiative. The purpose of the partnership is to develop green collar job opportunities, public-private partnerships, and job training programs.

The partnership is charged with developing and implementing a state energy sector strategic plan as required by the U.S. DOL in its solicitation of grant applications for State Energy Sector Partnership and Training Grants. As described under the pending ARRA grant applications, state Workforce Investment Boards were invited to apply for workforce preparation grants to meet the needs of energy efficiency, renewable energy, and other green industries. The Office of Workforce Competitiveness provides administrative support and coordinates efforts for the partnership.

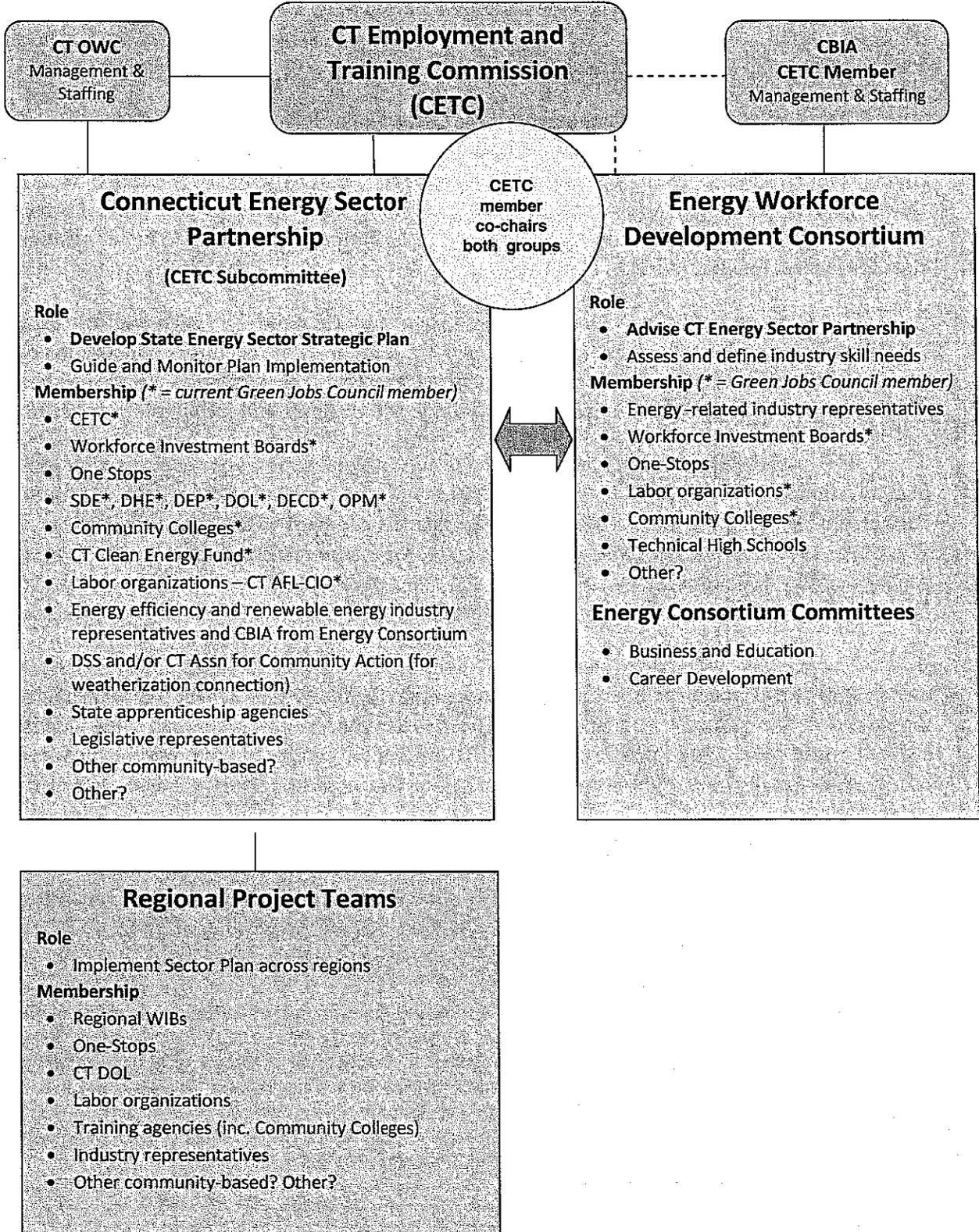
The Energy Workforce Development Consortium, which includes many of the same members of the Connecticut Energy Sector Partnership, is intended to advise the partnership and assess and define industry skill needs. Specifically, the consortium is charged with identifying challenges and developing solutions (with DECD) to meet the current and future workforce needs of energy-related companies in the state. The Connecticut Business and Industry Association staffs the consortium.

Third, the community college system was to expedite the creation of eight certificate credit programs and train 320 students within the next three years. A grant from the U.S. Department of Labor was recently awarded to Connecticut to support this effort (see SOAR grant in Table I-2)

² The mission of the Connecticut Energy Workforce Development Consortium is to “define the industry’s needs as it relates to workforce development, build awareness of the demand for energy personnel in the state, generate a sense of excitement around the industry, improve training programs to closely align classroom learning with workplace requirements, and create pathways to continuing education, certification and employment for high school and college graduates.” Members include executives from traditional and alternative energy companies, manufacturers of energy-related products, workforce investment boards, and representatives from technical high schools, community colleges, and universities. The consortium is staffed by the Connecticut Business and Industry Association.

Figure I-2. Connecticut Energy Sector Partnership Structure

(formerly Connecticut Green Collar Jobs Council)



Fourth, OWC was to provide administrative support and coordinate efforts among the many state agencies, public and independent colleges and universities, and quasi-public agencies whose missions include green collar industries and jobs. The OWC management and staffing role is shown in the Connecticut Energy Sector Partnership Structure in Figure I-2.

Beyond this executive order, the Governor's "Energy Vision" intends that 20 percent of all energy used and sold in the state will be from clean energy sources by the year 2020.³

Connecticut statutory changes driving the green movement. The demand for green collar jobs is consistent with Connecticut's energy utilization and conservation policy that requires the conservation of energy resources, and the development and utilization of renewable energy resources, such as solar and wind energy, to the maximum practicable extent (C.G.S. Sec. 16a-35k). There are also several new statutory requirements driving demand for green jobs. For example, *Connecticut is the first state with a required green building code for public and private buildings.* There are two recent public acts that promote the greening of Connecticut and are expected to increase the demand for a green collar workforce, particularly in the building sector. They are:

- P.A. 07-242 (An Act Concerning Electricity and Energy Efficiency) increases the state's "green building" requirements for new school, commercial, and government buildings. Regardless of whether the contractor/owner is receiving state funding/bonding, the construction is required to meet specific energy and environmental standards such as the LEED silver standard or its equivalent.
- P.A. 09-192 (An Act Concerning Green Building Standards and Energy Efficiency Requirements for Commercial and Residential Buildings) delays the date (to July 1, 2010) when "green building" standards are to take effect. New construction and renovation of commercial, school, and residential (5+ family units) buildings of a certain square footage will be required to be green by adhering to LEED silver certification or its equivalent (e.g., Green Globes), as specified in the newly revised state building code.

Additionally, P.A. 08-98, the 2008 Global Warming Law, codifies Governor Rell's energy vision, mandates reductions in state greenhouse gas emissions, and makes changes designed to help the state achieve these reductions.

Energy funds. More than a decade ago, two funds were established to promote use of clean energy and energy efficiency in Connecticut.

Connecticut Clean Energy Fund. As described in a previous program review study,⁴ the Connecticut Clean Energy Fund (CCEF) was established in 1998 to provide financing for alternative sources of energy. Funded by a surcharge on electric utility bills and administered by Connecticut Innovations (a quasi-public agency), the fund's goals are to:

³ Connecticut's Energy Vision for a Cleaner, Green State, Governor Jodi Rell's Energy Plan, 2006.

⁴"Energy Efficiency & Conservation Programs in Connecticut," Legislative Program Review and Investigations Committee, January 2009.

- create a clean energy supply for Connecticut,
- accelerate the development of clean energy technologies, and
- educate Connecticut consumers about the benefits and availability of clean energy.

The fund is undertaking initiatives in postsecondary education institutions. For example, under the direction of its FY09-FY10 Comprehensive Plan, CCEF intends to support community college initiatives through funding expensive equipment needed for training in renewable energy. Beneficiaries of this support will be Gateway and Naugatuck Valley community colleges, which have been identified as currently having the necessary laboratory setting and regional base from which to draw students. The fund also provides financial support to the University of Connecticut Center for Clean Energy Engineering (previously known as the Connecticut Global Fuel Cell Center).

The Connecticut Clean Energy Fund has several initiatives to introduce and potentially encourage students at the primary and secondary education level to consider careers in the green field. For example, the Learning for Clean Energy Innovation is a program that gives ninth grade teachers a broad knowledge of alternative energy sources. So that they may introduce these concepts into the classroom, to date, 180 teachers have participated in one-day workshops on solar photovoltaic energy. The solar education unit introduced at the workshop was developed in consultation with the State Department of Education, education experts and consultants, and the National Renewable Energy Laboratory. In 2009, the program also began offering professional development workshops on wind energy.

The Connecticut Clean Energy Fund Board of Directors recently approved funding for expansion of the Learning for Clean Energy Innovation program within Connecticut's technical high school system. The program will build teacher capacity to train students for clean energy jobs, focused on solar photovoltaic and solar thermal technologies, with shared equipment housed at three technical high schools (Wolcott, Grasso, and E.C. Goodwin).

Lastly, CCEF operates a Solar Photovoltaic (PV) Rebate Program to install solar energy products on residences, and on nonprofit and governmental sites. Requirements to become an installer for this program require PV-1 or E-1 licensure, having taken a PV installation training course, and completed at least three installations as the lead installer (or ten installations as an apprentice). As of November 2009, approximately 38 PV installers qualified to participate in this program.

