GREENFORCE FLORIDA

ALTERNATIVE ENERGY WORKFORCE PROFILE

JANUARY 2009

FLORIDA DEPARTMENT OF EDUCATION
DIVISION OF WORKFORCE EDUCATION

greenforce Florida

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On June 28, 2008, Governor Crist, in his keynote address at the "Serve to Preserve" Summit on Global Climate Change, signed House Bill 7135 with the intent of reducing Florida's dependence on foreign oil, developing renewable energy, and reducing greenhouse emissions. Just before signing the groundbreaking legislation, Governor Crist said, "We must develop the talent and expertise in our people so they can fill the high-wage, high-demand jobs in the green tech field." [1]

EXECUTIVE SUMMARY

The renewable energy and energy efficiency (RE&EE) industries represented more than 9 million jobs and US $1.04 trillion in U.S. revenue in 2007, according to a new report published by the American Solar Energy Society (ASES). The renewable energy industry grew three times as fast as the U.S. economy, with the solar thermal, photovoltaic, biodiesel, and ethanol sectors leading the way, each with 25%+ annual revenue growth.

Key steps include a national renewable portfolio standard, long-term extension of the production tax credit, effective net metering policies, and improved access to electric transmission infrastructure.

According to the advanced scenario in the report, which represents the upper limit of what is technologically and economically feasible, RE&EE would generate about 37 million jobs and US $4.29 trillion in annual revenue by 2030. It's one of three forecast scenarios highlighted in this report.

Under the base case (business as usual) scenario, which assumes no major change in policy or initiatives, the green job forecast is for more than 16 million jobs and US $1.9 trillion in revenue in the U.S. by 2030 – less than half the jobs and revenue than the advanced scenario. The third scenario assumes moderate policy improvements at the federal and state level and forecasts 19.5 million jobs and US $2.24 trillion in revenue by 2030.

Key conclusions from the American Solar Energy Society's Green Collar Jobs conducted by Management Information Services, Inc.[2] [January, 2009] report include:

- Renewable energy and energy efficiency currently provide more than 9 million jobs and US $1.04 trillion in revenue in the U.S. (2007). The previous year (2006) renewable energy and energy efficiency represented 8.5 million jobs and US $972 billion in revenue
- 95% of the jobs are in private industry

[1] *Governor Charlie Crist, keynote address at the "Serve to Preserve Summit" on Global Climate Change, June 25, 2008.*

[2] *The ASES Green Collar Jobs report was conducted by Management Information Services Inc. [http://www.renewableenergyworld.com/rea/news/infocus/story?id=54524] – needs to be hyper linked*

- As many as 37 million jobs can be generated by the renewable energy and energy efficiency industries in the U.S. by 2030 – more than 17% of all anticipated U.S. employment.
- Hottest sectors include solar thermal, solar photovoltaics, biofuels, and fuel cells (in terms of revenue growth).
- Hot job areas include electricians, mechanical engineers, welders, metal workers, construction managers, accountants, analysts, environmental scientists and chemists
- The vast majority of jobs created by the renewable energy and energy efficiency industries are in the same types of roles seen in other industries (accountants, factory workers, IT professionals, etc)
- These jobs are mainly in two categories that every state is eager to attract – college-educated professional workers (many with advanced degrees), and highly skilled technical workers.
- The renewable energy industry grew more than three times as fast as the U.S. economy in 2007 (not including hydropower)

GREENFORCE FLORIDA is a working group of industry, labor and education leaders who believe that Florida is positioned to be at the epicenter of the emerging green industry and understands its future demands.

GREENFORCE FLORIDA is committed to Florida's leadership role, assisting our nation and the people of our great state, by preparing the workforce for jobs future and present, thus encouraging green industries to Florida.

GREENFORCE FLORIDA VISION STATEMENT AND MISSION

Vision Statement. To create secondary and postsecondary career education pathways in alternative energy that are accessible and lead to progressively higher training and upward mobility in education and employment.

Mission. To create high quality alternative energy workforce education programs that are responsive to each community's unique workforce needs driven by alternative energy industries and to produce prepared workers with portable credentials such as industry recognized certifications.

The U.S. had tallied more than 750,000 green jobs in 2006 and is set to add millions more in the next few decades, according to a new report by the U.S. Conference of Mayors and Global Insight, a Boston-based economic research firm. In fact, the green economy could soon become the nation's fastest-growing job segment, accounting for roughly ten percent of new jobs over the next 20 years. The report forecasts that by 2038, renewable electricity production will create 1.23 million jobs; alternative transportation fuels, 1.5 million jobs; engineering, legal, research and consulting positions

will be more than 1.4 million; and commercial and residential retrofits at 81,000 jobs, for a total of 4.2 million.[3]

The Center for American Progress's Green Jobs 101 white paper defines green jobs as living-wage, career-track jobs that contribute to preserving or enhancing environmental quality. Green jobs have some important characteristics, including:

- Green jobs are today's jobs repurposed and expanded in a low-carbon economy;
- Clean energy creates more jobs than fossil fuels;
- Green jobs are local and difficult to outsource; and
- Green jobs are good, career-ladder jobs.

Florida's focus on green jobs will not take much needed attention away from the focus on traditional energy jobs, but rather will expand the focus. It is important that Florida maintains a focus on core energy jobs which include transmission and distribution positions which will be required regardless of the source of generation.

This profile focuses on Greenforce occupations related to the alternative energy industry. Future Greenforce Florida reports and activities will focus on preparing our workforce for additional green jobs that can be found in construction, manufacturing, health science, etc.

[3] Pentland, William. "The Hottest Places for Green Jobs in the U.S.", November 6, 2008, Fobes.com.

GREENFORCE FLORIDA FINDINGS AND PROPOSED NEXT STEPS[4]

1. Florida should fast-track the creation of an Alternative Energy Career Pathway to help provide Floridians with the skills that they need to work in jobs in the Alternative Energy Industries, beginning with occupations in the Solar Industry.

The demand for trained practitioners and professionals in renewable energy is growing rapidly. There are many career paths to choose from, including the following:

- System Design and Installation
- System Technicians and Service Personnel
- Architecture and Engineering
- Sales and Marketing
- Research and Development
- Finance and Accounting
- Policy and Planning

Currently, the greatest demand in solar and small wind systems is for installation practitioners. This career path is especially attractive to individuals who enjoy hands-on construction work. Apprenticeship programs to train electricians, plumbers, roofers, etc., provide an excellent entry into this career path. In addition to traditional apprenticeship programs offered by trades groups, many community colleges and career and technical schools offer such training. For experienced construction workers, such as journeyman electricians and plumbers, often a recognized workshop or short course in one of the renewable energy technologies will suffice to steer their careers in a new and greener direction.

Once renewable energy systems have been installed, technicians and service personnel are required to monitor performance, ensure proper operation, perform scheduled maintenance, and repair or replace components as needed. Two-year technician programs at community colleges, such as electronics or computer science, provide good backgrounds for technician careers. Technicians are also heavily involved in testing subsystem (e.g., the electrical, mechanical, communications, etc) and complete renewable energy systems.

Energy technologists are also needed in the area of system design. System design is the process of selecting sizing and configuring components to form a complete system. For small, simple systems such as a solar thermal system for residential applications or a stand-alone photovoltaic (PV) system for lighting or water pumping applications, the required knowledge can obtained fairly quickly and easily by taking one or two courses. For larger or more complex systems, more training will usually be required and may range from a certificate program consisting of three or more courses to a two-year or four-year program.

Architects and Engineers (A&E) are the design professionals responsible for preparing the plans and specifications used by contractors on large construction projects. Consequently, the responsibility for designing and possibly managing large renewable energy projects often is assumed by A&E firms. Examples of such projects include large commercial PV systems on buildings and utility-scale PV systems and large wind farms.

[4] Refer to Appendix B for a list of the Greenforce Florida Team membership

As markets for renewable technologies expand, so does the demand for marketing personnel, entrepreneurs, and sales professionals. Often the individuals responsible for selling renewable energy systems are also responsible for assessing the suitability of sites for renewable energy installations, and for estimating construction costs. Many renewable energy companies are recruiting marketing majors to train them in site assessment and construction cost estimation.

Research and Development (R&D) is absolutely necessary to advance science and engineering, develop new materials and processes, and identify technological breakthroughs that will have profound effects on our lives. Students interested in R&D should plan on science and engineering undergraduate programs followed by graduate studies that address significant energy and environmental challenges.

Meeting the ever increasing energy demands of the country will require not only a large number of small renewable energy applications but also many very large systems. These large systems require professionals that understand the very important and necessary role that financing plays in project implementation. Likewise, due to their complexity, these large projects will require professionals with expertise in construction cost accounting. An undergraduate major in finance and accounting, coupled with a minor or a certificate in a technical field, will provide a strong foundation for a career in renewable energy.

Renewable energy technologies and government policies change rapidly. Professionals who can analyze and anticipate the effects of changing policy are of value to both industry and government. The renewable energy industry is becoming more crowded and more highly competitive. Industry executives need policy analysts and planners who can help develop business strategies that will help them succeed. Government needs professionals with similar skills to meet the needs of their citizens. Backgrounds in political science, computer science, and business administration should prove useful to individuals seeking careers in policy and planning.

The following are some of the degrees, certifications or licenses required within the alternative energy arena:

- Solar or Electrical Contractor
- North American Board of Certified Energy Practitioners (NABCEP) Certified PV, Solar Thermal or Small Wind Turbine Installer
- Graduate of an Electrical of Other Construction Trade Apprenticeship Program
- North American Board of Certified Energy Practitioners (NABCEP) Entry Level Certificate of Knowledge in PV
- Academic or Non-Credit Certificate Program Recipient (three to six courses)
- Architecture or Engineering Degree
- Associate in Science (A.S.) or Associate in Applied Science (A.A.S) Degree in Electronics, Building Sciences, Electrical or Mechanical Construction, Energy Management, Engineering Technology or Renewable Energy Technology Program
- Two or Four-Year Degree in Computer Science, Business, or Political Science
- Bachelor in Engineering Technology Degree in Construction, Mechanical Design or Electrical Systems
- Post-Graduate Degree in Science or Engineering

Based on direction from the Greenforce Florida Team, the Department of Education is working collaboratively with a group of stakeholders to fast-track the development of the career pathways, standards, benchmarks and frameworks for several solar industry occupations. Through the efforts of

the Greenforce Florida Team a green-collar workforce will be prepared to serve Florida's growing alternative energy industries.

2. "Green" the United States Department of Education (USDOE) Career Clusters to help prepare more Floridians to obtain jobs in the alternative energy industries.

Many new green jobs are similar to existing jobs but will require some additional skills in the construction industry, such as roofers, plumbers, electricians and other related occupations. However, given the broad interdisciplinary impact of the energy field, it is necessary to explore all career clusters to see how energy may affect existing occupations and which new jobs may emerge. From manufacturing industries where solar panels, heating systems, fuel cells, or biomass technologies are being produced to environmental fields, transportation industries, or health occupations, the infusion of sustainable solutions and alternative energies should become a priority in the new green economy.

Greenforce Florida will use the USDOE Workforce Education Career Clusters Pathways as a platform. Greenforce Florida will identify occupations that will be affected by the green economy. Pertinent learning objectives will be added or updated to address the growing needs for new skills in these emerging industries. The following are offered as examples of occupations where the infusion of green technologies and principles may be appropriate. The Greenforce Florida Team will conduct further analysis to define sets of skills necessary for each occupation.

Agriculture, Food and Natural Resources
- Agribusiness Systems
  - Agriculture Products Buyer
  - Farm Manager
  - Product Sales Representative
- Environmental Systems
  - Environmental Sampling and Analysis
  - Pollution Prevention and Control Managers
  - Water Quality Managers
- Natural Resources Systems
  - Geologists
  - Hydrologists
  - Environmental Interpreters
- Plant Systems
  - Agricultural Educators
  - Bioinformatics Specialists
  - Plant Breeders and Geneticists

Architecture and Construction
- Construction
  - Electrician
  - Roofer
  - Plumber
  - Insulation worker
  - Equipment and Materials Manager
- Pre-Construction
  - Architectural and civil drafters
  - Electrical and Electronics Engineering Technicians
  - Landscape Architects
  - Environmental Designer

- Maintenance Operations
  - Pipe Fitter
  - Heating, ventilation, and refrigeration
  - Electrician
  - Glazier

Health Science

- Biotechnology Research and Development
  - Biochemist
  - Lab Assistants
  - Research Assistants

Manufacturing

- Health, Safety and Environmental Assurance
  - Environmental Specialists
  - Safety Technicians
- Logistics and Inventory Control
  - Process Improvement
  - Quality Control Technicians
- Maintenance, Installation and Repair
  - Electrical Installers/Repairers
  - Facility Electricians
  - Plumbers, Pipe Fitters and Steam Fitters
  - Industrial Maintenance Technicians
- Manufacturing Production Process
  - Manufacturing Technicians
  - Precision Inspectors, Testers and Graders
  - Production Managers
- Production
  - Automated Manufacturing Technicians
  - Sheet Metal Workers
  - Welders

Science, Technology, Engineering and Mathematics

- Engineering and Technology
  - Agricultural Technician
  - Electrician
  - Quality Technicians
  - Facilities Technician
- Science and Math
  - Lab Technician
  - Technical Writer
  - Research Technician

Transportation, Distribution and Logistics

- Facility and Mobile Maintenance
  - New Fuels Systems Deployment and Maintenance
  - Industrial Equipment Mechanics
- Health, Safety and Environmental Management
  - Environmental Compliance Inspectors
  - Environmental Science and Protection Technicians

3. The Greenforce Florida Team should begin identifying alternative energy occupations by those that requiring short term training now and those that require two- or four-year degrees. By developing task analysis for those most needed occupations, the educational institutions can begin training via fast-track methods (workshops, non-credit options, and postsecondary adult vocational programs) and develop long-term educational paths for an educated green workforce.

4. The Greenforce Florida Team and the Agency for Workforce Innovation should work to identify what and where the needs are for the many types of green jobs being created in Florida. The Greenforce Florida Team will create a "Green Jobs Handbook" for Florida. Once the occupations for the regions are identified, work can begin to create the training/curriculum needs for the entire state; and institutions can decide which training to provide to support their local regions green workforce needs.

5. The Greenforce Florida Team recommends that all public educational institutions work together – secondary, postsecondary, technical colleges and state colleges – to ensure that alternative energy training and education will transfer seamlessly across the state. Dual enrollment opportunities should be created and offered to increase the enrollments of secondary students into postsecondary institutions; thus, increasing the trained workforce at a faster pace.

6. School districts should be encouraged to Include "Alternative Energy and its Applications" as a Major/Minor for Florida's high school students. This major/minor will include such classes as core sciences, AP Environmental Science, Solar Energy I and II, career education classes, and dual enrollment (DE) courses for a flexible, coherent field of study for students with varying academic skills.

7. The Greenforce Florida Team should explore the possibility of permitting Solar Energy I and II courses to count as science credits toward high school graduation. Currently, Solar Energy I and II are science electives.

8. The Greenforce Florida Team should review teacher certification requirements for alternative energy courses and develop findings and recommendations, if warranted.

9. Technical Centers and colleges will need to adopt new strategies and work closely together in creating customized, including abbreviated, programs to facilitate movement of existing workers into the alternative energy workforce. Florida's current curriculum offerings at postsecondary institutions and community colleges are designed primarily for new-entry students. The training effort for initially populating an alternative energy workforce will focus primarily on re-training or expanding the skills sets of existing workers. Close collaboration between Workforce Florida Inc., Agency for Workforce Innovation, and the Department of Education will be essential to formulating curriculum offerings that are responsive to and aligned with these needs.

10. The Greenforce Florida Team should pursue the creation of an Alternative Energy Primary Learning Center (Web based) for educators that allows for student and teacher collaboration. Since no state-approved textbook or ancillary materials exist, there is a vacuum of viable curriculum at the secondary level. In this online, secure community, teachers could exchange "classroom tested" materials, and students could build and foster relationships with peers across the state.

11. Greenforce Florida should be involved in the development of uniform curriculum guidelines in Alternative Energies for industry training and education in Florida, including Solar, Solar Thermal, Wind, Biomass, Fuel Cells, Batteries, Ocean Energies, and other emerging technologies. The goal

is to create a series of uniform but flexible templates, so each school can adapt the specific content and delivery system to the needs of its region.

In developing these templates, Greenforce Florida should take advantage of existing research and work completed by the Florida Solar Energy Center, Florida Banner Centers for Energy, Interstate Renewable Energy Council, North American Board of Certified Energy Practitioners, National Renewable Energy Laboratory, Florida Energy Systems Consortium, and other Institutes, colleges and universities around the country.

12. The Greenforce Florida Team should create a concerted statewide effort to provide information about career opportunities leading to emerging jobs in alternative energy industries. As part of the awareness campaign, consideration should be given to career exploration in the middle schools; therefore, helping to design an introduction to alternative energies careers component. Additionally, career awareness strategies should be developed and implemented that are directed towards community college students.

    Career pathways could begin with the development of courses appropriate for high school career academies, with the infusion of energy literacy into academic subjects, and articulation into postsecondary levels. Existing programs could be updated when necessary or new ones created to provide:

    - Continuing education workshops to update skills of existing workforce in the Construction Industry, Manufacturing, Transportation, Engineering Technology Agriculture, Health, etc.
    - Career Education Certificates.
    - Industry Certifications: Adopting or adapting existing ones and developing new ones with industry support.
    - College credit certificate options under A.S./A.A.S. degrees.
    - Advanced Technical Certificates for specializations beyond 4 year degrees.
    - Transferable courses for Baccalaureate options.

INTRODUCTION

Purpose. The purpose of this profile is to present information that will assist Florida in increasing the number and skill level of workers who are available to meet the workforce needs of Florida's current and emerging alternative energy industries. It is anticipated that Florida will need "Green Tech" and "Green-collar" workers to meet the growing job demands.

This profile includes nine distinct information sections that policymakers, educators, alternative energy representatives, students and Floridians need to fully understand how Florida can be postured to successfully prepare an alternative energy workforce. The nine sections presented in this profile are:

1. Green-collar Jobs, Research on How Cities Can Link Residents to Green-collar Jobs and Job Opportunities for the Green Economy. The information presented in this section explains the terminology and language often used in the green job/economy movement. Alternative energy enterprises are often included in research and discussions regarding Florida's green economy.

2. Alternative Energy Definitions and Available Alternative Energy Resources in Florida. It is important to understand the numerous alternative energy source definitions and have information on the availability of these sources of alternative energy to have a better understanding of how they may impact our economy and workforce needs.

3. Energy Goals and Policies. National and state energy goals and policies directly impact the growth of Florida's alternative energy industries and thus potential job growth. Relevant national and state energy goals and policies are presented in this section. Florida's policies essentially frame alternative energy industries expansion opportunities and possibilities within Florida.

4. Key Alternative Energy Workforce Entities. Many associations and organizations play a pivotal role to ensure that Florida has a well-trained workforce that meets the needs of alternative energy industries including: Center for Energy Workforce Development, Employ Florida Banner Center for Alternative Energy, Employ Florida Banner Center for Construction, Employ Florida Banner Center for Energy, Florida Advanced Technological Education Center, Florida Department of Education – Division of Workforce Education, Florida Energy Systems Consortium, The Florida Energy Workforce Consortium, Florida Solar Energy Center, Florida Solar Energy Research and Education Foundation, and Workforce Florida, Inc.

5. Preparing Florida's Alternative Energy Workforce. This section presents information on Florida's science standards, programs and partnerships that are currently integrated into Florida's public education system that provide opportunities for students to learn about alternative energy and enter an alternative energy career pathway. Specifically, this section addresses the following:
    - Next Generation "Energy" related Sunshine State Standards
    - Career Clusters
    - Secondary Career and Technical Education Programs
    - Career and Professional Education (CAPE) Academies
    - Major Areas of Interest
    - Florida Energy and Education Partnerships

- Florida Solar Energy Center K-12 Activities

6. Alternative Energy Programs and Courses Currently Offered in Florida School Districts, Technical Centers and Colleges. Public school districts, public technical centers and public colleges completed a survey that identifies programs and courses that are offered at their institution related to alternative energy. The results of the survey are provided in this section.

7. Alternative Energy Industry Workforce Needs in Florida. Alternative energy industries in Florida completed an online survey to communicate to the Department of Education their workforce needs now and in the future.

8. Florida's Alternative Energy Research. Research innovation leads to product commercialization. The Florida Energy Systems Consortium's vision is to be the "world leader in energy research, education, technology, and energy systems analysis". Florida also has a renewable energy technologies grant program created to stimulate capital investment in our state and to promote and enhance the statewide utilization of renewable energies technology. Florida's Farm to Fuel initiative was created to enhance the market for and promote the production and distribution of renewable energy from Florida-grown crops, agriculture wastes and residues and other biomass and to enhance to the value of agriculture products or expand agribusiness in Florida.

9. Other States' Select Information. This section briefly describes the Michigan Green Jobs Initiative, provides information on a few educational programs in Arizona, Massachusetts, Wisconsin and identifies green job workforce development legislation in state legislatures across the country.

SCOPE

Clean energy, renewable energy, green energy, whatever you call it, the alternative energy industry is about producing reliable energy with minimal environmental impacts.[5] Alternative energy is typically defined as coming from sources that do not deplete natural resources or harm the environment. The term *alternative* is used to contrast with fossil fuels according to some sources. This alternative energy workforce profile focuses on the following types of alternative energy industries: biomass, geothermal, hydroelectric, hydrogen (produced with renewable energy), nuclear, ocean, solar, and wind.

- Since the Florida Energy Workforce Consortium has previously identified the workforce challenges and top occupations of concern, this profile does not address fossil energy occupation needs. The consortium defined Florida's energy workforce challenges as: energy demand; workforce by the numbers; aging workforce; and pipeline development initiatives. The top occupations of concern as of the Fall of 2008 include: line installers and repairers; plumbers, pipe fitters and steamfitters; welders; maintenance and repair workers; electricians; engineering technicians, instrumentation and control techs and power plant operators. The Florida Energy Workforce Consortium, formed in 2006, is developing solutions to meet the current and future workforce needs of the state's energy industry. Organized by the Governor's workforce investment board, Workforce Florida, Inc., the FEWC includes representatives from major electric utilities and associations, contractors, organized labor, state economic development, workforce development, and education. The consortium's primary goals are to develop

[5] Emerging Technology Brief, Alternative Energy, Enterprise Florida

accurate projections of future energy industry workforce needs detailed by occupation and to prioritize those needs for focused educational and recruiting efforts.

METHODOLOGY

Multiple research approaches were utilized to develop this Alternative Energy Workforce Profile. Stakeholders that can identify Florida's alternative energy workforce needs and prepare future workers were tapped to assist with this project from the beginning. Both educators and industry representatives were involved with this project.

Lucy Hadi, Chancellor of the Division of Workforce Education, in the Florida Department of Education (DOE), created an Alternative Energy Industry Workforce Liaisons workgroup to assist the DOE with the development of an online survey for alternative energy industries. Refer to Appendix A for a list of the members of this workgroup. Additionally, this group was instrumental in distributing the survey to alternative energy industries across Florida. Most importantly, this work group reviewed the draft report and provided invaluable insight and recommendations. Additionally, a Greenforce Florida Team comprised of industry, college, school district, technical center and Department of Education representatives was formed to develop recommendations and provide assistance with this profile. Refer to Appendix B for a list of the members of the Greenforce Florida Team.

Educators were also included throughout the duration of this project as Department staff conducted site visits of alternative energy programs at high schools, technical centers, and colleges. School District Technical Center Directors, Career and Technical Education Directors, and Community College Occupational Deans were all provided an opportunity to describe the types of alternative energy activities that are currently occurring on their campuses. Educators also reviewed the draft report and provided recommendations.

Educators and industry representatives met in December to discuss issues surrounding the development of the talent and expertise that is and will be needed to support alternative energy industries in Florida. The next steps and recommendations presented in this profile were developed by industry representatives and educators working together.

An extensive literature review was conducted in order to develop this profile. Finally, Department of Education, Division of Workforce Education staff provided valuable insights and ideas on how Florida can increase the number and skill level of workers who meet the workforce needs of Florida's current and emerging alternative energy industries.

SECTION 1: GREEN-COLLAR JOBS AND RESEARCH TO DETERMINE HOW CITIES CAN LINK RESIDENTS TO GREEN-COLLAR JOBS

Amid a challenging economic outlook, plummeting housing prices, rising foreclosure rates, record-high oil prices, sinking consumer confidence, and a looming recession, 2007 was another banner year for clean energy with no signs of a slowdown in 2008. Solar, wind, biofuels, geothermal, hybrid and all-electric vehicles, advanced batteries, green buildings, and other clean-energy-related technologies and markets provided bright spots in an otherwise sluggish economy.[6] By 2010, "green employment" will reach 5.8 million jobs and by 2020, a whopping 6.9 million. Moreover, sales in the green industries—including energy suppliers and consumer-products makers—are expected to climb from $341 billion in 2010 to $496 billion in 2020. When industries grow like this, you can expect significant job creation. [7]

GREEN-COLLAR JOBS

We are all quite familiar with the colorful distinction of the different employment sectors. "White-collar" employment includes salaried professionals and clerical workers. "Blue-collar" employment involves manual labor. Now a third sector is emerging the "green-collar" workers.[8]

"Green-collar" jobs involve products and services that are environment-friendly. Any organization that seeks to improve upon the environment is considered "green" – and if it employs individuals to that effect, then it has created "green-collar" jobs. "Green-collar" jobs include designers, manufacturers, installers, maintenance workers, architects, builders, energy raters, code officials and building inspectors. Also, the transportation sector uses alternative fuel that will require mechanics for electric, hybrid-electric, natural gas, and hydrogen fueled vehicles. The "green-collar" sector is booming; it is currently the fifth largest market sector in the United States.[9] In Florida, as recent as October 25, 2008, Palm Beach Community College (PBCC) announced that it has teamed with Florida Power & Light Company to start producing graduates for careers in alternative energies, also dubbed "green-collar jobs." Graduates of the new program are expected to earn between $45,000 and $50,000 right out of school. Florida Power & Light Company donated $30,000 for the creation of the new program, and have promised to employ graduates each year upon their completion of the program. The degree will have a focus on both fossil fuel and alternative and renewable energies. As a result of the program being announced in the Palm Beach Post, PBCC has received over 400 inquires about the Power Technology Program with over half only interested in the "green energy" careers of wind, solar, bio-fuels, and/or hydro.

The Political Economy Research Institute (University of Massachusetts) "Job Opportunities for the Green economy: A State-by-State Picture of Occupations that Gain from Green Investment" (June, 2008) report provides information on the kind of jobs that are needed to fight global warming and build a green economy in the United States. A green economy is based on the efficient use of energy, reducing polluting emissions and promoting the use of renewable sources of power. A green economy uses these investments to create new opportunities, good jobs, and stronger communities. The term "green jobs" has spread rapidly over the past year. The authors seek to make the term concrete by

[6] Clean Energy Trends, Clean Edge – The Clean-Tech Market Authority, March 2008
[7] Herman Trend Alert: On-the-Edge Jobs, October 15, 2008
[8] "White-collar, Blue-collar, Green-collar?" Alternative Energy News, October 17, 2007, http://www.alternative-energy-news.info/white-blue-green-collar/
[9] Ibid.

highlighting many—but by no means all—of the occupations that will play a central role in building the green economy. The authors do not attempt here to estimate how much growth there is likely to be in any area of green investments or green jobs in the United States, rather they provide a snapshot of some of the key industries and occupations that will experience increasing growth through green investments.

The authors specifically focus on six key strategies for attacking global warming and highlight some of the major occupations associated with each of the strategies. The authors provide a list of the six green economy strategies that they examined: 1) building retrofitting; 2) mass transit; 3) energy-efficient automobiles; 4) wind power; 5) solar power; and 6) cellulosic biomass fuels; and a list of representative occupations that will be needed for advancing each of these strategies. For the purpose of this alternative energy workforce profile a few tables were selected from the University of Massachusetts report noted in the footnote. Refer to Appendix C for select tables from the report. Refer to http://www.peri.umass.edu/green_jobs/ to obtain a complete copy of the report.