Connecticut Energy Efficiency Fund. Connecticut has been nationally recognized as a leader in energy efficiency programs. For example, the American Council for an Energy-Efficiency Economy, a nonprofit policy and research organization that evaluates state energy efficiency programs, ranked Connecticut among the top three states in 2006 and 2008.

The Connecticut Energy Efficiency Fund (CEEF) was created by legislation in 1998 and, like CCEF, is funded by a surcharge on electric utility bills. Programs funded through CEEF are administered by the electric utilities (Connecticut Light & Power, and United Illuminating) in

conjunction with the gas utilities (Connecticut Natural Gas, Southern Connecticut Gas, and Yankee Gas). The purpose of CEEF is to advance efficient use of energy, reduce air pollution and other harmful environmental impacts, promote economic development, and provide energy security and affordability. Residents are offered incentives to replace older appliances with newer, more energy efficient models. Businesses are also encouraged to maximize energy efficiency and lower operating costs, keeping Connecticut employers competitive and in-state.

Private sector is driving the green movement. The private sector is another driver of the green movement. According to the director of the Institute for Sustainable Energy at Eastern Connecticut State University, there are only two commercial fuel cell companies in the world: United Technologies Corporation in South Windsor; and FuelCell Energy, Inc. in Danbury. Combined, the two companies have produced 400-500 units, including 10 fuel cell units in Connecticut.

There are a number of Connecticut companies that received ARRA grants. Bouffard Metal Goods of Waterbury, for example, received \$5,000,000 for an electric drive vehicle battery components program. Schuco of Newington, a world leader in aluminum, steel, PVC-U and solar products for building envelopes, was recently chosen by one of Southern California's leading solar energy companies to supply products for major solar photovoltaic projects.

As companies make commitments to enter or expand in green areas, the workforce demand for green collar jobs increases. Additionally, the private sector partners with state agencies on the energy consortium, collaborates with college centers or institutes having a green focus, and serves on local advisory councils and energy fund boards.

Defining Green Collar Jobs

Beyond understanding what is *driving* the green movement, the second "D" is *defining* green collar jobs. Knowledge of which occupations are considered green collar jobs is a prerequisite to: estimating the size of the current green collar workforce; projecting future employer demand; and delivering education and training needed for green collar jobs.

There are a multitude of green collar job definitions produced by such entities as the U.S. Department of Labor, the Connecticut Department of Labor, Department of Economic and Community Development, and green job study groups and institutes. Table I-4 gives examples of some of the definitions of green collar jobs and the green field. While there is currently no single generally accepted definition of green collar jobs or the green field, there are some common themes. Five of the seven definitions shown, for example, specifically mention **improving or preserving the environment**. Four of the definitions reference "**energy**" in three different ways:

- saving energy/reducing energy usage;
- advancing new energy efficient technologies/increasing the efficiency of energy usage; and
- expanding the use of renewable energy/fostering more sustainable energy.

Table I-4. Various Definitions of Green Collar Jobs and the Green Field	
Source	Definition
DECD/DOL plan for green jobs in CT (per Executive Order No. 23)	Jobs that protect wildlife or ecosystems, reduce pollution or waste, or reduce energy usage and carbon emissions
Connecticut Department of Labor ¹	White and blue collar jobs in green businesses, whose products and services directly improve environmental quality
CT DOL Economic Digest, December 2008	Occupations with Standard Occupational Classification ² definitions that indicate their direct contribution to preserving and enhancing the quality of the environment
Institute for Sustainable Energy at Eastern Connecticut State University ³	<ul style="list-style-type: none"> • Jobs that preserve, restore, or improve the environment • Jobs that help save energy, advance new energy efficient technologies, and foster a more sustainable regional and national energy system • Either blue or white collar positions, updated to adopt sustainability as a core segment of the individuals' job description • Career opportunities capable of supporting a family's income, with the potential for advancement
Prepared by the National Center for O*NET (Occupational Information Network) Development for the U.S. DOL Employment and Training Administration	The green economy encompasses the economic activity related to reducing the use of fossil fuels, decreasing pollution and greenhouse gas emissions, increasing the efficiency of energy usage, recycling materials, and developing and adopting renewable sources of energy
Centers of Excellence of the California Community Colleges Economic and Workforce Development	<p>An occupation that:</p> <ul style="list-style-type: none"> • directly works with policies, information, materials, and/or technologies that contribute to minimizing environmental impact • requires specialized knowledge, skills, training, or experience in these areas
Working definition from the Workforce Information Council Green Jobs Study Group, with membership from the U.S. Bureau of Labor Statistics and seven state departments of labor ⁴	<p>Jobs in which the work is essential to products or services that improve energy efficiency, expand the use of renewable energy, or support environmental sustainability. The job involves work in any of these green economic activity categories:</p> <ul style="list-style-type: none"> • renewable energy and alternative fuels • energy efficiency and conservation • pollution, waste and greenhouse gas (GHG) management, prevention, and reduction • environmental cleanup, remediation, waste clean-up, mitigations • sustainable agriculture and natural resource conservation • education, regulation, compliance, public awareness, and training and energy trading
¹ CT Career Resource Network Update, LMI, "CT's Blueprint for Green Collar Job Creation."	
² The Standard Occupational Classification system, which is being adopted by all Federal statistical agencies for reporting occupational data, consists of 821 detailed occupations.	
³ In handouts distributed by the Institute for Sustainable Energy at the Hartford, New Haven and Fairfield County Federal Recovery Act Program--April 13, 14, and 17, 2009.	
⁴ Members included U.S. Bureau of Labor Statistics representatives, and state Department of Labor representatives from California, Colorado, Pennsylvania, Florida, New York, Connecticut, and Washington.	

Preserving the environment is often linked with using less energy -- referred to as **energy efficiency** (EE) -- and/or with using an alternative source of energy that is not harmful to the environment -- referred to as **renewable energy** (RE). It has previously been noted that Connecticut is a nationally recognized leader in energy efficiency programs. Also, *Connecticut was one of just seven states awarded a "Gold Star" standard by a national organization, signifying its continued search for new and innovative opportunities to reduce energy use, strengthen building codes and appliance standards, promote renewable energy, and lower polluting emissions from cars.*⁵

Many green collar jobs are linked to energy efficiency or renewable energy. Less energy use, for example, is a goal of weatherization installers and technicians. Fuel cell engineers, on the other hand, are striving to develop a renewable energy product that chemically produces electricity without emitting environmentally harmful exhausts and gases. Table I-5 shows energy efficiency and renewable energy technologies that are the focus of many green collar jobs.

Energy Efficiency Technologies	Renewable Energy Technologies
<ul style="list-style-type: none"> • High efficiency heating, ventilation, and air conditioning • Efficient lighting • Efficient home appliances • Water heating • Commercial refrigeration • Pumps, motors, and drives • Building envelope • Demand response (e.g., reduce consumption at peak/critical times) 	<ul style="list-style-type: none"> • Fuel cells • Solar (PV and solar hot water) • Wind • Geothermal • Hydrogen (<5ML) • Hydrogen • Biomass • Storage • Power grid infrastructure
Source: Connecticut Renewable Energy/Energy Efficiency Economy Baseline Study, Phase 1 Deliverable: Full Report, March 27, 2009, by Navigant Consulting, Inc.	

Challenges in defining green collar jobs. As is apparent, *one of the challenges in this emerging field is the difficulty in defining exactly what constitutes a green job.* An economist with the Connecticut DOL noted that green encompasses many areas of the economy, and which occupations are considered green vary from day to day.⁶ Green may also be thought of as a philosophy or growing movement (green washing of America) that can encompass nearly every occupation. For example, in a plan prepared by DECD and the state DOL to develop green industries and green jobs in Connecticut (as required by Executive Order No. 23), 119 green occupations were identified including lawyers, janitors, and roofers.⁷ A list of these 119 green occupations is provided in Appendix B.

⁵ "America's Clean Energy Stars: State Actions Leading America to a New Energy Future," research report prepared by Environment America Research & Policy Center, 2007.

⁶ "How 'Green' is Connecticut's Economy?" by Nicholas A. Jolly, Ph.D., Economist Connecticut DOL, December 2008 Connecticut Economic Digest.

⁷ "Plan to Develop Green Industries and Green Jobs in Connecticut." Prepared by the Departments of Labor and Economic and Community Development, June 2009.

Elements of many occupations will include the need to possess green skills as federal, state, and local environmental and energy requirements evolve. Also, as the Connecticut DOL Director of Research noted, as technology improves, what is considered green today can be even greener tomorrow—there is always more green you can do. Conversely, some narrowly define green collar jobs to specifically include only well-paying jobs able to support a family.⁸

One approach to dealing with the challenges in defining an emerging field is to group occupations by the way in which they are impacted by the green movement.

Grouping of green collar jobs. The U.S. Department of Labor has defined three general categories for occupations in the green economy:

1. Green *increased demand* occupations – existing occupations performed within a green setting;
2. Green *enhanced skills* occupations – existing occupations requiring additional green skills and knowledge, and perhaps new credentialing; and
3. Green *new and emerging* occupations – new occupations that arose due to the green economy.

Table I-6 provides examples of green occupations within each of the three U.S. DOL categories.

Increased Demand	Enhanced Skills	New & Emerging
Chemical Engineers	Electrical Engineers	Carbon Trading Analysts
Computer Software Engineers, Systems Software	Industrial Engineering Technicians	Fuel Cell Engineers
Construction Carpenters	Machinists	Solar Photovoltaic Installers
Electric Power-Line Installers and Repairers	Plumbers	Weatherization Installers and Technicians
Industrial Machinery Mechanics	Power Plant Operators	Wind Energy Engineers

Source: National Center for O*NET Development (www.onetcenter.org).

Additional new and emerging green collar occupations identified by the Institute for Sustainable Energy at Eastern Connecticut State University are listed in Appendix C.