University of Massachusetts researchers provide a snapshot of the kinds of jobs that are needed to build a green economy in the United States.[10] They found that the vast majority of jobs associated with these strategies are in the same areas of employment in which people already work today. For example, constructing wind farms creates jobs for sheet metal workers, machinists and truck drivers; increasing the energy efficiency of buildings through retrofitting relies on roofers, insulators and building inspectors; and expanding mass transit systems employs civil engineers, electricians, and dispatchers. So green jobs don't just mean new jobs—they can also mean greater job security for people who already work in these fields.[11] What makes these entirely familiar jobs "green" is that the people working in them are contributing their everyday labors toward building a green economy. The report concludes that what is clear is that millions of U.S. workers, across a wide range of familiar occupations, states, and income and skill levels will benefit from defeating global warming and transforming the United States into a green economy.

RENEWABLE ENERGIES REVENUES AND JOBS IN FLORIDA

Workforce Florida's Employ Florida Banner Center for Alternative Energy conducted a Workforce Needs Assessment for Florida's alternative energy industries to determine the number of current workers within the alternative energy industry sector.[12] The following Table provides an initial estimate of Florida's renewable energies revenue and jobs.

[9] Pollin, Robert and Jeanette, Wicks-Linn, "Job Opportunities for the Green Economy: A State-by-State Picture of Occupations that Gain from Green Investment." The Political Economy Research Institute (University of Massachusetts), *June 2008.*
[11] Ibid.
[12] Alternative Energy Banner Center, "*Workforce Needs Assessment*" from the Florida Solar Energy Center (June 2008).

Table 1
Florida Renewable Energies Revenue and Jobs, 2006

Industry Segment	Revenues/Budgets (billions)	Direct Jobs	Total Jobs (direct plus indirect)
Photovoltaics	0.06	422	973
Solar Thermal	0.1	50	118
Biomass			
Ethanol	0.39	4,154	9,548
Biodiesel	0.02	171	391
Biomass Power	1.05	4,092	9,424
Fuel Cells	0.06	298	688
Hydrogen	0.05	248	570
Total, Private Industry	1.59	9,185	21,142
Total, State and Local Government	0.06	155	357
Trade and Professional	0.04	93	214
Total all Sectors	1.69	9,433	21,713

From Table 1, the numbers for biodiesel, biomass power and fuel cells are considered to be large since Florida does not have any significant manufacturing or production facilities in these three areas.

SAMPLE OF GREEN JOBS IN FLORIDA

Florida's Agency for Workforce Innovation (AWI) has identified a "Sample of Jobs in a Green Economy" http://www.labormarketinfo.com/library/pubs/green/green_jobs_brochure_fl.pdf. Listed below is sample of AWI's Green Jobs related to alternative energy.

BioFuels

- Agricultural inspectors
- Agricultural workers
- Agriculture and forestry supervisors
- Chemical engineers
- Chemical equipment operators and tenders
- Chemical plant and system operators
- Chemical technicians
- Chemists
- Electrical and electronics repairers, commercial and industrial equipment
- Farm product purchasers
- Industrial truck drivers
- Laborers and freight, stock and material movers

- Mixing and blending machine setters, operators and tenders
- Sales representatives, wholesale and manufacturing, technical and scientific products
- Separating, filtering, clarifying, precipitating and still machine setters, operators, and tenders
- Shipping, receiving and traffic clerks
- Truck drivers, heavy and tractor-trailer

Smart Grid

- Computer software engineers
- Construction laborers
- Electrical engineers
- Electrical equipment assemblers
- Electrical equipment technicians
- Electrical power line installers and repairers
- Machinists
- Operating engineers
- Team assemblers

Solar Power

- Construction equipment operators
- Construction managers
- Electrical engineers
- Electrical equipment assemblers
- Electricians
- Industrial machinery mechanics
- Installation helpers
- Laborers
- Metal fabricators
- Welders

Wind Power

- Computer-controlled machine tool operators, metal and plastic
- Construction equipment operators
- Customer service representatives
- Cutting, punching and press machine setters, operators and tenders, metal and plastic
- Drilling and boring machine tool setters, operators and tenders, metal and plastic
- Electrical equipment assemblers
- Environmental engineers
- First line production supervisors
- Industrial truck drivers
- Industrial production managers
- Laborers and freight, stock and material movers
- Machinists
- Maintenance and repair workers
- Millwrights
- Production, planning and expediting clerks
- Sheet metal workers
- Structural iron and steel workers

- Team assemblers
- Welders, cutters, solderers and brazers

For additional information on "green jobs" refer to *The Green Jobs Handbook,* authored by the Environmental Defense Fund (www.edf.org/cagreenjobs). The Green Jobs Handbook is a an expansive listing of green jobs throughout the California economy that includes job descriptions, salary information, minimum education requirements, potential certifications, employer types, job market growth potential, and much more.

RESEARCH TO DETERMINE HOW CITIES CAN LINK RESIDENTS TO GREEN-COLLAR JOBS

The Apollo Alliance and Green For All, the Center for American Progress and the Center on Wisconsin Strategy released a joint report in March 2008, titled, "*Green-Collar Jobs in America's Cities – Building Pathways out of Poverty and Careers in the Clean Energy Economy*" that focuses on local green jobs in clean energy industries – energy efficiency, renewable energy, alternative transportation, and low-carbon fuels. The authors state that this publication specifically offers guidance on how cities can link residents to green-collar jobs. They hope it will help cities across America develop strategies to expand their green economies and connect the promise of the global clean energy future to the practical realities of local green economic workforce development.

Although their report is focused on providing cities and regions ways to leverage local environmental, economic development, and workforce development programs to grow green-collar jobs of the future the basic principles presented below could also be applied to Florida's initiative to grow green jobs. The report presents the following steps for cities to follow to prepare their green-collar workforce.[13]

> *Once you've identified your goals, assessed your opportunities, and enacted the policies and programs to spur green job growth in your community, the next step is to prepare a green-collar workforce to take advantage of these new job opportunities. Your green-collar jobs initiative should focus on training for jobs that actually exist and on providing opportunities for low income residents who have often been excluded from past workforce and economic development programs. To meet both objectives, your green-collar workforce training program needs to have two distinct but related elements: Green-collar jobs training partnerships and a Green Job Corps, or similar program, to create green pathways out of poverty. As you consider how best to develop both elements, here are several essential points to keep in mind:*
>
> ***Green-collar job training initiatives should be developed in concert with existing workforce and economic development strategies, not as stand-alone, boutique programs.*** *This is important for a number of reasons. First, the workforce development system in this country is already too fragmented. Many communities already suffer from disconnected programs that lack a strategic and systemic approach to serving their dual customers: industry and workers. Green-collar job training initiatives should be vehicles for increasing the integration and strategic coherence of your workforce programs, not an impetus for further fragmentation. Second, to meet the expanding demand for green-collar workers, our nation needs to be ready to create green-collar job training programs throughout the country and to scale. Neither goal will be achievable unless we build our programs on the foundation of the workforce system already in place in cities, large and small, across America. Third, while*

[13] "Green-collar Jobs in America's Cities – Building Pathways Out of Poverty and Careers in the Clean Energy Economy." Apollo Alliance-Green for All with the Center for American Progress and the Center on Wisconsin Strategy, (March, 2008)

making our economy cleaner and more efficient will create some new industries and many new kinds of jobs, much more of it will involve transforming and expanding the industries and jobs we already have. From a workforce development perspective, this means less focus on creating exotic new courses of study, and more emphasis on embedding green curricula into existing courses of study.

Green-collar job workforce efforts should be linked, whenever possible, to existing policies, programs and investments aimed at growing the green economy and combating climate change. *For example, a city might require that green businesses that benefit from municipal tax credits or other incentives participate in green-collar job training partnerships, allocate funds to on-the-job training for current workers transitioning to the new energy economy, or hire workers from a Green Jobs Corps or similar program.*

Green-collar job training programs should provide entry points for a range of workers: *from those who have been laid off; to underemployed workers struggling to make ends meet in dead-end, minimum-wage jobs; to unemployed men and women trying to get onto some kind of career track; to disconnected young people looking for a point of entry into the mainstream economy. Each of these future workers needs a different kind of support to get started on a career pathway in the green economy. Some need transitional financial aid while training to learn new skills. Others require help learning "soft skills" such as resume building and interview techniques. A number will benefit from short-term job placements in agencies or industries participating in green-collar job training partnerships. Still others need targeted, comprehensive support to prepare them to succeed in a conventional skills training program.*

SECTION 2: ALTERNATIVE ENERGY DEFINITIONS AND AVAILABLE RESOURCES IN FLORIDA

This section briefly provides basic definitions for certain types of alternative energy and information on the availability of some alternative energy in Florida.

ALTERNATIVE ENERGY DEFINITIONS

Florida's economy and quality of life depend on a secure, adequate and reliable supply of energy. As the fourth most populous state, Florida ranks third nationally in total energy consumption. As a result, Florida is leading the nation on the journey for discovering and using the newest and cleanest energy technologies such as hydrogen, solar and biofuel.[14] Refer to Table 2, to learn about select alternative energy terms and definitions.

Table 2
Alternative Energy Source Definitions[15]

Algae Fuel	Algae fuel, also called algal fuel, oilgae, algaeoleum or third generation biofuel, is a biofuel from algae. Compared with second generation biofuels, algae are high-yield high-cost (30 times more energy per acre than terrestrial crops) feedstocks to produce biofuels. One biofuels company has claimed that as the whole organism uses sunlight to produce lipids, or oil, algae can produce more oil in an area the size of a two-car garage than an entire football field of soybeans. Though there are many factors to overcome for algae to be a wide-spread source of energy, several positive factors can already be considered. Algal fuels do not impact fresh water resources, and can use ocean and wastewater. The cost of various algae species is typically between US $5–10 per kg dry weight,[citation needed] with research actively looking to reduce capital and operating costs and make algae oil production commercially viable. With the record oil price increases since 2003, competing demands between foods and other biofuel sources and the world food crisis, there is much interest in algaculture (farming algae) for making vegetable oil, biodiesel, bioethanol, biogasoline, biomethanol, biobutanol and other biofuels. The production of biofuels to replace oil and natural gas is in active development, focusing on the use of cheap organic matter (usually cellulose, agricultural and sewage waste) in the efficient production of liquid and gas biofuels which yield high net energy gain. One advantage of many biofuels over most other fuel types is that they are biodegradable, and so relatively harmless to the environment if spilled. The United States Department of Energy estimates that if algae fuel replaced all the petroleum fuel in the United States, it would require 15,000 square miles (40,000 square kilometers), which is a few thousand square miles larger than Maryland, or 1.3 Belgiums. This is less than 1/7th the area of corn harvested in the United States in 2000.

[14] Florida's Department of Environmental Protection's Web site (http://www.floridaenergy.org/energy/)
[15] From Wikipedia, the free encyclopedia

Biofuel[16]	**Biofuels** are renewable fuels made from organic matter rather than from fossil fuels. Today's primary biofuels are ethanol and biodiesel. Biofuels can help reduce harmful tailpipe emissions, greenhouse gases, and our dependence on imported oil, while supporting domestic agriculture. Currently, Florida is partnering in a range of biofuel-related projects throughout the state, aimed at bringing biofuels into the mainstream by making them more widely available. Florida's large biomass supply is conducive for the development of significant cellulosic ethanol production. In addition, Florida's subtropical climate is ideal for growing algae as well as Jatropha plants, both of which are excellent sources for the production of biodiesel. Ethanol also known as ethyl alcohol or grain alcohol is a flammable, colorless chemical compound and is the alcohol found in alcoholic beverages. Ethanol is also the most widely used biofuel today. It can be made by converting starch sources into sugars, which are then fermented, producing ethanol. Ethanol can also be made from cellulosic sources, which include wood, grasses, and other non-edible parts of plants. Ethanol is used as an oxygenate in gasoline, helping it burn cleaner and reducing tailpipe emissions, as well as reducing our dependence on imported oil. Biodiesel – is a fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils, such as jatropha, soy, etc.; animal fats; oil wastes; or algae. Biodiesel is most often used as a mixture of twenty percent (or less) biodiesel blended with diesel fuel.
Biomass	**Biomass** refers to living and recently dead biological material that can be used as fuel or for industrial production. Most commonly, biomass refers to plant matter grown to generate electricity or produce biofuel, but it also includes plant or animal matter used for production of fibers, chemicals or heat. Biomass may also include biodegradable wastes that can be burnt as fuel. It excludes organic material which has been transformed by geological processes into substances such as coal or petroleum. Industrial biomass can be grown from numerous types of plants, including miscanthus, switchgrass, hemp, corn, poplar, willow, sorghum, sugarcane, and a variety of tree species, ranging from eucalyptus to oil palm (palm oil). The particular plant used is usually not very important to the end products, but it does affect the processing of the raw material. Production of biomass is a growing industry as interest in sustainable fuel sources is growing. Although fossil fuels have their origin in ancient biomass, they are not considered biomass by the generally accepted definition because they contain carbon that has been "out" of the carbon cycle for a very long time. Their combustion therefore disturbs the carbon dioxide content in the atmosphere. Plastics from biomass, like some recently developed to dissolve in seawater, are made the same way as petroleum-based plastics, are actually cheaper to manufacture and meet or exceed most performance standards. But they lack the same water resistance or longevity as conventional plastics.