Estimates of number of green collar jobs in Connecticut. While PRI staff may recommend future use of this U.S. Department of Labor definition of green collar jobs, *the present general lack of consensus on what constitutes a green collar job has led to a variety of estimates on the current size of Connecticut's green collar workforce, ranging from 5,493 to more than 22,000 individuals.*

Estimates of green collar occupations based on licensure, certification, and accreditation. Green collar jobs may also be defined through green licensure, certification, and accreditation. Table I-7 summarizes the types of green collar-related licenses, certificates, or accreditations and the number credentialed in Connecticut. (The licensing and certifying bodies will be described more fully later in this section.)

⁸ Institute for Sustainable Energy at Eastern Connecticut State University.

License or Certificate or Accreditation	Source of Certificate or License	Number Certified or Licensed in Connecticut
Limited Licensed Solar Electric Contractors (PV-1)	DCP	15
Limited Licensed Solar Electric Journeypersons (PV-2)	DCP	13
Licensed Solar Thermal Contractors (ST-1)	DCP	93
Licensed Solar Thermal Limited Journeypersons (ST-2)	DCP	12
Building Performance Institute Accredited Contractors	BPI	2
Building Performance Institute Certified Technician	BPI	125
Business Energy Professional (BEP)	AEE	11
Certified Building Commissioning Professional (CBCP)	AEE	10
Certified Cogeneration Professional (CCP)	AEE	1
Certified Demand-Side Manager (CDSM)	AEE	10
Certified Energy Auditor (CEA)	AEE	15
Certified Energy Manager (CEM)	AEE	125
Certified Energy Procurement Professional (CEP)	AEE	14
Certified GeoExchange Designer (CGD)	AEE	8
Certified Indoor Air Quality Professional (CIAQP)	AEE	2
Certified Lighting Efficiency Professional (CLEP)	AEE	14
Certified Measurement & Verification Professional (CMVP)	AEE	3
Certified Power Quality Professional (CPQ)	AEE	2
Certified Carbon Reduction Manager (CRM)	AEE	6
Certified Sustainable Development Professional (CSDP)	AEE	13
Distributed Generation Certified Professional (DGCP)	AEE	4
Certified Energy Manager-In-Training (EMIT)	AEE	3
Certified Green Building Engineer (GBE)	AEE	7
Certified Solar PV Installers	NABCEP	8
Certified Solar Thermal Installer	NABCEP	1
Passed Entry Level (basic) Certificate Program Exam	NABCEP	27
LEED Green Associate	USGBC	29
LEED Green Advanced Professional	USGBC	1,214
Sources: Department of Consumer Protection, Building Performance Institute, Association of Energy Engineers, North American Board of Certified Energy Practitioners, U.S. Green Building Council.		

Estimates of green collar jobs based on their contribution to environmental preservation and enhancement. Estimates of the current green collar workforce supply are produced by the Connecticut DOL based on Standard Occupational Classification (SOC) definitions, and choosing occupations that contribute directly to preserving and enhancing the quality of the environment. Using this methodology, there are 5,493 workers in green occupations in Connecticut (Table I-8). *The most plentiful green jobs are natural sciences managers, water and liquid waste treatment plant and system operators, and environmental engineers.* Some of the occupations shown include coursework that would encompass green technology, but no specific license or certification is required.

Occupation	Estimated Number Employed in 2006	Education Level Required
Natural Sciences Manager	933	Bachelor's plus work experience
Water & Liquid Waste Treatment Plant and System Operator	856	Long-Term On-The-Job Training
Environmental Engineer	747	Bachelor's
Environ. Scientist & Specialist	685	Master's
Environ. Science & Protection Tech.	392	Associate's
Nuclear Engineer	339	Bachelor's
Environmental Engineering Technician	216	Associate's
Nuclear Technician	195	Associate's
Power Plant Operator	175	Long-Term On-The-Job Training
Geoscientist	174	Master's
Nuclear Power Reactor Operator	108	Long-Term On-The-Job Training
Hydrologist	97	Master's
Other ^a	576	
Total	5,493	

^aIncludes agricultural engineers, soil and plant scientists, zoologists and wildlife biologists, conservation scientists, and foresters.
Source: Office of Research, Connecticut Department of Labor, December 2008 Economic Digest.

Estimates of green collar jobs based on employment in green industries. Another way the Connecticut DOL estimates the number employed in various green jobs is by counting, regardless of occupation, the number employed in a green industry, based on whether the North American Industry Classification System (NAICS) manual defines the particular industry as producing a product or service that contributes directly to preserving and enhancing the quality of the environment. Using this definition, Appendix D provides detailed information on the 22,373 Connecticut residents working in green industries. Staff from the Connecticut DOL said *while the greatest numbers of green jobs in Connecticut are currently in waste management and remediation, the most lucrative jobs are in hydroelectric power generation.*⁹ A breakout of the jobs of the 1,691 residents employed in renewable energy, and the 2,675 employed in energy efficiency areas is also provided in the appendix.

Yet another Connecticut DOL definition of green jobs in Connecticut combined industry and occupational information, and concluded that *the largest increase in green employment would occur in the occupational category, "management, scientific, and technical consulting services"* (29 percent increase).

Summary. *Regardless of the methodology used to define green collar jobs, all show an increase in green jobs.* The Connecticut DOL believes there will be a need for engineers and scientists to continue to advance the utility of new alternative energy sources and the development and application of new green products; however, a much larger segment of the workforce will remain in their current occupations, but need to learn new skills and knowledge related to the production, installation, monitoring, maintenance and repair of these new green systems and products.

⁹ Quoted in March 2, 2009 Hartford Courant article, "Green-collar Jobs": Two Rell Directives Would Create Environmentally Oriented Projects."

Regulation by the Department of Consumer Protection defining green collar jobs.

Licensing of persons working in particular occupations becomes increasingly important in a new and emerging field such as green collar jobs. Licensing assures consumers that practitioners have a basic level of competency, although *there is currently very little regulation of these new and emerging occupations.*

The Connecticut Department of Consumer Protection (DCP) is authorized to issue licenses for work performed in three green/renewable energy areas: solar-thermal, solar-electric, and wind-electric. Table I-9 shows the requirements for, and work permitted under, each type of green license.

Until summer 2009, in order to perform solar thermal work, individuals were required to hold either ST-1 or ST-2 solar thermal licenses, which limit the individuals to perform solar thermal work only. Connecticut recently added an alternative option, which allows only certain licensed individuals that hold other types of heating/piping/cooling and plumbing/piping licenses (excluding all residential heating/piping/cooling limited S type licensed contractors and journeypersons), to obtain a certificate to perform solar thermal work, provided the individual has completed a solar thermal installation training course and passed a solar thermal work exam as approved by DCP (C.G.S. Sec. 20-334a).

License Number	License Name and Issuing Body	Requirements to Qualify for License	Work Permitted Under License
PV-1	<ul style="list-style-type: none"> Limited solar electric contractor license Issued by the Electrical Work Examining Board 	2 years as licensed journeyperson or equivalent experience and training	<ul style="list-style-type: none"> Limited to solar electricity systems Includes wind generation systems
PV-2	<ul style="list-style-type: none"> Limited solar electric journeyperson's license Issued by the Electrical Work Examining Board 	Completion of a registered apprenticeship program or at least 1 year or equivalent experience and training	<ul style="list-style-type: none"> Limited to solar electricity systems under the employ of a contractor licensed for such work Includes wind generation systems
ST-1	<ul style="list-style-type: none"> Solar thermal contractor Issued by the State Board of Heating, Piping, Cooling, and Sheet Metal Work Examiners 	2 years as licensed journeyperson or equivalent experience and training	<ul style="list-style-type: none"> Limited to solar hot water heating systems
ST-2	<ul style="list-style-type: none"> Solar thermal limited journeyperson Issued by the State Board of Heating, Piping, Cooling, and Sheet Metal Work Examiners 	Completion of a registered apprenticeship program or at least 1 year or equivalent experience and training	<ul style="list-style-type: none"> Limited to solar hot water heating systems under the employ of a contractor licensed for such work

Source: R.C.S.A. Sec. 20-332-2(m)(n), R.C.S.A. Sec. 20-332-5(hh)(ii).

National green collar certifying organizations defining green collar jobs. *In addition to state licensing of occupations in the green field, there are also national certifying organizations that are attempting to define green collar jobs through the establishment of professional competency standards that are recognized by others in the green field. In an emerging field, such external seals of approval offer assurances to prospective employers and clients.*

Certification of *energy efficiency professionals and/or contractors* is offered by the Building Performance Institute and the Association of Energy Engineers. Certification of *renewable energy installers* is offered by the North American Board of Certified Energy Practitioners.

Building Performance Institute. The Building Performance Institute (BPI) is a contractor credentialing organization aimed at improving the energy efficiency (i.e., weatherization) of existing homes. In order for a company to receive certification, all employees must be BPI-certified professionals, having demonstrated knowledge of how to apply house-as-a-system techniques in upgrading the energy efficiency of homes. Independent BPI inspectors review paper files and randomly sample a percentage of sites for inspection. While no formal experience is necessary to participate in most of the required written and field exams, the BPI website recommends potential applicants obtain training from a BPI affiliate and have some experience in the building performance industry. Courses available for small homes certification are: building analyst, building envelope, manufactured housing, heating, and air conditioning/heat pump. A multifamily building certification is also offered, with available courses in multifamily building analyst, energy efficient multifamily building operators, multifamily hydronic heating system design, and multifamily advanced heating.

The Building Performance Institute's website notes that there were 70 training affiliate organizations nationally in January 2009, and 121 such organizations by September 1, 2009 (with 116 more organizations in the process of becoming training affiliates). The institute attributes the rapid growth in training home performance professionals to the funding for weatherization and energy efficiency retrofits provided under the American Recovery and Reinvestment Act of 2009: \$5 billion through the Weatherization Assistance Program and another \$3 billion from the State Energy Program. BPI certification is also required for Energy Star contractors, and is reportedly a preferred certification among employers in the building trades.¹⁰

There are currently two BPI-credentialed contractors in Connecticut and 125 certified professionals. Additionally, there are two BPI training affiliate organizations in Connecticut, with several out-of-state national companies also offering BPI training.