[16] Florida Department of Environmental Protection's Web site (http:www.floridaenergy.org/energy)

Geothermal	**Geothermal** is related to energy and may refer to: • Geothermal (geology), heat that comes from within the Earth • Direct exchange geothermal heat pump, a method of heating and cooling with the energy of the earth using direct exchange of heat • Geothermal desalination, the production of fresh water using heat energy extracted from underground rocks • Geothermal heating, a method of heating and cooling a building using underground heat • Geothermal power, electricity generated from naturally occurring geological heat sources • Hot dry rock geothermal energy, heating water in hot deep rock • Geothermal heat pump, a method of heating and cooling using a heat pump with the earth as a heat reservoir • Earth sheltering, constructing a building into a hill side or Earth berm to reduce heating and cooling requirements • Earth cooling tubes, using ambient earth temperature to cool and dehumidify air.
Hydroelectricity	**Hydroelectricity** is electricity generated by hydropower, i.e., the production of power through use of the gravitational force of falling water. It is the most widely used form of renewable energy. Once a hydroelectric complex is constructed, the project produces no direct waste and has a considerably different output level of the greenhouse gas carbon dioxide (CO2) than fossil fuel powered energy plants. Worldwide, hydroelectricity supplied an estimated 715,000 MWe in 2005. This was approximately 19% of the world's electricity (up from 16% in 2003), and accounted for over 63% of electricity from renewable sources. Some jurisdictions do not consider large hydro projects to be a sustainable energy source, due to the human, economic and environmental impacts of dam construction and maintenance.
Nuclear Power	**Nuclear power** is any nuclear technology designed to extract usable energy from atomic nuclei via controlled nuclear reactions. The most common method today is through nuclear fission, though other methods include nuclear fusion and radioactive decay. All utility-scale reactors heat water to produce steam, which is then converted into mechanical work for the purpose of generating electricity or propulsion. Today, more than 15% of the world's electricity comes from nuclear power, more than 150 nuclear-powered naval vessels have been built, and a few radioisotope rockets have been produced.
Solar Energy[17]	**Solar energy** refers to the radiant energy of the Sun. Harnessing this heat and sunlight can provide the world with an abundant energy resource. Today's solar technologies tap this renewable resource to provide electricity, hot water, heat, light, and even cooling, for homes, businesses, and industry. In Florida, solar electric systems (PV or photovoltaic systems), solar water heaters, and solar pool heaters are the most commonly installed solar equipment.
Tidal Power	**Tidal power**, sometimes called **tidal energy**, is a form of hydropower that converts the energy of tides into electricity or other useful forms of power. Although not yet widely used, tidal power has potential for future electricity generation. Tides are more predictable than wind energy and solar power. Historically, tide mills have been used both in Europe and on the Atlantic coast of the USA. The earliest occurrences date from the Middle Ages or even from Roman times.

[17] Florida Solar Energy Education and Research Foundation (www.flaseia.org)

Wave Power	**Wave power** refers to the energy of ocean surface waves and the capture of that energy to do useful work—including electricity generation, desalination, and the pumping of water (into reservoirs). Wave power is a form of renewable energy. Though often co-mingled, wave power is distinct from the diurnal flux of tidal power and the steady gyre of ocean currents. Wave power generation is not currently a widely employed commercial technology although there have been attempts at using it since at least 1890. The world's first commercial wave farm is based in Portugal, at the Aguçadora Wave Park, which consists of three 750 kilowatt Pelamis devices. The north and south temperate zones have the best sites for capturing wave power. The prevailing westerlies in these zones blow strongest in winter.
Wind Power	**Wind Power** is the conversion of wind energy into a useful form, such as electricity, using wind turbines. At the end of 2007, worldwide capacity of wind-powered generators was 94.1 gigawatts. Although wind produces about 1% of world-wide electricity use, it accounts for approximately 19% of electricity production in Denmark, 9% in Spain and Portugal, and 6% in Germany and the Republic of Ireland (2007 data). Globally, wind power generation increased more than fivefold between 2000 and 2007. The principle application of wind power is to generate electricity. Large scale wind farms are connected to electrical grids. Individual turbines can provide electricity to isolated locations. In the case of windmills, wind energy is used directly as mechanical energy for pumping water or grinding grain. Wind energy is plentiful, renewable, widely distributed, clean, and reduces greenhouse gas emissions when it displaces fossil-fuel-derived electricity. Therefore, it is considered by experts to be more environmentally friendly than many other energy sources. The intermittency of wind seldom creates problems when using wind power to supply a low proportion of total demand. Where wind is to be used for a moderate fraction of demand, additional costs for compensation of intermittency are considered to be modest.

ALTERNATIVE ENERGY RESOURCES IN FLORIDA

Florida's energy policies drive the growth of alternative energy businesses in Florida, but obviously the availability of the alternative energy is extremely critical in determining potential job growth. The U.S. Department of Energy Web site (http://www.eere.energy.gov/) provides news about advances in renewable energy and energy efficiency in Florida and links to Web sites published by the Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) that contains specific information about Florida. Information provided by the U.S. Department of Energy on Alternative Energy Resources in Florida is provided below.

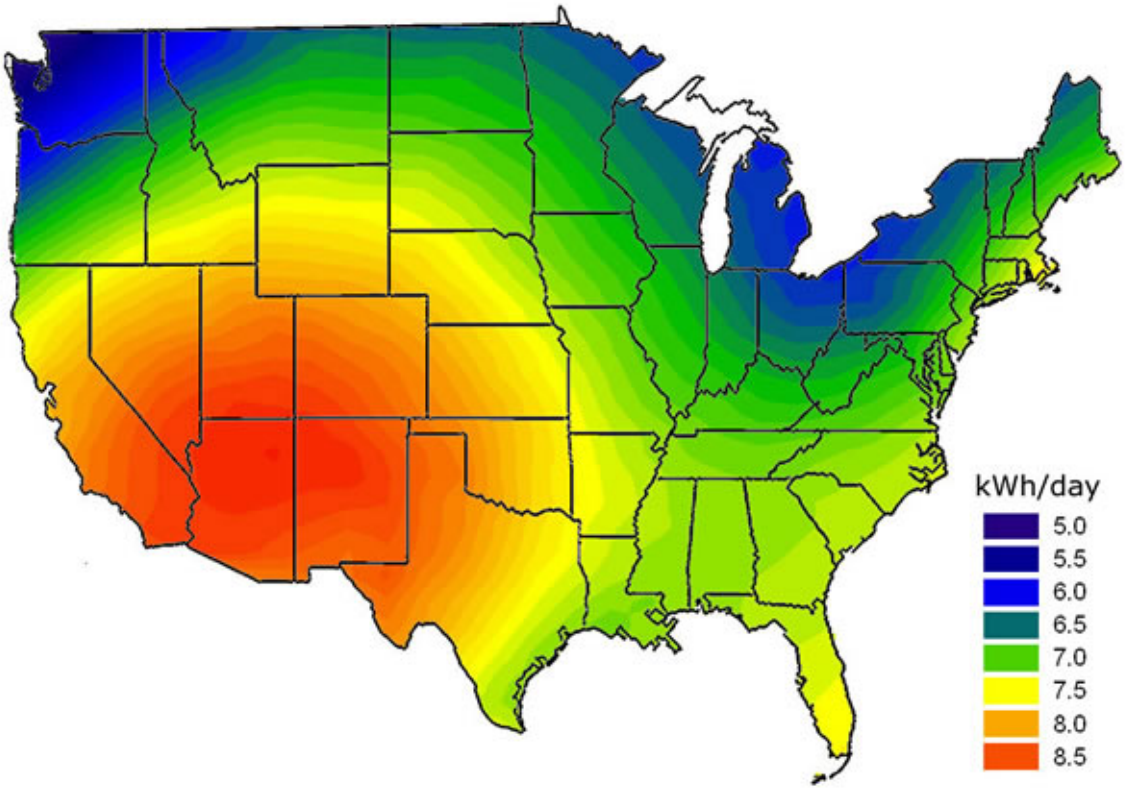
BIOMASS: Studies indicate that Florida has good biomass resource potential. For more state-specific resource information, see Biomass Feedstock Availability in the United States: 1999 State Level Analysis.

GEOTHERMAL: Florida has vast low-temperature resources suitable for geothermal heat pumps. However, Florida does not have sufficient resources to use the other geothermal technologies.

HYDROPOWER: Florida has a low hydropower resource as a percentage of the state's electricity generation. For additional resource information, check out the Idaho National Laboratory's Virtual Hydropower Prospector (VHP). VHP is a convenient geographic information system

(GIS) tool designed to assist you in locating and assessing natural stream water energy resources in the United States.

SOLAR: Solar radiation mapping by both the Florida Solar Energy Center (FSEC) and the Department of Energy show that Florida receives 85% of the maximum solar resource available in the U.S. Though the desert southwest has the largest solar resource in the continental U.S., at 85% Florida still is an ideal location for solar technology installations. For comparative purposes, Florida receives 40% more incident sunlight than Germany - the world leader in solar installations.[18]



WIND: Current resources indicate that Florida may have sufficient wind resources to use large-scale wind turbines near the coasts. In addition, small wind turbines may have applications in some areas. For more information on wind resources in Florida, visit Wind Powering America's U.S. Wind Resource Map. http://www.windpoweringamerica.gov/wind_maps.asp

ENERGY EFFICIENCY: Energy efficiency means doing the same work, or more, and enjoying the same comfort level with less energy. Consequently, energy efficiency can be considered part of your state's energy resource base — a demand side resource. Unlike energy conservation, which is rooted in behavior, energy efficiency is technology-based. This means the savings may

[18] Note: FSEC solar map compares the solar resource for a 2-kilowatt photovoltaic residential application across the entire continental United States, thus representing the relative amount of sunlight available in these regions. Florida produced, on average, 7.2 kWh/day out of a maximum capacity of 8.5 kWh/day, or 85%. www.fsec.ucf.edu/en/publications/html/FSEC-PF-380

be predicted by engineering calculations, and they are sustained over time. Examples of energy efficiency measures and equipment include compact fluorescent light bulbs (CFLs), and high efficiency air conditioners, refrigerators, boilers, and chillers.

Saving energy through efficiency is less expensive than building new power plants. Utility companies can plan for, invest in, and add up technology-based energy efficiency measures and, as a consequence, defer or avoid the need to build a new power plant.

DESIGN happens even before the energy efficient technologies are brought in. Think of it this way, the color and type of roof can result in huge energy savings. Using light colored, reflective roof material is energy efficient, but it is not really considered a technology. Design elements include orientation of the building, ductwork, placement of windows, overhangs, landscaping, insulation, radiant barrier, and much more. These are all things we can easily do now by educating the construction industry.

For more information on current state policies related to energy efficiency, visit the Alliance to Save Energy's State Energy Efficiency Index. For more information on each alternative energy, visit the State Energy Alternatives Technology Options page. For more information, including links to resource maps, energy statistics, and contacts for Florida, visit the Florida Solar Energy Center Web site at (http://www.fsec.ucf.edu/en/) or EERE's State Activities and Partnerships Web site at (http://apps1.eere.energy.gov/states/state_specific_information.cfm/state=FL)

For more technical readers we have provided a synopsis of Florida's renewable energy potential as reported by Navigant Consulting Inc., in it's report titled, "Florida Renewable Energy – Potential Assessment" published in November 2008.

Solar

Photovoltaic
- rooftop mounted 52,000MW
- ground mounted 37,000MW

Concentrating Solar Power (CSP)
- 380MW

Solar Water Heating
- systems greater than 2MW 1,136MW
-

Wind

Onshore
- 1,266MW

Offshore
- 48,662MW

Biomass

- 5,960-13,750MW

Ocean

- 750MW

Hydroelectric

- No potential given in Navigant but Florida has 55.7MW installed

SECTION 3: ENERGY GOALS AND POLICIES

NATIONAL GOALS AND POLICIES

THE ENERGY POLICY ACT OF 2005

The Energy Policy Act of 2005 (P.L. 109-58) was signed by President Bush on August 8, 2005. The new energy law was shaped by competing concerns about energy security, environmental quality, and economic growth. Major provisions in the bill include:

- *Electricity.* The Federal Energy Regulatory Commission (FERC) is authorized to certify a national electric reliability organization (ERO) to enforce mandatory reliability standards for the bulk-power system. Federal power of eminent domain may be used to acquire electric transmission rights-of-way in areas designated as congested by the Secretary of Energy. The act repeals a requirement under the Public Utility Regulatory Policies Act (PURPA) that utilities must purchase power from all qualifying facilities and small power producers at a rate based on the utilities' avoided cost. Also repealed is the Public Utility Holding Company Act of 1935 (PUHCA), which restricted the structure of holding companies of investor-owned utilities.
- *Renewable Fuels Standard.* Gasoline sold in the United States must contain an increasing amount of renewable fuel, such as ethanol or biodiesel. Motor fuels must contain at least 4.0 billion gallons of renewables in 2006, a level that increases by 700 million gallons each year through 2011 before reaching a level of 7.5 billion gallons in 2012.
- *Tax Incentives.* Tax reductions of $14.5 billion over 11 years are provided to encourage domestic energy production and energy efficiency, including about $1.3 billion for energy efficiency and conservation, about $4.5 billion for renewable energy, a $2.6 billion package of oil and gas incentives, nearly $3.0 billion for coal, and more than $3.0 billion in electricity incentives (which includes a new production tax credit for nuclear power).
- *Energy Efficiency.* Improved national energy efficiency is encouraged through new statutory standards, requirements for federal action, and incentives for voluntary improvements.
- *Domestic Energy Production.* The act encourages production on federal lands through royalty reductions for marginal oil and gas wells on public lands and the outer continental shelf. Provisions are also included to increase access to federal lands for drilling activities and other energy projects.

2008 FARM BILL – TITLE IX ENERGY

The Farm Bill continues and expands funding for Federal agency procurement of biobased products, construction and development of advanced biofuel refineries, biomass research and development, and biodiesel education. New programs encourage renewable energy use by biorefineries, renewable energy systems and energy efficiency improvements, rural energy self sufficiency, development of next generation feedstocks, and use of forest and woody biomass for energy production. The bill authorizes an overall $1 billion to fund programs in the energy title that will leverage renewable energy industry investments in new technologies and new feedstocks. Major provisions in the bill include:

- Provides $320 million in loan guarantees for biorefineries producing advanced biofuels
- Provides $35 million for a new program to help existing ethanol facilities reduce their fossil fuel use

- Creates the Rural Energy for America Program (REAP) to provide $250 million in grants and loan guarantees for agricultural producers and rural small businesses to purchase renewable energy systems and make energy efficiency improvements
- Provides $120 million for the Biomass Research and Development Program
- Funds the Bioenergy Program at $300 million
- Creates a Biomass Crop Assistance Program to develop the next generation of feedstocks for renewable energy
- Establishes a sugar-to-ethanol program
- Provides $9 million for the Biobased Markets Program authorizing eligible producers to label biobased products as a 'USDA Certified Biobased Product'
- Funds the Biodiesel Education Program with $5 million to help educate government and private owners of vehicle fleets about the benefits and technical aspects of biodiesel.[19]

THE ENERGY INDEPENDENCE AND SECURITY ACT OF 2007

The Energy Independence and Security Act (P.L. 110-140, H.R. 6) consists mainly of provisions designed to increase energy efficiency and the availability of renewable energy. The highlights of key provisions enacted into law are as follows:

- *Corporate Average Fuel Economy (CAFE)*. The law sets a target of 35 miles per gallon for the combined fleet of cars and light trucks by model year 2020.
- *Renewable Fuels Standard (RFS)*. The law sets a modified standard that starts at 9.0 billion gallons in 2008 and rises to 36 billion gallons by 2022.
- *Energy Efficiency Equipment Standards.* The adopted bill includes a variety of new standards for lighting and for residential and commercial appliance equipment. The equipment includes residential refrigerators, freezers, refrigerator-freezers, metal halide lamps, and commercial walk-in coolers and freezers.
- *Repeal of Oil and Gas Tax Incentives.* The enacted law includes repeal of two tax subsidies in order to offset the estimated cost to implement the CAFE provision.

EMERGENCY ECONOMIC STABILIZATION ACT OF 2008

The Emergency Economic Stabilization Act of 2008, commonly referred to as a bailout of the U.S. financial system, contains the following energy related provisions:

- *Qualified Energy Conservation Bonds*. The bill creates a new category of tax credit bonds to finance State and local government initiatives designed to reduce greenhouse emissions.
- *Extension and Modification of Credit for Energy-Efficiency Improvements to Existing Homes***.** The bill extends the tax credit for energy-efficient existing homes for 2009, and includes energy-efficient biomass fuel stoves as a new class of energy efficient property eligible for a consumer tax credit of $300.
- *Extension of Energy-Efficient Buildings Deduction*. Current law allows taxpayers to deduct the cost of energy-efficient property installed in commercial buildings. The amount deductible is up to $1.80 per square foot of building floor area for buildings achieving a 50% energy savings target.

[19] http://www.ers.usda.gov/FarmBill/2008/titles/titleixenergy.htm

- *Extension of Credit for Energy-Efficiency Improvements to New Homes*. Under current law, contractors receive a credit for the construction of energy-efficient new homes that achieve a 30% or 50% reduction in heating and cooling energy consumption relative to a comparable dwelling.
- *Modification and Extension of Energy-Efficient Appliance Credit*. Manufacturers receive a tax credit for the production of energy-efficient dishwashers, clothes washers and refrigerators.
- *Accelerated Depreciation for Smart Meters and Smart Grid Systems*. The bill provides accelerated depreciation for smart electric meters and smart electric grid equipment. Under current law, taxpayers are generally able to recover the cost of this property over a 20-year period. The bill allows taxpayers to recover the cost of this property over a 10-year period, unless the property already qualifies under a shorter recovery schedule.
- *Extension and Modification of Qualified Green Building and Sustainable Design Project Bond*. The bill extends the authority to issue qualified green building and sustainable design project bonds through the end of 2012.
- *Investments in Recycling*. The bill allows taxpayers to claim accelerated depreciation for purchase of equipment used to collect, distribute or recycle a variety of commodities.

FLORIDA'S ENERGY GOAL AND POLICIES

Florida law currently contains over 30 titles governing a wide range of energy issues. Most of the statutes have been subject to rulemaking and additional regulation is found in the Florida Administrative Code. Titles include: Building Codes and Standards, Energy Conservation and Solar Energy in Government Facilities, Utility Regulation, Energy Efficiency, Renewable Resources, Transportation, and Energy Planning and Policy.

The State's Comprehensive Plan provides energy goals and policies for Florida. Florida's energy goal is to reduce our energy requirements through enhanced conservation and efficiency measures in all end-use sectors and to reduce atmospheric carbon dioxide by promoting an increased use of renewable energy resources and low-carbon-emitting electric power plants.[20] Florida's energy policies also contain specific provisions that target the reduction of per capita energy consumption, provide incentives for consumer and producer energy conservation, promote the development and application of solar energy technologies, provide an energy conservation media campaign and promote the use and development of renewable energy resources and low-carbon-emitting electric power plants.[21]

RECENT KEY ENERGY POLICIES

Alternative energy sources provide many benefits. Renewable energy development can create quality jobs and promote economic development, especially in rural areas. If used to diversify utility resource portfolios, alternative energy technologies can provide a hedge against rising fuel prices and can be valuable risk management tools.[22] Demand side renewable energy and distributed generation allow individual consumers and businesses to take steps to reduce their carbon footprint while stabilizing their energy expenditures.

[20] Section 187.201(11)(a), Florida Statutes
[21] Section 187.201(11)(b), Florida Statutes
[22] U.S. Department of Energy Web site, Energy Efficiency and Renewable Energy – Why Consider Alternative Energy

The fundamental policy objectives of encouraging renewable energy generation are to reduce greenhouse gas emissions, provide fuel diversity, provide more energy security, and stimulate Florida's economy. Due to Governor Crist's leadership there are a number of policy development activities that are currently taking place in Florida that will have a tremendous impact on the future of renewable energy. One such policy is the establishment of a Renewable Portfolio Standard (RPS). An RPS sets the minimum amount of energy, from renewable sources that must be provided through the electric utility infrastructure in a given time period. This minimum requirement is applied to each utility, but provisions are often made for utilities to purchase renewable energy or credits from other utilities. The Public Service Commission is currently engaged in rulemaking for Florida's Renewable Portfolio Standard. This rule must be presented to the Legislature in its 2009 Session for its consideration and ultimate ratification. Florida's Energy and Climate Change Action Team recommends that the policy require 20 percent of retail electricity sales be met by renewable energy by 2020.[23] Governor Crist has requested that the Public Service Commission adopt a 20 percent Renewable Portfolio Standard, with a strong focus on solar and wind energy.[24] In January 2009, the Florida Public Service Commission voted to send the legislature a proposal that calls for 20 percent of their fuel mix to come from renewable energy sources by 2020. The Florida legislature can approve or reject the recommendation before the rule takes effect.

Florida's energy policies have a direct impact on the alternative energy industry workforce needs as Florida continues to craft and implement renewable sustainable energy policies. Therefore, in order to assess the state's current and future alternative energy industries workforce needs, recent key energy legislation and executive orders were reviewed.

On May 2, 2006, the Governor and Cabinet of the State of Florida expressed their support for the "25 x '25" vision. The "25 x '25" vision is a national initiative that envisions America's farms, ranches, forests, and other working lands as the provider of 25 percent of this nation's energy needs by 2025, while continuing to produce safe, abundant and affordable food, feed and fiber. The Resolution recognizes the potential role of agriculture and forestry as an energy producer and that these industry sectors are positioned to play an expanded role in the development and implementation of new energy solutions. The 2007 Florida Legislature also voiced support for the 25 x'25 goal and increased production of renewable energy and biofuels to help increase energy security for the state and nation (Senate Resolution 1860 and House resolution 7117). 25 x '25, in partnership with the Florida Farm-to-Fuel Initiative, is encouraging technological innovation and deployment and the creation of supportive policies that rapidly increase energy efficiency and production of renewable energy, move that energy to consumers, and ensure that renewable energy has a market.

During July 2007, Governor Crist issued three executive orders declaring three clear and courageous goals: increase our energy efficiency, reduce our greenhouse gas emissions, and increase our use of alternative and renewable energy technologies.[25] The Executive Orders: established reduction targets for greenhouse gas (GHG) emissions; directed the Department of Environmental Protection (DEP) to implement through agency rules a regulatory cap on electric utility GHG emissions and, through adoption of California's proposed standards, GHG emission limits on new motor vehicles; requested the Public Service Commission (PSC) to implement net metering and a Renewable Portfolio Standard (RPS) for electric utilities; and created the Governor's Action Team on Energy and Climate Change to develop additional energy and climate change policies. The specific Executive Orders are:

[23] Energy and Climate Change Action Plan for the State of Florida, The Governor's Action Team on Energy and Climate Change (October, 15, 2008)
[24] Executive Office of the Governor, Governor Crist Press release, September 10, 2007
[25] Governor Charlie Crist's remarks "2008 Serve to Preserve Florida Summit on Global Climate Change," June 2008.

- Executive Order #07-126: Establishing Climate Change Leadership by Example: Immediate Actions to Reduce Greenhouse Emissions from Florida State Government
- Executive Order #07-127: Establishing Immediate Actions to reduce Gas Emissions within Florida
- Executive Order #07-128: Establishing the Florida's Governor's Action Team on Energy and Climate Change

The Florida Energy Commission, created by the 2006 Legislature, also issued a series of recommendations addressing energy affordability, security, efficiency, reliability and global climate change.[26]

The 2008 Legislature passed, and Governor Charlie Crist signed, House Bill 7135 (Progressive Energy Initiatives for a Clean, Reliable and Energy Secure Future). House Bill 7135 includes policies relating to energy affordability, security, efficiency, and reliability and also provides a responsible response to concerns with global climate change and anticipated federal legislation. Excerpts from "*The House of Representatives 2008 Session Summary of House Bill 7135"* are presented in Appendix D.

After the 2008 legislative session, the Governor signed H.B. 7135 into law which in Section 65 instructed the Department of Environmental Protection (DEP) to develop rules to enable a cap-and-trade system. DEP will adopt cap-and-trade rules in January 2010. Once adopted, it will be submitted to the Florida Energy and Climate Commission (FECC) which shall review the proposed rules and submit a report critiquing the plan to the Governor and the Legislature prior to the 2010 legislative session. During the 2010 legislative session the proposed rule will be considered for ratification by the Legislature.

[26] "The Florida House of Representatives 2008 Session Summary of House Bill 7135"

SECTION 4: KEY ALTERNATIVE ENERGY WORKFORCE ENTITIES

In addition to public schools, career and technical education centers and community and state colleges, several associations and organizations are extensively involved in helping to meet Florida's current and future alternative energy workforce needs. These associations and organizations, listed alphabetically, include:

- Center for Energy Workforce Development (CEWD)
- Employ Florida Banner Center for Alternative Energy
- Employ Florida Banner Center for Construction
- Employ Florida Banner Center for Energy
- Florida Advanced Technological Education Center (FLATE)
- Florida Department of Education (FLDOE)
- Florida Energy Systems Consortium (FESC)
- Florida Energy Workforce Consortium (FEWC)
- Florida Solar Energy Center (FSEC)
- Florida Solar Energy Research and Education Foundation (FlaSEREF)
- Workforce Florida, Inc. (WFI)

Center for Energy Workforce Development: [27] The Center for Energy Workforce Development (CEWD) is a non-profit consortium of electric, natural gas, and nuclear utilities and their associations, created to address the critical needs of today's energy industry - the Workforce. It is the first partnership between utilities, their associations, contractors and unions to focus on the need to build a skilled workforce pipeline that will meet future industry needs. [http://www.cewd.org/]

Employ Florida Banner Center for Alternative Energy:[28] The Employ Florida Banner Center for Alternative Energy is a partnership of universities, community colleges, technical institutes, workforce agencies and industries that presents a statewide training program for the alternative energy technologies of photovoltaics and solar water heating. The goal of this Banner Center is to supply education, training and workforce placement in alternative energy technologies for students located throughout Florida. Workforce Florida, Inc., initiated the training program and awarded a contract to the University of Central Florida's Florida Solar Energy Center (FSEC) in February to establish and lead the training center, along with six other Florida partners. Instructors for the alternative energy courses begin

[27] http://www.cewd.org/

[28] Employ Florida Banner Center for Alternative Energy's Web site and the Florida Solar Energy Center, FSEC to Lead Alternative Energy Training Program in Florida, Press Release, May 16, 2008

their training at FSEC on May 19, 2008, with courses being offered to students as early as this summer term, depending on the institution.

FSEC's educational partners for this training program – Brevard Community College in Cocoa, Westside Tech in Orlando, Tallahassee Community College in Tallahassee, and Broward Community College in Ft. Lauderdale – cover the majority of Florida's most populated areas. The Florida Solar Energy Research and Education Foundation and the Florida Solar Energy Industries Association (FlaSEIA) along with selected members from Florida's utility and solar industries will supply the project's business affiliations. The Brevard Workforce Board is also a partner to this program.

The Employ Florida Banner Center for Alternative Energy will offer two core programs in photovoltaic (solar electricity) and solar thermal (solar hot water and pool heating) technologies. Both programs will be designed for students at any level, regardless of previous skill level. The results from the initial program offerings will be analyzed and used as feedback to update and finalize the curriculum. After the first year, the plan will be expanded and offered throughout Florida at other community colleges and technical centers. The initial curriculum program for these two areas will utilize existing resources but will expand depending on response from industry and partner feedback.

The Employ Florida Banner Center for Alternative Energy will continue to expand to additional educational facilities offering partner status and train-the-trainer opportunities in order to meet the expected demand for solar technology training in Florida. Additionally, the Banner Center plans to expand its offerings to include training in other alternative energy areas such as biofuels, energy efficient building design, and construction and technologies.
[http://www.fsec.ucf.edu/en/education/banner/aboutus.htm]

Employ Florida Banner Center for Construction (BCC). The Employ Florida Banner Center for Construction (BCC) is a consortium of industry, workforce, and educational partners providing training and career advancement solutions for Florida's construction workforce. Construction is a continuously growing sector of Florida's economy and there exists an ongoing industry crisis in finding and maintaining a skilled workforce. BCC is a key component of increasing workers career opportunities and reducing employer training and recruitment expenses. The tenets of the BCC are to:

- Bring workers, entry level to advanced, and employers together in the most economical means available;
- Ensure that programs within Florida educational institutions are relevant and meet the construction industry's needs and standards;
- Maximize lifelong learning in settings demanded by today's marketplace; i.e., on-campus, virtual and on-site (business) training;
- Allow industry on-going access to research and educational developments and a source for skilled workers;
- Enhance local partnership opportunities among industry, education, and workforce development services that optimize local resources;
- Promote economic development in the construction industry. [http://www.buildflorida.org/]

Employ Florida Banner Center for Energy:[29] The Banner Center has embraced a vision of partnering with Florida's energy providers for the future. Addressing a wide range of areas such as vocational and technical training, industry news, relevant industry publications, and research information pertaining to the energy industry, the Banner Center intends to be a vital link in ensuring the reliable, stable, and progressive energy environment so key to Florida's economic development.

This vision as embraced by the Banner Center also includes serving as a repository of data associated with the energy companies serving the state. The ultimate objective is to be a source of complete, consistent, and timely data regarding the composition of the state's energy infrastructure. Finally, the vision intends that the Banner Center would serve as a source of information on employment opportunities for Florida's energy stakeholders—potential employees as well as those companies recruiting workers.