Association of Energy Engineers. The Association of Energy Engineers (AEE) is a nonprofit international professional society with a presence in 78 countries, and a dual mission of promoting the scientific and educational interests of professionals working in the energy industry and advancing sustainable development efforts. AEE has been certifying professionals since 1981, requiring applicants to meet specific educational and/or experience criteria, and pass a written exam. Certifications are awarded by AEE for:

- energy managers;
- sustainable development professionals;
- energy auditors;
- business energy professionals;
- energy procurement professionals;

¹⁰ John J. Heldrich Center for Workforce Development Research Brief, "Preparing the Workforce for a "Green Jobs" Economy" by Jennifer Cleary and Allison Kopicki, February 2009.
Energy Star provides online training to contractors on energy efficient building design.

- distributed general certified professionals;
- energy managers-in-training;
- carbon reduction managers;
- building commissioning professionals;
- measurement and verification professionals;
- lighting efficiency professionals;
- green building engineers; and
- power quality professionals.

According to the AEE website, the certified energy manager credential, for example, is widely accepted and recognized by the U.S. Department of Energy, Office of Federal Energy Management Programs, and the U.S. Agency for International Development.¹¹ It is the standard for qualifying energy professionals in the United States and internationally. There are currently 125 certified energy managers (CEM) in Connecticut; as outlined in a recently submitted grant to the U.S. Department of Labor, Connecticut is estimated to need another 70-100 CEMs in the future. If funded, certification training will occur at several of the community colleges, where there are faculty members with certification to train and help students prepare for the four-hour CEM certification exam (estimated to have a 30 percent passage rate on the first try).

Table I-10 shows the number of Connecticut residents with certification in each of the areas. There are a total of 166 residents with at least one certification; some residents have multiple certifications.

Certification	Count
Business Energy Professional (BEP)	11
Certified Building Commissioning Professional (CBCP)	10
Certified Cogeneration Professional (CCP)	1
Certified Demand-Side Manager (CDSM)	10
Certified Energy Auditor (CEA)	15
Certified Energy Manager (CEM)	125
Certified Energy Procurement Professional (CEP)	14
Certified GeoExchange Designer (CGD)	8
Certified Indoor Air Quality Professional (CIAQP)	2
Certified Lighting Efficiency Professional (CLEP)	14
Certified Measurement & Verification Professional (CMVP)	3
Certified Power Quality Professional (CPQ)	2
Carbon Reduction Manager (CRM)	6
Certified Sustainable Development Professional (CSDP)	13
Distributed Generation Certified Professional (DGCP)	4
Energy Manager-In-Training (EMIT)	3
Green Building Engineer (GBE)	7
TOTAL	248
Source: PRI staff communication with Association of Energy Engineers staff.	

¹¹ www.aee.center.org/certification/CEM/page.htm. (October 2009)

North American Board of Certified Energy Practitioners. The North American Board of Certified Energy Practitioners (NABCEP) is the national organization that certifies professional installers in the field of renewable energy. Certification is based on training and passage of an exam demonstrating knowledge of standards set by subject matter experts. Nationally, there are 936 certified solar photovoltaic (PV) installers and 112 certified solar thermal installers as of September 2009.

NABCEP has awarded solar PV installer certificates to eight Connecticut residents and solar thermal installer certification to one Connecticut resident. In addition to these two types of certification, small wind certification may become available in approximately six months.

Gateway Community College is listed as the only registered Connecticut provider of training for the NABCEP entry-level PV exam, which tests basic understanding of PV systems. Passing the exam results in receipt of a NABCEP basic certificate, which gets the graduate onto the worksite to gain the experience needed to sit for the more advanced NABCEP photovoltaic certificate.

To date, Gateway has administered the entry-level exam once, which was passed by 12 of its students. There are 15 additional Connecticut residents who have passed the entry-level exam after having taken coursework available from one of the other providers in the northeast region. Other states have many more NABCEP training providers. Massachusetts, for example, has nine providers (six of which are community colleges), and New York has 11 providers (six of which are at 2- or 4-year colleges).

In order to sit for the more advanced Installer Certification Exam, one must have been the lead installer for two PV systems and have received at least 40 hours of advanced PV training. The training can come from a variety of sources including community colleges or universities, independent training providers with ISPQ (Institute for Sustainable Power Quality) accreditation, apprenticeship training programs, vocational/technical schools, or industry in-house training programs.

U.S. Green Building Council. The U.S. Green Building Council (USGBC) is a nonprofit organization with a goal of making green buildings available to everyone within a generation. To that end, the USGBC administers the Leadership in Energy and Environmental Design (LEED) certification program, a rating system that assesses the environmental sustainability of new and existing buildings.

In evaluating the level of energy and environmental design of a building, according to the council's website, LEED "...provides independent, third-party verification that a building project meets the highest green building and performance measures."¹²

¹² <http://www.usgbc.org>. (November 2009).

The LEED rating system has a maximum of 69 possible points, with more points signifying increasingly more green features. Buildings are certified as follows:

1. base certification 26-32 points;
2. silver certification 33-38 points;
3. gold certification 39-51 points; and
4. platinum certification 52-69 points.

Some of the points given to buildings (or communities) depend on the extent to which buildings are designed and built to improve:

- energy savings;
- water efficiency;
- carbon dioxide (CO₂) emissions reduction;
- indoor environmental quality; and
- stewardship of resources and sensitivity to their impacts.

A list of the 42 Connecticut buildings with LEED certification as of November 2009 is found in Appendix E. Many of the buildings are located on the campuses of boarding schools or colleges; there are also supermarkets and large corporations on the list.

Additionally, the U.S. Green Building Council certifies LEED professionals. The recently established LEED green associate credential is given in non-technical fields of practice to individuals who have demonstrated green building expertise by passing a USGBC exam. The LEED AP (advanced profession) certification is given to persons who have demonstrated advanced depth of knowledge in green building practices on a national exam and also have documented, professional experience on a LEED project within the last three years. As of November 2009, Connecticut had 29 people credentialed at the LEED green associate level and 1,214 credentialed at the LEED AP level.

The *Connecticut Green Building Council* is a state chapter of the U.S. Green Building Council. It is a nonprofit organization that promotes the construction of high performance energy efficient buildings in Connecticut. Efforts include:

- holding a series of workshops on green building topics;
- maintaining a speaker's bureau, and sponsoring educational forums and seminars on green building; and
- periodically offering Connecticut-based LEED training in cooperation with the U.S. Green Building Council.

Developing the Green Collar Field and Future Job Opportunities

Who is developing the green field? In addition to *driving* the green movement and *defining* green collar jobs, the third “D” is *developing* the green collar field and future job opportunities. The promotion and development of the green collar field by several state agencies, business associations, and private companies is now discussed.

Role of state workforce development agencies in developing the green collar field. *There are many state agencies and private organizations working on green collar job initiatives in Connecticut. In part because of federal requirements pertaining to ARRA grant submissions, there are consortiums and partnerships currently being formed or shaped, often expanding to include more key stakeholders. While these agencies and organizations have many responsibilities, Table I-11 focuses on each state agency’s role in developing green collar job opportunities in Connecticut, either directly or indirectly.*

Roles of other organizations in developing the green collar field. Besides the entities just described, there are other organizations that play a role in developing green collar job opportunities in Connecticut. The *Connecticut Business and Industry Association (CBIA)*, for example, representing 10,000 Connecticut companies, has staffed the aforementioned Energy Workforce Development Consortium and established an Environmental Policies Council to connect businesses with environmental experts, regulators, and state and federal policymakers. The association has also developed a virtual Green Business Center that features green vendors, news, best practices, and incentives for CBIA member companies. The CBIA Education Foundation has helped design curriculum for Hartford High School’s Academy of Engineering and Green Technology.

The Connecticut Business and Industry Association also periodically surveys members regarding sustainability and green business practices. In the most recent survey, CBIA found 73 percent of respondents reported engaging in green/sustainable practices in 2009, a sharp increase from the 59 percent in 2008 and 47 percent in 2007.

Some of *Connecticut’s companies* play a role in developing green collar job opportunities. United Technologies Corporation, solar panel companies, and fuel cell companies, among others, are generating green jobs as their businesses expand, due in part to ARRA funds and state tax and other incentives. FuelCell Energy, Inc. of Danbury, for example, was recently awarded \$1.5 million by the U.S. Department of Defense¹³ to continue development of its electrochemical hydrogen separator, which has industrial and transportation applications. Apollo Solar of Bethel was awarded \$1.5 million by the U.S. Department of Energy to develop commercial-ready solar power technology for development of nationwide solar energy grid integration systems.

Where will future green collar job opportunities be? The Connecticut DOL estimated the current and projected number employed in various green occupations. Of all the green occupations examined, only the demand for nuclear engineers and power plant operators is expected to decline during the next decade (Table I-12).

¹³ U.S. Department of Defense Engineer Research and Development Center’s Construction Engineering Research Laboratory.