The day-to-day operational strategies and tasks associated with the Banner Center for Energy are managed and coordinated by the staff of the Electrical Utility Institute, with oversight provided by Lake-Sumter Community College (LSCC) and Workforce Florida, Inc. (WFI), and a Banner Center Steering committee. Indian River State College is a critical partner with LSCC in the development of the Employ Florida Banner Center for Energy. While LSCC has a depth of experience with the Lineman program and related training, Indian River State College has established itself as a premier provider of Power Generation education and training programs

The Employ Florida Banner Center for Energy seeks to become a statewide information and training resource for all energy providers. Accordingly, partnerships with other community colleges and universities, K-12 programs, and selected private training providers will be an essential component of the delivery mechanism. Education partners will be instrumental in the development of new programs, replication of existing programs, development of K-12 academies, and articulation agreements to four-year programs. [http://bannercenterforenergy.com/]

Florida Advanced Technological Education Center (FLATE): House Bill 7135 further directs the Florida Energy Systems Consortium to work with the Florida Community College System using the Florida Advanced Technological Education Center for the coordination and design of industry-specific training programs for technicians. FLATE is a National Science Foundation (NSF) funded Regional Center. FLATE's mission is to create a relevant statewide educational delivery system by supporting technical programs, curriculum development, best practices, student involvement, and outreach activities necessary to meet the workforce capacity and high performance skill needs of the manufacturing related sectors within the state.[30]

As of mid-October FLATE had partnered with the Florida Energy System Consortium to begin identifying the specific scope and objectives of their efforts and activities. The anticipated scope includes working with college curriculum and programs and outreach/recruitment activities to get middle and high school students interested in these programs. FLATE representatives will be developing curriculum frameworks aligned to industry needs and assisting colleges to implement the new programs. [http://www.fl-ate.org/]

Florida Department of Education – Division of Workforce Education: The Division of Workforce Education is responsible for developing educational programs that will prepare individuals for the occupations that are important to Florida's economic development. With partners from education,

[29] http://bannercenterforenergy.com/
[30] http://www.fl-ate.org

business and industry, and trade associations, the Next Generation Occupational Standards for Career and Technical Education Initiative will align Workforce Education Programs with skill requirements of the new economy. The Division of Workforce Education is responsible for the development of curriculum frameworks for career and technical education programs from middle school through associate degrees. Each program curriculum framework includes the technical and academic skills that are essential to the career/occupation – "*What a student needs to know and be able to do*." [http://www.fldoe.org/workforce/]

Florida Energy Systems Consortium (FESC):[31] The 2008 Legislature created the Florida Energy Systems Consortium (House Bill 7135) to promote collaboration among experts in the State University System for the purposes of sharing energy-related expertise and assisting in the development and implementation of a comprehensive, long-term, environmentally compatible, sustainable, and efficient energy strategic plan for the state. Additionally, the Legislature directed the consortium to develop education and outreach programs to prepare a qualified energy workforce and informed public. Specifically, the faculty associated with the consortium shall coordinate a statewide workforce development initiative focusing on college-level degrees, technician training, and public and commercial sectors awareness. The consortium shall develop specific programs targeted at preparing graduates who have a background in energy, continuing education courses for technical and non technical professionals, and modules, laboratories, and courses to be shared among the universities. Additionally, the 2008 Legislature provided $2.5 million for education and outreach to the University of Florida[32].

The Florida Energy Workforce Consortium (FEWC): The Florida Energy Workforce Consortium, formed in 2006, is developing solutions to meet the current and future workforce needs of the state's energy industry. Organized by the Governor's workforce investment board, Workforce Florida, Inc., the FEWC includes representatives from major electric utilities and associations, contractors, organized labor, state economic development, workforce development, and education. The consortium's primary goals are to develop accurate projections of future energy industry workforce needs detailed by occupation and to prioritize those needs for focused educational and recruiting efforts. To ensure that solutions are developed in a sustainable and well-coordinated fashion, the FEWC is addressing several key objectives through five committees:

- Career Awareness**:** Improving the image of the industry and introducing to young people the high-paying jobs and career paths within it.
- Funding & Resources**:** Marshalling all available resources and focusing them on the most pressing challenges ahead.
- Policy & Education**:** Impacting education public policy to support implementing energy industry-relevant education and training at the secondary and postsecondary levels with an eye toward opportunities to transfer knowledge from the existing workforce to entry-level workers. Also encouraging more alignment and cross-agency engagement in state and federal funding (e.g., Perkins, Workforce Investment Act) to address training needs.
- Untapped Labor Sources: Attracting, recruiting and training workers from untapped and under-represented labor pools.
- State and National Outreach**:** Raising awareness of the impending workforce shortages and its impact on the energy sector and the state's economic development potential, thus avoiding potential adverse impacts to our state's citizenry and businesses.

Top Occupations of Concern

[31] Section 1004.648(d), Florida Statutes
[32] Chapter 2008-152 (Section 29), Laws of Florida

- Line Installers and Repairers
- Plumbers, Pipefitters & Steamfitters
- Welders
- Maintenance and Repair Workers
- Electricians
- Engineering Technicians
- Instrumentation & Control Technicians
- Power Plant Operators

The FEWC will continue to expand its membership to include contractors, their associations and labor organizations who provide contract labor essential to utility construction and operations. The workforce needs of both direct and indirect hires to the energy industry will be considered together because they rely on very similar job skills and, in many cases, compete for the same labor pool. [http://www.getintoenergyflorida.com/wiki]

Florida Solar Energy Center (FSEC): The Florida Solar Energy Center, a research institute of the University of Central Florida, is the largest and most active state-supported renewable energy and efficiency institute in the United States. Created by the Florida Legislature in 1975, FSEC's mission is to research energy technologies that enhance Florida's and the nation's economy and environment, and to educate the public, students and practitioners on the results of the research. Current areas of focus include building design and energy efficiency, photovoltaics, solar thermal, hydrogen and fuel cells, alternative fuels and education and outreach. FSEC is also responsible for testing and certifying of solar systems sold in the state of Florida. [http://www.fsec.ucf.edu/en/]

Florida Solar Energy Research and Education Foundation (FlaSEREF): The Florida Solar Energy Research and Education Foundation is a non-profit organization that serves as a liaison between Florida solar businesses and those developing educational programs for the industry to ensure that the industry's workforce training needs are being met. In addition, FlaSEREF delivers educational outreach and demonstration projects to a multitude of audiences including consumers, builders and businesses. [http://www.flaseref.org/]

Workforce Florida, Inc. (WFI):[33] Under Florida's Workforce Innovation Act of 2000, the Legislature created Workforce Florida, Inc. Established as a not-for-profit corporation, WFI is the principal workforce policy organization for the state. The purpose of WFI is, "to design and implement strategies that help Floridians enter, remain and advance in the workplace, becoming more highly skilled and successful, benefiting these Floridians, Florida businesses, and the entire state, and to assist in developing the state's business climate." [http://www.workforceflorida.com/]

Additionally, section 22 of House Bill 7135 stipulates that St. Petersburg College may work with the Florida Community College System and may consult with the University of Florida to provide training and educational opportunities that will ensure that Green Building Rating System Certifying Agents (accredited professionals who possess a knowledge and understanding of green building processes, practices, and principles) are available to work with the entities specified in subsection (2) as they construct public buildings to meet green building rating system standards. St. Petersburg College may work with the construction industry to develop online continuing education curriculum for use statewide by builders constructing energy-efficient and sustainable public-sector buildings and by students interested in the college's Green/Sustainability Track in its Management and Organization Leadership

[33] "*Efforts to Address Workforce Issues Related to the Space Programs,*" The Florida Senate, Issue Brief 2009-305, October 2008.

area of study. Curriculum developed may be offered by St. Petersburg College or in cooperation with other programs at other community colleges.

Finally, the **Space Coast Clean Cities Coalition** is a non-profit corporation for education, research, and implementation of alternative fuel technology for infrastructure and vehicles. The program initially started through the US Department of Energy to reduce the use of fossil fuels for transportation and reduce vehicle emissions for cleaner air. The Clean Cities program has five main objectives of which job creation and training is one of the five objectives. The coalition conducts workshops each year and provides assistance and literature for job training and business creation. This is a major economic development and market development effort of Clean Cities in providing technology assistance to business to promote the growth of the industry. [http://clean-cities.org/]

SECTION 5: PREPARING FLORIDA'S ALTERNATIVE ENERGY WORKFORCE

BACKGROUND

Educational programs and curriculum in alternative energy are limited throughout Florida and the United States. Some educational organizations throughout the U.S. offer courses and workshops in alternative energy, but this training is not routinely available at traditional vocational schools, community colleges or universities, nor is it designed for workforce deployment.[34]

Section five of this profile presents information on Florida's science standards and programs and partnerships that are currently built into our public education system to provide opportunities for students to learn about alternative energy and alternative energy career pathways. This section addresses the following:

- Next Generation "Energy" Related Sunshine State Standards
- Career Clusters
- Secondary Career and Technical Education Programs
- CAPE Academies
- Major Areas of Interest
- Florida Energy and Education Partnerships
- Florida Solar Energy Center K-12 Activities

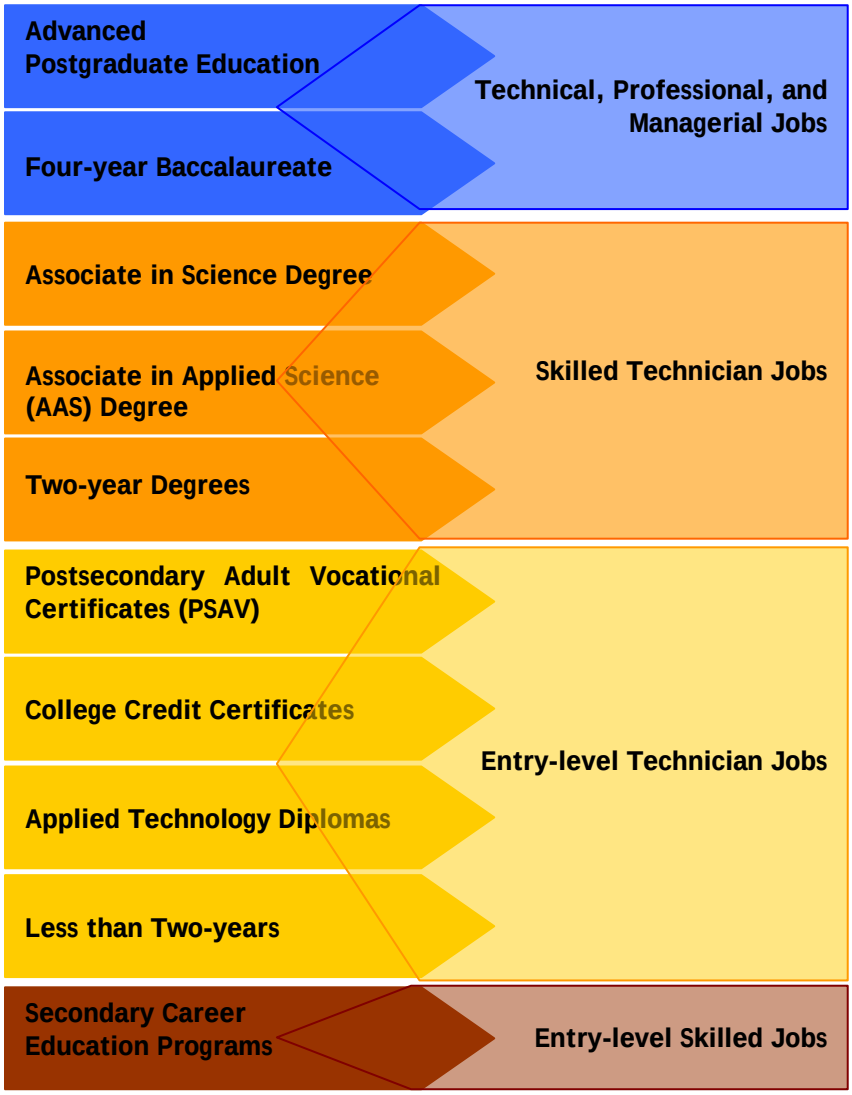
Due to the many occupations that can be included under the alternative energy sector, there are several educational and technical degrees and certificates that potential employees can obtain. Many of the occupations demand graduate degrees because of the advanced nature of the knowledge needed. These graduate degrees include: chemists, chemical engineers, physicists, and automotive engineers. As the alternative energy industry advances, more openings are becoming available for less advanced positions that require two-year degrees or certificates from local community colleges. In addition, there will be an increase in construction and maintenance jobs to build new facilities and keep them running.[35]

FLORIDA CAREER PATHWAYS

The Florida Department of Education's Division of Workforce Education has developed graphic that displays the linkage between education and training to the workforce and careers. The chart below illustrates the many entry and exit points, as well as the critical educational bridges, that career ladders provide for workers and job seekers at all levels.

[34] Florida Solar Energy Center, Press Release, May 16, 2008
[35] Michigan Regional Skills Alliances, Alternative Energy Industry Knowledge Development Guidebook – 2006-07

Florida's Pathways Linked to Education and Careers



As alternative energy is an emerging industry, an established workforce to support alternative energy does not yet exist in Florida. A key challenge for workforce stakeholder agencies will be to first determine where alternative energy workers will come from and to establish an infrastructure to ensure its sustainability. The sources from where these workers originate will present challenges to meeting their unique training needs. Individuals who make up the alternative workforce will range from field technicians to engineers.

The existing power and energy workforce will provide the majority of individuals for establishing an alternative energy workforce. These workers are already equipped with the foundational skills needed, but will require upgrading of these skills to address the job requirements for the various forms of alternative energy. The transition workforce includes individuals not directly employed in power and energy related fields but who may seek to learn new skills to enter occupations evolving from growth of the alternative energy industry. These individuals have related skills from their current occupation and will require training to acquire new skills in their chosen alternative energy field.

NEXT GENERATION "ENERGY" RELATED SUNSHINE STATE STANDARDS

Section 1003.41, Florida Statutes, requires that all public K-12 education instruction be based on the Sunshine State Standards, now known as Next Generation Sunshine State Standards. These content standards serve as the basis for classroom instruction, teacher professional development, pre-service teacher training, teacher certification examinations, and adoption of instructional materials.