Table I-11. Roles of State Agencies in Developing Green Collar Job Opportunities in Connecticut

State Agency	Role(s)
Connecticut Department of Labor	<ul style="list-style-type: none"> • Plays key role in projecting numbers employed currently and in the future green collar workforce • Recently approved U.S. DOL grant will allow CT DOL to work with neighboring states to identify job vacancies and green collar jobs in greatest demand • Work with Workforce Investment Boards to obtain training for under- and unemployed individuals, particularly in weatherization installation, energy audit field • Establishment of a 21st Century Green Jobs Training Initiative, which shall provide training to meet the needs of the energy industry and other green industry
Connecticut Office of Workforce Competitiveness	<ul style="list-style-type: none"> • Manages and staffs Connecticut Employment and Training Commission and its Connecticut Energy Sector Partnership (formerly Green Jobs Council), charged with developing green job opportunities and establish training programs • Soon to be established Green Science and Engineering Advisory Group to develop strategies for introducing green principles into education, manufacturing, engineering, and other aspects of business and industry, and to leverage resources available to Connecticut through its universities • Provide administrative support and coordinate efforts among state agencies, public and private colleges and universities, and quasi-public agencies whose missions relate to green collar industries and jobs
Connecticut Office of Policy and Management	<ul style="list-style-type: none"> • Energy division has key role in securing the ARRA green funds • May reallocate existing job training funds within the Secretary's discretion, to the new 21st Century Green Jobs Training Initiative
Department of Social Services	<ul style="list-style-type: none"> • Designated to receive U.S. Department of Energy block grants for weatherization • Operates the Weatherization Assistance Program (WAP), the purpose of which is to help low-income residents reduce their energy bills by making their homes more energy efficient. Weatherization is performed through the CAP agencies.
Department of Economic and Community Development	<ul style="list-style-type: none"> • Gives priority to projects incorporating clean and green energy through its awarding of monies from the Small Manufacturers Competitiveness Fund • Under contract with CCEF, conducted an economic and fiscal impact analysis of the renewable energy and energy efficiency industry group on the state's economy
State Department of Education	<ul style="list-style-type: none"> • Planning currently underway to create a Green Collar Corps • Purpose is to teach primarily high school students the skills needed to help their communities decrease their environmental and energy footprint • The Corps will be trained to conduct energy audits for residential and commercial businesses • Priority will be given to the enhancement and expansion of the technical high school system's model green jobs programs
Connecticut Innovations, Inc.	<ul style="list-style-type: none"> • Expand the Accelerator at Science Park to include green technology companies
Department of Transportation	<ul style="list-style-type: none"> • In consultation with DECD and DAS, develop a plan to implement a green transportation corridor along interstate routes 91 and 95 • The plan will find opportunities to require green improvements, including use and distribution of alternative energy sources along the green transportation corridor
Dept. of Env. Protection	<ul style="list-style-type: none"> • Develop a plan for the installation of green technology at all state parks

Source: PRI staff analysis.

Occupation	Estimated Number Employed in 2006	Projected Number Employed in 2016	Demand
Hydrologist	97	121	↑25%
Geoscientist	174	209	↑20%
Environmental Engineer	747	891	↑19%
Environ. Science & Protection Tech.	392	458	↑17%
Environmental Engineering Technician	216	248	↑15%
Natural Sciences Manager	933	1,062	↑14%
Water & Liquid Waste Treatment Plant & System Operator	856	955	↑12%
Environ. Scientist & Specialist	685	761	↑11%
Nuclear Power Reactor Operator	108	113	↑5%
Nuclear Technician	195	197	↑1%
Nuclear Engineer	339	335	↓1%
Power Plant Operator	175	169	↓3%
Other ^a	576	629	↑9%
Total	5,493	6,148	↑12%

^aIncludes agricultural engineers, soil and plant scientists, zoologists and wildlife biologists, conservation scientists, and foresters.
Source: Office of Research, Connecticut Department of Labor, December 2008 Economic Digest.

Another source of projections, the Advanced Technology Environmental and Energy Center,¹⁴ predicts most green collar job opportunities to be in:

- building and selling energy-related products;
- building energy assessment;
- energy efficient building construction;
- building operations and maintenance;
- project engineering and implementation;
- energy transmission and distribution; and
- transportation systems and services.

Lastly, a recent Connecticut job-training grant application¹⁵ prepared by the Connecticut Energy Training Partnership, projected the following annual openings in key energy efficiency and renewable energy sectors:

- energy-efficient building, construction, assessment, and retrofit (2,775 jobs);
- deconstruction and materials use (2,124 jobs);

¹⁴ The Advanced Technology Environmental and Energy Center (ATEEC) is a national center that promotes and supports environmental and energy technology education to address the needs of the national and global workforce.

¹⁵ EnergizeCT! A Statewide Energy Training Partnership, submitted to the U.S. Department of Labor.

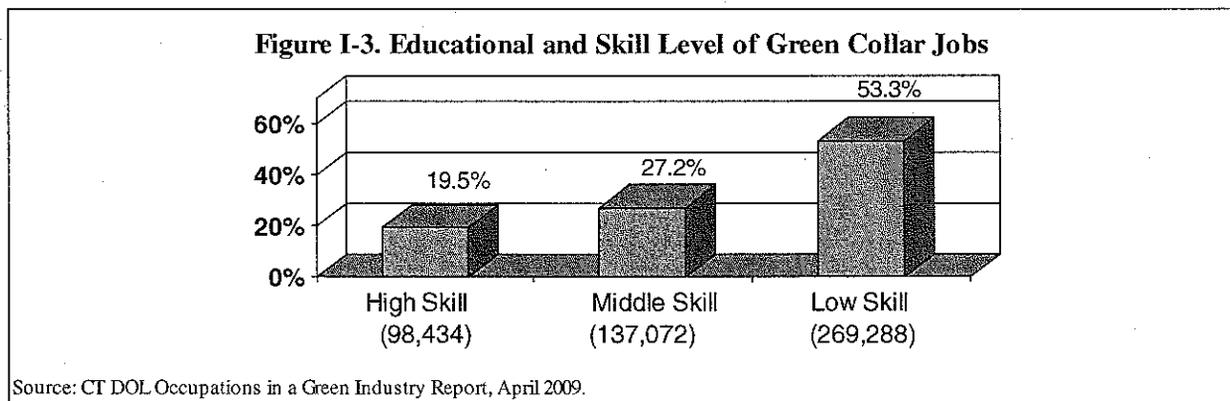
- environmental protection/clean water (occupations include carpenters, electricians, glaziers, maintenance/repair, ironworkers, finishing trades, laborers, environmental technicians) (1,683 jobs);
- solar and wind (2,065 jobs);
- fuel cell (493 jobs); and
- biofuels (occupations include electrical and electronics, environmental and chemical technicians, and advanced manufacturing) (306 jobs).

Delivering Education and Training for Green Collar Jobs

Until now, this section has described the forces *driving* the green movement, the many *definitions* of green collar jobs, and the players involved in *developing* the green collar field and future job opportunities. The fourth “D” of the green collar field is *delivering* education and training for green collar jobs. The various training programs resulting from ARRA stimulus funds are providing existing workers with additional green skills and knowledge, and sometimes additional credentialing or certification. The ARRA funds are also providing unemployed and underemployed people with entry level jobs in such areas as weatherization and green construction.

All public postsecondary education institutions, many independent colleges and proprietary schools, and the technical high schools play a role in delivering education and training individuals for green collar jobs. *Although there is no consensus on the definition of green jobs, the occupations discussed in this section require a range of education and training levels, from less than a high school diploma to a graduate degree.* While the focus of the PRI study is on jobs requiring postsecondary education, career ladders and lattices are an important aspect of the continuum of green collar jobs. Therefore, a discussion of certain green collar occupations requiring on-the-job or other (non-college) training is also included.

Using the Connecticut Department of Labor comprehensive working definition of green occupations, which lists 119 green occupations including lawyers, janitors, and roofers, Figure I-3 shows *approximately one in five green collar jobs requires a bachelor’s degree or higher* (high skill level) and *one-quarter either an associate’s degree, postsecondary vocational training, or long-term on-the-job training* (middle skill level). *Over half of the green collar jobs, however, do not require any postsecondary education or extensive on-the-job training* (low skill level).



Because the entry level job salaries are often unable to support a family, *these low skill level jobs can be viewed as part of a career ladder or lattice*, where continuing education, training, and experience lead to financially adequate jobs. Further, while much of the explosion of weatherization jobs is being driven by ARRA funding, it is possible that demand for weatherization jobs will decrease as federal funding is withdrawn. Thus, career ladders and lattices play an increasingly important role in the green energy field.

Green collar career ladders and lattices. Figure I-4 summarizes the green collar educational continuum and the roles various state institutions and agencies may play in the preparation of the green collar workforce. Although not included in this diagram, independent colleges, nonprofit agencies, businesses, and others also play a role in the preparation of the green collar workforce. The roles of the many partners in this effort are described later in this section.

Career ladders and lattices are made up of a group of related jobs that comprise a career. Figure I-5 shows an example of a possible green collar career ladder. Many of the entry-level positions are in the weatherization field. With the recent Connecticut Department of Social Services \$64 million grant from the U.S. Department of Energy for the Weatherization Assistance Program, that trend will continue. Thus, someone starting out may enter the green collar field with a position as a weatherization worker at a wage averaging \$12-\$14.70 per hour, depending on the county within Connecticut¹⁶, and with further education, advance to an energy auditor, earning approximately \$31.25 per hour. While career ladders lay out a series of advancing jobs within a given industry, career lattices offer workers the flexibility of taking jobs either within the same industry or in a different industry. A sampling of average salaries and educational requirements for some of the new and emerging green collar occupations is provided in Appendix F.

Near future workforce supply. Initiatives to train Connecticut's green collar workforce are occurring at Connecticut's public community college system, state college system, and the University of Connecticut. Independent postsecondary education institutions are also involved in the training of Connecticut's green collar workforce, as are the technical high schools, Connecticut Clean Energy Fund, for-profit institutes, unions, and national training organizations.

Beyond traditional students, there are current members of the workforce taking courses or obtaining certificates to enhance skill sets with green knowledge and technology. As noted earlier, two of the three green collar job categories defined by the U.S. DOL pertain to: existing occupations conducted within a green setting; and existing occupations requiring additional green skills and knowledge. Occupations in the first category (that require postsecondary education) are already being offered at colleges. Occupation in the latter category may simply require supplementary college courses, or green applications within existing college courses.

¹⁶ The Davis-Bacon Act requires Connecticut and other states receiving ARRA funds to pay prevailing wages for various weatherization-related jobs.