The biggest change to the new science standards is that fewer science concepts are introduced for grades K-8; thus, allowing more time for teachers to teach greater depth and to make connections to "real-world" applications. Learning about alternative energy sources and applications for energy conservation and smart energy use would be an important way to help teachers implement these new standards by teaching to greater depth and making connections to current energy issues. Several new science benchmarks provide places where teachers could discuss alternative energy across the K-12 curriculum. Appendix E identifies K-12 alternative energy related next Generation Sunshine State Standards.

CAREER CLUSTERS

Florida's Department of Education, Division of Workforce Education has developed, implemented and organized career and technical programs by the 16 career clusters (Table 3) that are recognized by the U.S. Department of Education's Office of Vocational and Adult Education and the National Association for State Directors of Career Technical Education Consortium. The 16 career clusters are occupational categories with broad industry-validated knowledge and skills statements that define what students need to know and be able to do in order to realize success in a chosen field. These broad knowledge and skills are common to all occupations within the cluster. Each career cluster contains individual career pathways with identified specialties that require a common set of knowledge and skills for career success. Florida has developed sample programs of study in each cluster area, which outline sequences of academic, career, and technical courses and training that begin as early as ninth grade and lead to progressively higher levels of education and higher-skilled positions in specific industries or occupations. These programs of study include curriculum, articulation mechanisms and industry certifications. By 2013, Florida will require all career and technical programs to be offered via a comprehensive program of study using a state template that may be customized at the local level.

Table 3
Career Clusters

SIXTEEN CAREER CLUSTERS
Agriculture, Food, and Natural Resources *
*Architecture and Construction**
Arts, A/V and Communications
Business, Management, and Administration
Education and Training
Finance
Government and Public Administration
Health Science
Hospitality and Tourism
Human Services
Information Technology

Law, Public Safety, Corrections, and Security
*Manufacturing**
*Marketing, Sales, and Service**
*Science, Technology, Engineering, and Mathematics**
*Transportation, Distribution and Logistics**

* *These clusters are most directly linked to alternative energy*

The Florida Department of Education's Next Generation Occupational Standards for Career and Technical Education's Manufacturing workgroup has tentatively identified "Energy Engineer/Resource Conservation" as a program to potentially be developed in the future. The Department of Education's Transportation Work Group has identified a new program for development within the next three years, Alternative Energy Technology. This program may include a common core with specialties in Sustainable Building Construction, Alternative Fuels for Automotive and Marine Applications, and Alternative Energy for Power Generation and Distribution. Additionally, the workgroup has identified "Alternative Energy Technician" as a possibility for future development.

SECONDARY CAREER AND TECHNICAL EDUCATION PROGRAMS

Power and Energy Technology**.** Currently, the Florida Department of Education has a Power and Energy Technology program within the Science, Technology, Engineering and Math Career Cluster. The purpose of the program is to provide students with a foundation of knowledge and technically oriented experiences in the study of power and energy technology. The content includes, but is not limited to, a study of power systems and the kinds and sources of energy. The three courses that comprise this program are:

- Power and Energy Technology I
- Power and Energy Technology II
- Power and Energy Technology III

Technical Content Standards Covered in the Program:

01.0 Demonstrate safe and appropriate use of tools, machines and materials in power & energy technology.
02.0 Describe sources of energy.
03.0 Demonstrate technical knowledge and skills related to power and energy systems.
04.0 Demonstrate technical knowledge and skills about steam power technology.
05.0 Demonstrate technical knowledge and skills about hydraulic and pneumatic power technology.
06.0 Demonstrate technical knowledge and skills about electric power technology.
07.0 Demonstrate technical knowledge and skills about solar cells and fuel cells.
08.0 Demonstrate technical knowledge and skills about nuclear power technology.
09.0 Perform advanced study and technical skills related to energy and power.
10.0 Measure and report the power and efficiency of power producing systems.
11.0 Conduct a research and experimentation project on an energy and power system.
12.0 Demonstrate an understanding of career opportunities and requirements in the field of power and energy technology.

In the 2007-2008 academic year, Charlotte County was the only school district that offered this program.

Electrical Trades Program. This cluster of three programs prepares students for employment or advanced training in a variety of construction electrical industries. Of the 1,641 students enrolled in this cluster during the 2007-2008 academic year, ninety-four percent of students (1,544) were enrolled in the Electricity program, five percent of students (81) were enrolled in the Industrial Electricity program, and one percent of students (16) were enrolled in the Electrician program. In terms of the occupations impacted by alternative energy, these three programs will need to be updated or augmented to ensure a continued and ready alternative energy workforce. Based on 2007-2008 enrollment data from the Department of Education, these three programs are offered in 24 of the 67 school districts.

Associate Degree Programs. Currently, two associate degree programs are offered in Florida that are directly related to the power and energy industries. The first of these is Electrical Distribution Technology, offered at Lake-Sumter Community College and at South Florida Community College. The purpose of this program is to prepare students for employment as utility electrical line workers or in related work on private industry owned and operated electrical distribution systems. Enrollment in this program during 2007-2008 was very low (39).

The second associate's degree program is Electrical Power Technology. The purpose of this program is to prepare students for employment as an electrical and electronics technician, power generation and distribution technician, engineering aide, engineering technician, engineering assistant, instrumentation technician, relay technician, electrical technician, test technician, rotating machinery technician, research technician, research and development technician, and calibration lab technician or in a related occupation in electrical power. Based on data collected by the Department of Education, this program had enrollment of 46 students during the 2007-2008 academic years.

In 2006, Indian River State College created the Power Plant Technology Institute to prepare a pipeline of technicians for the Nuclear Industry. This effort was supported by FPL and the International Brotherhood of Electrical Workers (IBEW), and was done in partnership with Miami Dade College. This successful initiative which, in August of 2008, graduated its first cohort of 25 technicians, is being used as a platform to develop training for Fossil and Hybrid Power Plants and preparing curriculum for the infusion of Alternative Energies into the existing programs.

CAREER AND PROFESSIONAL EDUCATION (CAPE) ACADEMIES

In 2007, the Florida Legislature passed the Career and Professional Education Act. The purpose of the Act was to provide a statewide planning partnership between the business and education communities in order to attract, expand, and retain targeted, high-value industry and to sustain a strong, knowledge-based economy. The objectives of the Act are as follows:

- To improve middle and high school academic performance by providing rigorous and relevant curriculum opportunities;
- To provide rigorous and relevant career-themed courses that articulate to postsecondary-level coursework and lead to industry certification;
- To support local and regional economic development;
- To respond to Florida's critical workforce needs; and
- To provide state residents with access to high-wage and high-demand careers.

An important component of this act is the development of career and professional academies. According to section 1003.493, Florida Statutes, "career and professional academy" is a research-based program that integrates a rigorous academic curriculum with an industry-specific curriculum

aligned directly to priority workforce needs established by the regional workforce board. In 2008-2009, Florida's school districts have registered almost 500 career and professional academies with the Florida Department of Education.

Career academies are schools within schools that link students with peers, teachers, and community partners in a disciplined environment while fostering academic success. The career academy concept has three core elements:

- They are organized as schools-within schools that permit between 100-150 students to stay with a core group of teachers from grade nine or ten through grade 12. By promoting a more personalized and supportive learning environment, the programs aim to help students build strong relationships with peers and teachers.
- They integrate academic courses with technical and applied courses organized around a career theme. Traditional courses, usually including math, English, and social studies or science, are combined with occupational-related classes that focus on the academy's career theme, such as business and finance, computers and electronics, health care or environmental studies. Students take other elective classes outside the career academy structure.
- They establish partnerships with local employers in an effort to strengthen connections between school and work and to provide students with a range of career development and work-based learning opportunities.

Florida Power & Light (FPL) and the Academy of Finance (AOF) at William T. Dwyer High School in Palm Beach County is an example of a career and professional academy with a business partnership in action. During the 2008 school-year, academy students worked in teams to examine the financial feasibility of wind power. The "Wind Project" at Dwyer culminated with a series of live "sales" presentations by 100 of the school's top-ranking junior students. Eighteen teams of students (five to six students per team) presented their wind models to a panel of judges comprised of FPL executives and community members. The teams had worked on their projects for the entire school year and they followed a comprehensive curriculum designed by the Wind Power Project's sponsors, FPL and FPL Energy. The course covered multiple aspects of wind power, including tax credits and land leases. FPL and FPL Energy donated a total of $3,000 in scholarship monies, along with providing counseling and access to FPL Energy wind experts to the students and administrators through the academic year. The career academy partnership also included student internships and job-shadowing opportunities. FPL Energy operates 29 wind facilities in 15 states. The Dwyer project was created by FPL and FPL Energy as a way to showcase the power of wind, drawing on the talents of the next generation of potential "wind managers."

According to the Division of Workforce Education's analysis of district data reported to the state during the 2006-2007 school year, there were 90,751 career academy participants in the state, representing 10.4% of the total high school population (871,062). Career academy students are reported within all 16 career cluster categories. For a listing of Florida's career academies, you may visit: http://data.fldoe.org/careeracademies/.

MAJOR AREAS OF INTEREST

Section 1003.428(2)(b)(1), Florida Statutes, states that a student needs: "Four credits in a major area of interest (MAI), such as sequential courses in a career and technical program, fine and performing arts, or academic content area, selected by the student as part of the education plan required by s. 1003.4156. F.S. Students may revise major areas of interest each year as part of annual course registration processes and should update their education plan to reflect such revisions." Florida has over 400 approved major areas of interests.

Among MAI's that are currently available are integrated majors such as Environmental Management, Environmental Studies, and Environmental Sciences. Integrated MAI's are comprised of Career and Technical Education courses, core academic courses, and dual enrollment courses. Integrated majors give local school districts flexibility to customize a focus area of interest (such as alternative energy) to the community and the student.

Other current MAI offerings specifically from the Agriculture, Food and Natural Resources cluster include Environmental Resources, Land Resources Technology, Natural Resources, and Water Resources Technology. Within the STEM cluster (Science, Technology, Engineering and Mathematics) are majors in Power and Energy Technology and Transportation Technology.

As noted earlier in this report, it is anticipated that programs (and majors) in the Transportation and Manufacturing cluster related to alternative energy will be developed in the future as part of the Next Generation Occupational Standards project.

FLORIDA ENERGY AND EDUCATION PARTNERSHIPS/CAREER ACADEMIES

Electric utilities across Florida have been partnering with local secondary districts and schools to ensure that curriculum accurately reflects the up-to-date industry processes, equipment and terminology. Since 2001, with the implementation of the Gulf Power Academy in Pensacola, replications have been adopted throughout the state. Primarily based on the National Center for Construction Education and Research (NCCER) curriculum in Core, Electrical, Welding, Building Construction, and Carpentry, and on Project Lead the Way's Pre-Engineering Curriculum, these programs prepare students for work in a variety of careers - from entry-level craft to professional/technical and for college. All energy career academies incorporate tours of energy facilities, guest speakers from the industry, and representation on the program advisory councils. Many also incorporate internship opportunities, industry pre-employment testing, and articulation with two- and four- year degree programs. Through these programs, Florida's electric utilities are ensuring that they will have the highly technical, skilled employees they need to meet their future workforce needs. Refer to Appendix F for a list of High School Career Academies and Community College partnership programs.

FLORIDA SOLAR ENERGY CENTER K-12 ACTIVITIES

The SunSmart Schools Program. Originally known as Photovoltaics on Schools program is an initiative that combines green technology with education. The goal of the program is to get solar electric systems (photovoltaics) installed on schools and to use those systems as a means to offset electricity costs and to educate students, teachers, and the public about renewable energy technologies.

To date, 47 schools and educational partners are participating in the program, with two, four and ten kilowatt photovoltaic (PV) arrays installed throughout Florida. Each school is also equipped with a data acquisition system (DAS) that gathers information relating to the PV array. That information can be viewed by way of a Web site, EnergyWhiz.com, that lists each school and related data. In order to familiarize school personnel with the system and its potential as a source of study, two teachers from each of the 47 schools participated in interactive workshops providing basic information about how PV works, strategies for using the Web site in the classroom and hands-on activities that can be incorporated in existing science, math and social studies lessons. A separate workshop was provided to facilities managers from each site in order to assist the school with safely maintaining their PV system. In addition to the training, the program provides a $4 per watt rebate upon completion of key program components. Often, the utility provider for the school is an integral partner in the project providing up-front funding of the PV installation. In those instances the utility receives the rebate. Several of the utility providers also funded educational kits to each school within their service area. These contain hands-on lab materials, which aid in understanding solar and other renewable energy technologies. The program turns the school into a mini power plant producing an inexhaustible supply of clean electricity that can be used by the school or to offset its power costs. Teachers and students have an onsite source of data to enliven study and raise awareness of the technology and its potential as a solution to Florida's energy and climate change problems.

The program was initially funded by the Florida Department of Environmental Protection and the Florida Energy Office. Recently, the Florida Energy Office moved to the Governors Office of Energy & Climate Change. Although funds for SunSmart Schools are currently allocated, interest remains high with over 100 schools requesting to be considered for the program.

By linking the SunSmart Schools program with workforce training, such as the Banner Center for Alternative Energy, opportunities for mentoring, field experiences, and on-the-job training are presented.

Junior Solar Sprint. Each year since 1992, thousands of students from throughout Florida have participated in the Junior Solar Sprint (JSS). This U.S. Department of Energy program was created to expose students to photovoltaic technology through hands-on learning. Students design, build and race model solar electric cars. The Florida Solar Energy Center (FSEC) acts as coordinator of the program, organizing the statewide race, held during the EnergyWhiz Olympics in early May each year. FSEC also provides curriculum resources, materials, and professional development to teachers and technical assistance. Each year approximately 40 schools participate in the JSS races.

Hydrogen Sprint. Similar to the Junior Solar Sprint program, Hydrogen Sprint was developed for those JSS students who wanted to continue creating and engineering alternative fueled vehicles. In addition to designing, building and racing their hydrogen fuel cell vehicles, students must also produce a live informational lesson to the middle school audience and present the lesson during the EnergyWhiz Olympics.

Energy Innovations. The Energy Innovations program developed in partnership with BP, FSEC and FlaSEREF provides full-scale solar-electric (photovoltaic) design experiences to middle and high school students. Participating schools are provided with a photovoltaic array (500 watt) donated by BP to use in their classroom activities during the school year. The array is also to be the centerpiece of a real-world solar powered creation. In addition to the design and build component, students must develop supporting materials such as brochures, advertisements, Web page, video, technical report, etc., to explain and market their creation to the public. Energy Innovations challenges students to use science knowledge and engineering skills to solve real-world problems using solar energy, while preparing them for future careers. The program will be expanded to solar thermal technology beginning in 2009.