Figure I-4. Green Collar Educational Continuum

Connecticut has a Educational Continuum for "Green Collar" Workforce Development

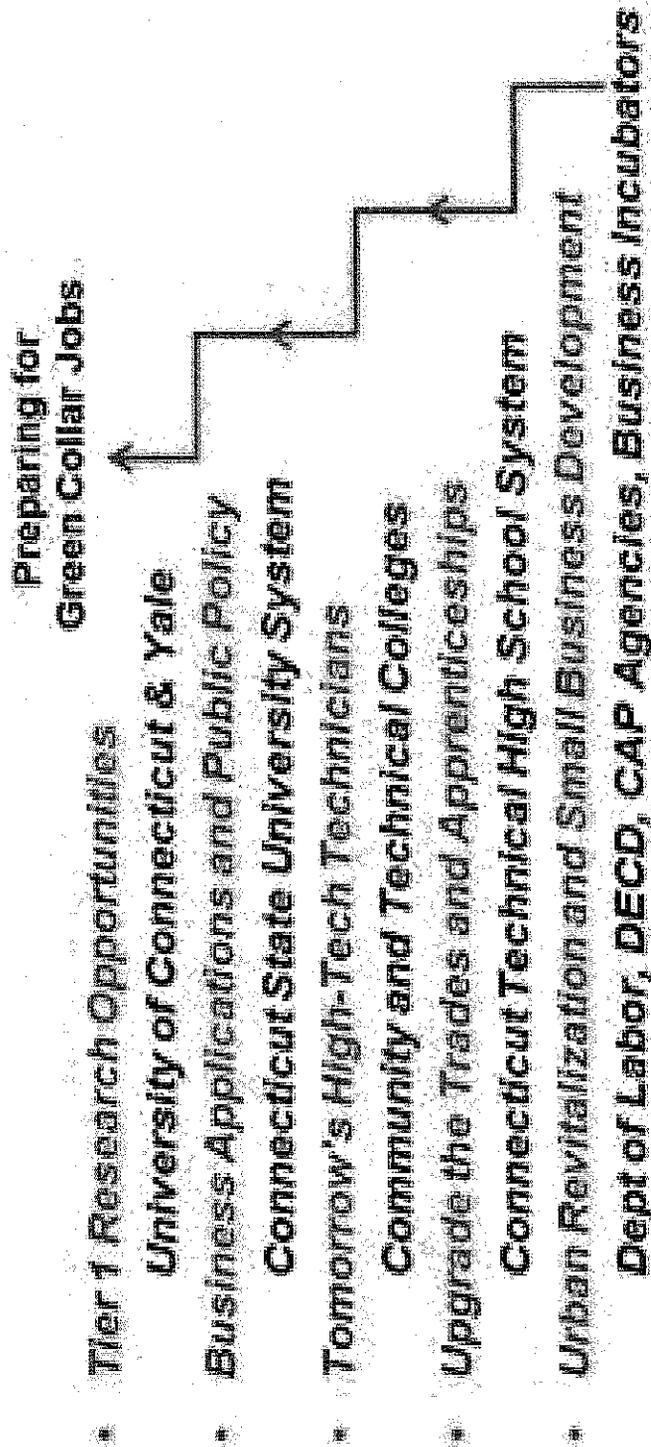
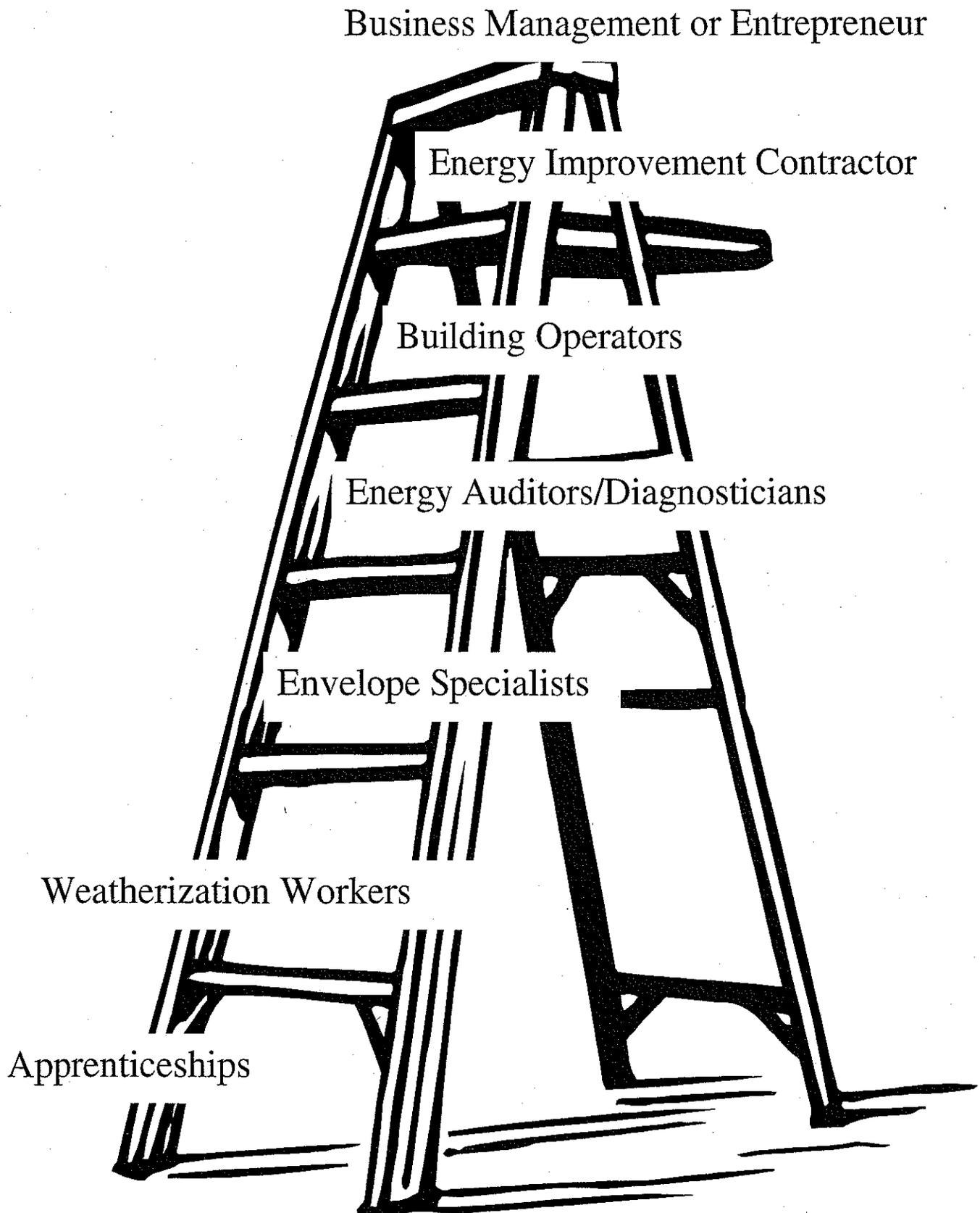


Figure I-5. Potential Green Collar Career Ladder



Source: Building a Green Collar Workforce, The Institute for Sustainable Energy at Eastern Connecticut State University.

There are students currently in college preparing for specific green collar occupations. Table I-13 identifies Connecticut postsecondary education institutions singled out by Navigant Consulting, Inc., as having employees engaged directly in EE/RE postsecondary teaching and/or research.

Institution	Type
Manchester Community College	Public community college
Three Rivers Community College	Public community college
Naugatuck Valley Community College	Public community college
Central Connecticut State University	Public four-year state university
Eastern Connecticut State University	Public four-year state university
University of Connecticut at Storrs	Public land-sea-grant university
Fairfield University	Independent university
Saint Joseph College	Independent university (college)
Quinnipiac University	Independent university
University of Bridgeport	Independent university
University of Hartford	Independent university
Yale University	Independent university

Source: Connecticut Renewable Energy/Energy Efficiency Economy Baseline Study Phase 1, March 27, 2009, Navigant Consulting, Inc.

Overall, the higher education institutions are contributing to creation of the near future green collar workforce in one of five ways:

1. offering majors or minors in directly related fields such as environmental science or environmental engineering;
2. offering majors or minors associated with the green movement;
3. establishing centers or institutes directly related to renewable energy, energy efficiency, or other green related areas;
4. offering certificates in green collar fields; and
5. offering individual courses to add green collar skills and/or knowledge.

A description is now provided of each of these the kinds of efforts.

1) Offering “environmental” majors. Table I-14 shows the 16 Connecticut colleges with an environmental major, such as environmental studies, environmental science, and forestry and environmental studies, and the number of degrees conferred. A minor in one of these environmental areas is offered by many of these 16 colleges and also other higher education institutions not offering an environmental major. Both Eastern and Southern Connecticut State Universities, for example, offer both majors and minors in environmental earth science.

There may also be multiple colleges within a university offering environmental majors or minors. The University of Connecticut, for example, has students in the colleges of agriculture and natural resources, engineering, and liberal arts and sciences, all studying fields with a primary focus

Table I-14. Number of Degrees Awarded in 2007-2008 in “Environmental” Programs			
College	Degree Type	Program Name	Number Awarded
Connecticut College	Bachelor’s	Environmental Chemistry	1
	Bachelor’s	Environmental Studies	15
Eastern CSU	Bachelor’s	Environmental Earth Science	11
Gateway CC	Associate’s	Environmental Science & Toxicology	1
Middlesex CC	Associate’s	Environmental Science	2
	Associate’s	Environmental Science: Biotechnology	5
Naugatuck Valley CC	Associate’s	Environmental Science: Biology	3
Sacred Heart University	Bachelor’s	Environmental Science	3
Saint Joseph College	Bachelor’s	Environmental Science	1
Southern CSU	Master’s	Environmental Education	11
Three Rivers CC	Associate’s	Environmental Engineering Technology	3
Trinity College	Bachelor’s	Environmental Science	6
UConn	Doctorate	Environmental Engineering	1
	Master’s	Environmental Engineering	6
	Bachelor’s	Environmental Engineering	4
	Bachelor’s	Environmental Science	19
University of Hartford	Master’s	Environmental Engineering	5
University of New Haven	Master’s	Environmental Engineering	12
	Master’s	Environmental Science	3
	Bachelor’s	Environmental Science	1
Wesleyan University	Master’s	Earth & Environmental Studies	3
	Bachelor’s	Earth & Environmental Science	12
Western CSU	Master’s	Biological & Environmental Sciences	5
Yale University	Bachelor’s	Engineering Science-Environmental Engineering	3
	Master’s	Environmental Engineering	13
	Doctorate	Environmental Engineering	5
	Bachelor’s	Environmental Studies	9
	Master’s	Forestry & Environmental Studies	121
	Doctorate	Forestry & Environmental Studies	5
TOTAL			289
Source: Connecticut Department of Higher Education Degree Completion Database.			

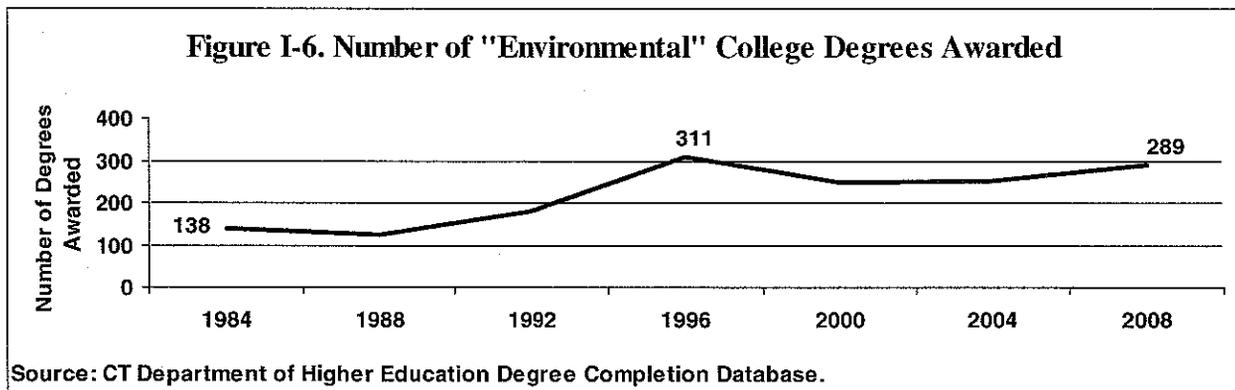
on the environment (e.g., environmental engineering, environmental science). Striking growth was seen in the environmental major in the College of Agriculture and Natural Resources, where there was a 75 percent increase in the number of environmental science majors from fall 2008 (36 students) to fall 2009 (63 students).¹⁷

¹⁷ University of Connecticut Green Research, Outreach and Academic Programs, report prepared by the University of Connecticut for the Legislative Program Review and Investigations Committee (October 2009).

Two additional colleges have started offering green majors to students. Trinity College recently reported¹⁸ having added a new major in environmental science, and Goodwin College reported adding an associate degree in environmental science, and certificates in:

- brownfield remediation;
- riverine ecology;
- water distribution operations;
- water treatment operations; and
- environmental health technician.

On the other hand, in the same recent survey, Sacred Heart University and Saint Joseph College both reported discontinuation of the bachelor degree in Environmental Science due to declining/low student enrollment (see Appendix G for a summary of the CCIC survey results). *Overall, however, there has been an increase in the number of environmental degrees conferred, particularly in comparison to the number of such degrees awarded in the 1980s* (Figure I-6).



2) *Offering majors or minors associated with the green movement.* Beyond the limited number of “environmental” majors, there are a variety of other majors that are considered green, depending on the person or organization making the determination. Regardless of whether the major is considered green, as has been discussed previously in this section, a green component has been added to many other majors. The California Community Colleges Centers of Excellence Economic and Workforce Development believes there are few specific new programs for green jobs, such as technical level jobs for specific trades (i.e., wind, solar, geothermal) that need to be created. The center instead recommends that colleges embed a green curriculum or green thread throughout all courses.¹⁹

Some of the majors frequently considered green or associated with the green movement by the Institute for Sustainable Energy at Eastern Connecticut State University include:

¹⁸ Connecticut Conference of Independent Colleges Survey for the PRI Study of the Alignment of Postsecondary Education and Employment, July 2009.

¹⁹ Understanding the Green Jobs: Tools and Resources, California Community Colleges Centers of Excellence Economic and Workforce Development.

- marine biology, marine chemistry, maritime studies, and coastal studies;
- landscape architecture, ornamental horticulture and turf grass management;
- geology;
- chemical engineering, civil engineering, electrical engineering, and mechanical engineering;
- forest science;
- meteorology;
- environmental economics; and
- construction management, and energy management and policy.

3) *Establishing centers or institutes directly related to renewable energy, energy efficiency, or other green areas.* Centers or institutes directly related to the environment, renewable energy, energy efficiency, or other green areas are found within every Connecticut college system. A description of each now follows.

Institute for Sustainable Energy at Eastern Connecticut State University. Established by the Board of Trustees of the Connecticut State University System in 2001, the Institute for Sustainable Energy at Eastern Connecticut State University is a cornerstone of the green initiative. The institute focuses on matters relating to energy education, energy policy, energy efficiency, energy conservation and load management, renewable energy, distributed generation, protection of environmental resources, and the dissemination of information on energy alternatives and sustainability to users and providers of energy. The mission of the institute is "...to be an objective energy and educational resource regarding the means for achieving a sustainable energy future for Connecticut."²⁰

Staffed by a director, educational and technical specialists, and an assistant, more than a dozen ECSU students obtain exposure and real world experience in the green field each year. The institute's educational efforts have included development of an educational website called Connecticut Energy Education (www.ctenergyeducation.com). This site contains information for educators featuring the energy topics in the Connecticut high school curriculum. Building Inspector Energy Code Standards Training is also offered by the institute.

The Center for Clean Energy at the University of Connecticut. The University of Connecticut trains students for green collar careers and also conducts research in its Center for Clean Energy. Formerly called the Connecticut Global Fuel Cell Center, the center recently changed its name to reflect a larger scope of interest that encompasses emerging energy technology areas such as biofuels, coal gasification, natural resource conservation, power management, and smart power transmission. As announced on the center website (www.ctfuelcell.uconn.edu), this expansion is expected to leverage the center's "...core strength and leadership in the field of advanced fuel cell technologies and power generation systems and enables our students and faculty to better address the global energy and environmental needs."

²⁰ http://www.easternct.edu/sustainenergy/about_us/mission_statement.html (November 2009).

The Center is operated by the University of Connecticut School of Engineering, and has recently added a new director and six faculty members. The center partners with and/or is funded by, the U.S. Departments of Energy and Defense, the National Science Foundation, the Connecticut Clean Energy Fund, UTC Power and Proton Energy Systems, and others. Students have the opportunity to learn about the green field through research with center faculty.

Center for a Sustainable Future at Gateway Community College. Established in 2009, the Center for a Sustainable Future at Gateway Community College offers courses in sustainable operations. Providing hands-on practical skills training, certificates are offered in solar energy technologies (completed by 78 students to date) and alternative energy transportation. Building performance certificates and clean water treatment plant classes are also offered. According to its website, the Center is positioning itself to prepare the in-state green workforce of the future, taking an integral role in "...the sustainable economic development of the State of Connecticut, facilitating the transition to renewable energy sources, sustainable building development, energy efficiency programs, alternative transportation technologies, water management, and numerous other sustainable initiatives."²¹

Clean Energy Institute at the University of Hartford. The Clean Energy Institute is a branch of the University of Hartford, Engineering Applications Center. Involving five full-time faculty with experience in both academia and industry, two part-time faculty from local industries, and six undergraduate and graduate students, the institute is currently working on energy-related projects that include:

- parabolic solar collector;
- development of solid absorbents for the capture of greenhouse gasses;
- use of biodiesel fuel in a university bus;
- design and testing of passive coolant devices for photovoltaic cells;
- comparison between predicted and measured power and a series of photovoltaic array; and
- novel ejector/condenser to compress vapor in liquid/vapor air conditioner.

4) *Certificates in green collar fields.* As described earlier, several approved and pending ARRA grants are expected to help unemployed and underemployed workers earn certificates in emerging green collar fields. In anticipation of those opportunities, and demand for such certificates from businesses and students, there are several certificate programs currently underway at several of the community colleges (see Appendix H for a comprehensive list of green certificates (and degrees) offered at each of the Connecticut community colleges). Also, two- and four-year colleges are considering including the earning of one or more certificates as an option for students enrolled in related associate and bachelor degree programs. Table I-15 shows the number of initial community college students who were enrolled or awarded a certificate in an environmental or green program in 2007-2008.

²¹ http://www.gwcc.comnet.edu/uploadedFiles/Corporate_and_Continuing_Education/CSF%20Credit%20Course%20Fall%202009%20Schedule.pdf. (November 2009).

College	Certificate Name	Number Enrolled	Number Awarded
Gateway CC	Wastewater Management	1	0
Gateway CC	Water Management	10	3
Gateway CC	Alternative Fuel Vehicle	1	1
Naugatuck Valley CC	Advanced Wastewater	1	0
TOTAL		13	4

Source: Assistant Chancellor of Connecticut Community College System.

Due to state plans and federal stimulus funding, the figures are expected to rise significantly. Table I-16, for example, shows the green certificate programs, including those under development, at particular community colleges as part of the federal grant, SOAR. With the exception of the Three Rivers Community College certificate programs begun in the fall 2009 semester, the certificate programs are anticipated to begin in the spring 2010 semester.

Community College	Certificate
Three Rivers Community College	<ul style="list-style-type: none"> • Sustainable Facilities Management • Sustainable Landscape Ecology & Conservation Technician
Norwalk Community College	<ul style="list-style-type: none"> • Building Efficiency & Sustainable Technologies Certificate/Sustainable Facilities Management
Gateway Community College	<ul style="list-style-type: none"> • Alternative Energy Transportation • Clean Water Treatment • Solar Energy Technologies
Naugatuck Valley Community College	<ul style="list-style-type: none"> • Alternative Energy Systems
Manchester Community College	<ul style="list-style-type: none"> • Sustainable Energy Certificate

Source: USDOL Community-Based Job Training Grant, “Sustainable Operations: Alternative and Renewable (SOAR) Energy Initiative.”

Features of the SOAR grant-funded certificate programs include: enhanced learning technology; increased instructional supports; tuition assistance; tutoring; and academic and career counseling. The Sustainable Landscape Ecology & Conservation Technician certificate, for example, requires 24-24.5 credits, usually taken over two semesters. The objective of the certificate is to provide students with entry-level skills needed to fill technician jobs in the areas of sustainable landscape design, planning, and conservation.

Many current Three Rivers Community College students studying for an associate degree in environmental engineering technology have expressed interest in obtaining a sustainable landscape ecology and conservation technician certificate, which would be achieved through completion of three additional courses. In developing career ladder opportunities, the program coordinator has been

working with representatives of the University of Connecticut College of Agriculture to accept the Three Rivers Community College courses for students wishing to transfer and obtain a bachelor's degree in either Plant Sciences or Natural Resources and the Environment.

5) *Individual courses to add green collar skills and/or knowledge.* For workers interested in learning about this emerging field, individual green credit and noncredit courses are available at many Connecticut postsecondary education institutions. *Community colleges in particular play an important function in availing the current workforce of green courses needed to enhance existing skill sets.* A full listing of green credit and noncredit courses offered at each of the community colleges, for example, is found in Appendix I for fall 2007 through fall 2009. Courses offered include:

- introduction to environmental science;
- environmental regulations;
- greenhouse management;
- water resources engineering;
- sustainable energy and the environment;
- principles of ecology; and
- alternative building systems.

Enrollment in the community college introduction to environmental science for-credit course has more than doubled in the past two years, from 212 students in fall 2007, to 447 students in fall 2009. While some students may be considering green certificates or degrees, it can be assumed that many of the part-time students are accessing the courses to improve or “green” current skills in the workplace.

Efforts by Connecticut's technical high schools. Preparation for green collar jobs is underway at the Connecticut technical high schools, including training on installing electricity-producing wind turbines. Recently, E.T. Grasso Technical High School in Groton graduated 13 students from its bioscience and environmental technology program, and a new facilities management program has been started at J.M. Wright Technical High School in Stamford²². The technical high schools are also working with the community colleges to develop career paths for related programs.

Other training efforts. As described earlier, the Connecticut Clean Energy Fund Board of Directors recently approved funding for expansion of the Learning for Clean Energy Innovation program within the Connecticut technical high school system. The program will build the capacity to train students for clean energy jobs, focusing on solar photovoltaic and solar thermal technologies, with the sharing of newly purchased equipment to be housed at three of the technical high schools (Wolcott, Grasso, and E.C. Goodwin). In addition to enabling seven high school teachers to be trained in green fields, funding has also been made available to tailor a related Massachusetts technical high school curriculum to Connecticut's needs. All electrical and plumbing students at the

²² The State Department of Education recently suspended operations at the J.M. Wright Technical High School in Stamford for two years in order to study options for restructuring.

three schools will have this new green curriculum that will eventually be used at other technical high schools.

Besides the nonprofit public and independent institutions of higher education, there are also *for-profit institutes* that play a role in promoting and preparing the Connecticut workforce for green collar jobs. The Baran Institute of Technology (East Windsor), for example, offers an electrician certificate, diesel technology program certificate, and HVAC/Technology program certificate. Among the training offered by the Everblue Training Institute (Hartford) are LEED exam preparation and certification courses, solar training, wind training, and energy auditor training.

Other organizations that play a role in promoting and preparing Connecticut's workforce for green collar jobs are the *unions*. Several unions have apprenticeship programs in green collar fields including wire solar panels, wind turbines, and biofuel plants. For example, the International Brotherhood of Electrical Workers has developed green training curriculums in the electrical industry that range from retrofitting buildings to installing wind turbines.

Lastly, there is a national energy council that has developed uniform guidelines and best practices for training in such areas as solar photovoltaic installation, which are applicable to training in either technical high schools or colleges. The *Interstate Renewable Energy Council* (IREC) is a national nonprofit organization that develops and promotes the use of uniform guidelines, competency standards, credentialing, best practices, and quality assessment for solar and other renewable energy professionals and training programs. IREC is currently promoting use of the Institute for Sustainable Power Quality (ISPQ) framework in its guidelines.

Through the accreditation of training programs and certification of trainers, IREC ensures that a national framework of standards and metrics is adhered to, covering curriculum, training equipment, and teacher qualifications for both face-to-face and online courses. There are currently no ISPQ accredited training programs in Connecticut and no applications for ISPQ accreditation under audit.

Model for Aligning Supply and Demand for Green Collar Jobs

The Rutgers University John J. Heldrich Center for Workforce Development recently identified key elements of an effective green jobs talent network.²³ Table I-17 shows four components of an effective talent network. This model will be referred to in the following discussion of potential barriers to alignment in the green collar jobs area when applicable.

V. What are Some Possible Barriers to Alignment in the Green Collar Jobs Area?

As described in the briefing report, there are several possible barriers to the alignment of postsecondary education and employment. This section focuses on several possible barriers to alignment in the *green collar jobs area*. The barriers discussed relate to: 1) elementary and secondary school students in the knowledge/talent pipeline; 2) postsecondary education institutions; 3) difficulty in making accurate demand predictions; 4) current economic challenges; and 5) state agency organization, programs and policies. Each is now briefly discussed.

²³ John J. Heldrich Center for Workforce Development Research Brief, "Preparing the Workforce for a "Green Jobs" Economy" by Jennifer Cleary and Allison Kopicki, February 2009.

Table I-17. Model for Aligning Supply and Demand for Green Collar Jobs

1.	Identify Assets	<ul style="list-style-type: none">• Create inventory of public and private assets• Identify existing training opportunities• Chart funding streams available to support green job growth and training efforts
2.	Cultivate Career Pathways	<ul style="list-style-type: none">• Support low-skilled, low-income workers to move into higher-skilled jobs that pay better wages through education and green jobs training• Ensure that training results in a nationally recognized credential• Focus on accreditation of training programs and creating “stackable” credentials through articulation agreements
3.	Align Green Jobs Workforce Training Efforts with Economic Development Initiatives	<ul style="list-style-type: none">• Establish a connection between attracting green energy businesses and customized training and hiring and recruitment systems
4.	Do Not Duplicate Training or Curricula	<ul style="list-style-type: none">• Ensure that workers in multiple locations have access to training that is relevant to employers by developing mechanisms to share curricula that result in credentials that are in high demand by employers• Consider developing centralized training centers that provide students with the opportunity to get hands-on training using state-of-the-art equipment

Source: Rutgers University John J. Heldrich Center for Workforce Development.

Barriers related to elementary and secondary school students. *Lack of awareness or understanding of what green collar jobs are* is one possible barrier related to elementary and secondary school students, parents, teachers, and guidance counselors. Because this is an emerging field and there is no consensus on what constitutes a green job, confusion is understandable.

The U.S. Department of Labor taxonomy is a useful tool to understand the categories of occupations in a green economy (i.e., green *increased demand* occupations, green *enhanced skills* occupations, and green *new and emerging* occupations). Additionally, the categorization of green occupations into *energy efficiency* and *renewable energy* may also be useful to understanding how the various jobs fit together. Therefore, until something more definitive is provided by the U.S. DOL or Connecticut DOL, **program review committee staff recommends:**

Wherever possible, the U.S. Department of Labor taxonomy and EE/RE categorization should be incorporated into explanations of green collar jobs.

Barriers related to postsecondary education institutions. As new certificate programs are developed, it would be useful to standardize the name of identical certificate coursework across all public colleges. This will allow for articulation agreements to be more easily developed and career ladders established. The cultivation of career pathways is one of the elements specified in the Heldrich Center model for aligning supply and demand for green collar jobs.

The standardization of new green certificate programs will also help identify education and training resources available, promoting possible opportunities to share expensive equipment needed for some green instruction. This will promote the identification of assets, another element required in the Heldrich Center model for aligning supply and demand for green collar jobs.

Currently, certificates requiring the same coursework may have different names, depending on the particular community college. To help identify the current training available and determine in the future whether more or less of such training would be needed by the Connecticut workforce, **program review committee staff recommends that:**

The Connecticut Community College System should implement uniform naming of green certificate programs across all member colleges.

Because green efforts among the higher education institutions are occurring in a variety of degree and certificate programs, stand-alone courses, and centers/institutes, it is difficult to implement any of the four elements of the Heldrich Center model for aligning supply and demand for green collar jobs (i.e., identification of assets, cultivation of career pathways, alignment of green jobs workforce training efforts with economic development initiative, and not duplicating training and curricula unnecessarily). *Although CETC and the Connecticut Energy Sector Partnership are charged with developing and coordinating green collar job opportunities, they are not a central repository for the many initiatives emerging across higher education.* By regularly soliciting this information with the support of OWC staff, more comprehensive information may be made available to higher education, Connecticut DOL, and the many other members of the partnership to then share with their agencies and organizations. Efforts to align green collar jobs and employer needs may then be done more accurately and efficiently. Therefore, **program review committee staff recommends that:**

The Connecticut Employment and Training Commission and the Connecticut Energy Sector Partnership should regularly solicit and make widely available information on green efforts occurring among the higher education institutions including new degree and certificate programs, stand-alone courses, and center/institute initiatives useful in the alignment of green collar jobs and employer needs.

Barriers related to difficulty in making accurate demand projections. As is apparent throughout this section, green collar jobs are just emerging and the official federal occupational code system (O*NET) has not yet caught up with these green occupations. Indeed, a recent Connecticut Department of Labor publication noted that, "Green is ubiquitous, encompassing many areas of the economy. Some occupations are 'green' one day and may be only partially green the next."²⁴

Until the green field has developed further, it will be difficult to make accurate demand projections. The recently awarded ARRA grant to the eight-state consortium, as described earlier, will address some of the challenges in making projections of demands for green jobs.

²⁴ CT Department of Labor Economic Digest, December 2008.