EnergyWhiz Olympics. An Olympic style showcase held at the Florida Solar Energy Center in early May highlights student talent in the area of alternative energy technologies. Current Olympic events include the Junior Solar Sprint, High School Hydrogen Sprint, Energy Innovations, Exemplary Projects in Energy and Conservation, and the 1st Annual Bright House Solar Energy Cookoff.

Youth Energy Solutions Program. Funded by Progress Energy and coordinated by the Florida Solar Energy Center, select schools within the utility providers service area participated in professional development, which allowed for the planning of alternative energy lessons to be integrated into existing curriculum. Hands-on materials and technical assistance were provided throughout the school year. Students were tasked with developing an energy vision for Florida. Those "visions" were shared at the YES Summit held at the University of Central Florida. A sample of the items shared included a hydrogen powered engine, green school strategies, and the great light bulb debate.

Utility Report Card. Utility Report Card is a program funded through the Florida Department of Environmental Protection which allows schools to view monthly electric bills via a Web site. The purpose of the program is to provide a tool for schools to track their energy use, as a first step towards reducing energy costs.

Energy Patrols. This program is coordinated by the National Energy Foundation. Energy Patrols in schools encourage energy conservation behavior among students through positive reinforcement. One school district had an estimated savings of nearly a million dollars in reduced energy costs due in part to a strong energy patrol program.

SECTION 6: ALTERNATIVE ENERGY PROGRAMS AND COURSES CURRENTLY OFFERED IN FLORIDA SCHOOL DISTRICTS, TECHNICAL CENTERS AND COLLEGES

In general, programs and courses targeted towards introducing or preparing our high school students for work in the alternative energy industries is very limited across the state. However, there are a few school districts that offer either a program or course specifically related to alternative energy. Some school districts do introduce the concepts of alternative energy on a limited basis in certain courses. In addition, while many school districts responded that they do not have any program or courses in place at this time, some expressed interest in learning more about possible programs or courses that their school districts could offer that address alternative energy.

METHODOLOGY AND SCOPE

Department of Education staff surveyed Florida's school districts, public technical centers and public community and state colleges to identify alternative energy programs and courses currently offered in these portions of our public education system. FLDOE staff surveyed each school district Career and Technical Education Director (67), each of Florida's State or Community College Occupational Deans (28) and each public Technical Center Director (44). The survey was sent via e-mail to each of the respective recipients on three separate occasions over a two-month time span. The following Tables reflect the results of the survey as reported by Florida's public school districts, colleges and technical centers.

SURVEY FINDINGS BY SCHOOL DISTRICT AND PUBLIC COLLEGE

A few school districts have developed and implemented alternative energy related programs and/or courses (see Table 4).

Table 4
School Districts

SCHOOL DISTRICT	SURVEY RESPONSES (verbatim from responders)
Alachua	Integrated content is shared between two of our academies to provide students with hands-on-experiences in producing and using one form of alternative energy. Academy of Automotive Technology and Academy of Agriculture and Environmental Resources. Students are building a car from the ground up in the auto technology program that will run on biodiesel and we want to manufacture biodiesel from the plants our students will cultivate in our agriculture program. Our Automotive Technology Academy and our *Academy of Agriculture and Environmental Resources* are developing the instructional content while they are constructing a production plant for producing biodiesel fuel and building, from the ground up, an automobile that will use the biodiesel as the fuel source. The *Academy of Agriculture and Environmental Resources* will start producing crops of different types to make the oil from plants for converting to biodiesel.
Broward	Automotive Service Technology 8, 9, 10 and 12 provide an introduction to alternative energy concepts and applications within the context of a traditional Automotive Service Technology program. The courses do not expressly offer alternative energy education in a stand-alone environment. The courses listed above are part of the DOE Curriculum Framework for Automotive Service

SCHOOL DISTRICT	SURVEY RESPONSES (verbatim from responders)
	Technology, specifically Electrical/Electronics and Engine Performance. All secondary programs in Broward County utilize an Alternative Fuels Trainer in which students can conduct scientific experiments using a variety of fuels in an internal combustion engine to determine efficiency, ecological impact, and viability. In addition, Miramar HS students engineer, build and run an all-electric vehicle that has won many national competitions for several years. These activities were developed to introduce students to the concepts of alternative energy applied to real-world applications to solve real problems. Current and future alternative energy workforce needs by occupation in your school district or service area. Current: Certified LEED construction technicians and professionals. Automotive Service Technicians – Hybrid technology, alternative fuels (ethanol, biodiesel) Future: Solar, Wind, Hydroelectric, and alternative fuel maintenance technicians Automotive and Marine Service Technicians – fuel cell, hydrogen and other emerging alternative energy sources Construction technicians in various trade and professional categories (A/C techs, electricians, architects, engineers, etc.) Atlantic Technical Center is planning to offer solar panel (photovoltaic) installers – short course and LEED (Leadership in Energy and Environmental design) certification. While McFatter Technical Center/High School currently does not offer any programs or courses they are establishing partnerships in the business community with groups involved in "going green" technologies.
Collier	Lorenzo Walker Institute of Technology offers an Automotive Service Technology program that prepares automotive technicians for positions in dealerships repairing hybrid vehicles.
Dade	Miami-Dade does not have any programs currently offered in the area of Alternative Energy. We do have a course where students work with Florida Power & Light in training for jobs in the distribution of energy. State School YYY1 will have a secondary Power & Energy Technology Lab that will study Alternative Energies in the curriculum. This course is a Technology Education program # 8601300. Power and Energy Technology are the building blocks for the social and economic future of our society. Students study emerging technologies in these fields through hands-on experiences with hydraulic, pneumatic, electric, and solar power technology. Students design and construct projects, such as solar. The Miami Lakes Education Center does not have any programs to prepare workers for alternative energy enterprises, but they do have a Toyota T-TEN program that introduces students to Hybrid vehicles.
Indian River	The school district of Indian River offers a Land Resources program that briefly offers alternative energy activities. Indian River State College is developing an Alternative Energy Education program which Land Resources will complement.
Lee	The Lee County High Tech Center Central does not currently offer any specific courses but they are currently including wind power in their electrical program and units in Hybrid, Electric and Fuel Cell in our Automotive Services Technology program.
Monroe	The Alternative Energy Center is a Florida Keys, Monroe County School District secondary site (Key West High School) where students focus on emerging green technologies as they apply to

SCHOOL DISTRICT	SURVEY RESPONSES (verbatim from responders)
	academic and technical occupations. We prepare students now for the jobs of the future with an emphasis on rigorous and relevant science education. Using inquiry based practices and collaborative community partnerships, the initial "Keys School District Sustained Investment Plan for Renewable Energy Savings" will convert district school buses to operate on biodiesel. Our curriculum and facility focuses on the production of biodiesel and other alternative energy sources. We collect Used Vegetable Oil (UVO) from local restaurants, and through the process of transesterfication, are able to produce biodiesel, soap and candles.
Orange	Westside Tech* offers component courses in our Manufacturing Cluster (HVAC, Welding, Building Construction, Electrical, and Electrician Apprenticeship). We also offer the following component courses: Bio-Diesel Manufacturing, Solar Installer, and Solar Thermal. However, we are still in the design states of some of our courses and we have offered some as component courses and some as workshop/seminars.
Pinellas	The Pinellas Technical Education Centers (PTEC): Automotive Technology – currently a program offered at PTEC; the program will incorporate hydrogen and electric automotive engine technology into the curriculum in the very near future. Students are trained in the area of electric and hydrogen powered vehicle repair. Clean Energy Welding – this course provides training in high quality welding to clean nuclear energy standards and will prepare students to enter the pipefitting industry as a welder, servicing nuclear power facilities. Electrician Apprenticeship Program - was developed to provide efficient training so an apprentice (student) can, through a systematic program of schooling and on-the-job training, become a well-qualified electrical worker. The competencies for solar energy training within the National Joint Apprenticeship and Training Committee (NJATC) curriculum are as follows: • Solar Photovoltaic Systems – recommended practices I,II & III • Fuel Cell Basics • Fuel Cell Applications • Fuel Cell Installation Heavy Duty Truck and Bus Mechanics – The topic of alternative fuels is covered under the task, "Fuel Systems – Diagnosis and Repair'. Plumbing Technology – The solar energy portion of the program was created to meet industry needs and to promote energy conservation. Students are trained in the maintenance and repair of hydronic and solar heating systems.
Polk	The Traviss Technical Center is currently participating in the National Alternative Fuels Training Consortium program sponsored by the US Dept of EPA to provide training on alternative fuel vehicles including CNG, Propane, biodiesel and ethanol. This program is in conjunction with ASE automotive technical certification program.
Seminole	Some in automotive programs
St. Johns	Environmental Studies is a new program that began in 2008, the program was chosen based on the targeted industries list for Region 8. ● Specific industry targets include JEA, Taylor Engineering, RS&H Engineering, PBS&J Engineering, Army Corps of Engineers – no graduates at this time ● The purpose of this cluster is to prepare students for employment or advanced training in the environmental industry. The cluster focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the environmental industry; planning, management, finance, technical and production skills, underlying principles of technology, labor issues, community issues and health, safety

SCHOOL DISTRICT	SURVEY RESPONSES (verbatim from responders)
	and environmental issues. Completers of these programs will be prepared to enter advanced training and education in specialized fields of environmental science or environmental business. They may also be employed as trainees or beginning workers in various environmental science or environmental technology related positions in certain businesses and industries. The district uses the state frameworks – Environmental Studies Cluster – Land, Air and Water Quality.
Taylor	Taylor Technical Institute offers an Electrical and Instrumentation Technology program.
Washington and Holmes	The Washington-Holmes Technical Center is participating in a State Farm Youth Sponsored Grant in which the Technical Center and Chipley High School have jointly purchased biodiesel fuel processing equipment. Jointly they will be processing used vegetable oils, sunflower seeds oils, peanuts, and soybeans into biodiesel fuel. Students will evaluate the quality of the product and the cost efficiency of the process to determine the potential of supporting this type of industry in our area.

* Alternative Energy Banner Center Partner

Some Florida public colleges have developed and implemented alternative energy related programs and/or courses (see Table 5).

Table 5
Public Colleges

COLLEGES	SURVEY RESPONSES (Verbatim from responders)
Brevard Community College*	• EETC 1551 Distributed Electrical Power Generation & Storage course (name to be changed to Renewable Green Energy Technologies) (course started in Fall 08) • EST 1800 Solar and Thermal Technologies for commercial and domestic residential solar hot water. • EST 1810 Energy efficient buildings for building sciences • EST 1820 Alternative Fuels and Electric Vehicle Technologies for alternative fuel transportation technologies • 2 Continuing Ed courses – PV and Solar Water Heating (offered this Fall) • Current course (EETC1551) and Photovoltaics (PV) course (college credit) under the Electronics option under the Engineering AAS degree • As individuals and businesses try to counter the rising cost of energy, the demand for Solar Water Heating (SWH) and interest in Photovoltaics (PV) systems is increasing. This course creates informed consumers and prepares students for employment as SWH and/or PV system installers. It also prepares students for the voluntary NABCEP certification exam. • *Competencies were developed by the Engineering Technology program coordinator using input from the Florida Solar Energy Center (FSEC) and with input from the National Electric Code. Competencies include (not complete list- course plan being re-written):* o *Demonstrating knowledge of the components of SWH and PV systems* o *Demonstrating knowledge of the installation producers for the above.* o *Demonstrating knowledge of the site survey for each type of solar system and payback analysis.*
Broward College*	• Photovoltaic Systems Design and Photovoltaic Systems Installation (will be offered in 2008-09 October/November. • The county, through the USGB and the Broward Chapter are ascertaining the county needs at this time.
Edison State	Drafting and Design Technology. We just incorporated LEED initiatives this academic year. 10

COLLEGES	SURVEY RESPONSES (Verbatim from responders)
College	students in 06-07 and 15 students in 2007-08. We began LEED AP courses. Began integrating LEED initiatives into our curriculum.
Hillsborough Community College	Modules within Architecture & Building Construction courses including ARC 2461 (Materials & Methods I) and TAR 1122C (Architectural Drawing II) address energy and other "green" design issues; HCC's Florida Advanced Technological Education Center's (FLATE) program is developing a specialization under the Engineering Technology degree that will include energy production using alternative fuels. FLATE was named in HB 7135 as the community college partner of the Florida Energy Systems Consortium (FESC) housed at University of Florida. Through this partnership, FLATE will provide technician level education and training to support the new state center of excellence. The college's Corporate Training Center (TCTC) is also partnering with FLATE to develop a course on Lean Sustainability. The Institute of Florida Studies at HCC is developing a LEED Certification program and a Waste Water License B certification program. The Institute also conducts workshops and training sessions related to environmental/green concerns. These programs are delivered to secondary students and working professionals.
Indian River State College	Indian River State College (IRSC) offers training for the energy industry under the Power Plant Technology Institute, which is part of the AS degree in Electronics Engineering Technology. Curriculum for this program was developed in partnership with Florida Power and Light (FPL), International Brotherhood of Electrical Workers (IBEW), and Miami Dade College and is based on national standards for Nuclear Energy training. This curriculum has been shared with other colleges and will be adapted to meet the workforce needs of Fossil and Hybrid power plants. Additionally, and as part of a national initiative supported by the Nuclear Energy Institute (NEI) and the Institute of Nuclear Power Operations (INPO), IRCS, in partnership with Miami Dade College, Central Florida Community College, Florida Power and Light, and Progress Energy, is developing curriculum for additional options in Nuclear Energy for Non-licensed Operators, Radiation Protection Technicians and Chemistry Technicians. These options are based on the Unified Curriculum Guidelines for Maintenance workers developed by the NEI. Responding to the emerging needs of the energy sector and to the broad interaction between industries affected by its diverse fields, Indian River State College will open in 2010 a new Energy Center designed to integrate career pathways in the Energy industry. The new Energy Center will offer training and education in Nuclear Energy, Fossil and Hybrid Power Plant Technologies, Alternative Energies, Transportation and Energy Efficient Building Design. From training in Solar, Wind, Fuel Cells, Biomass and others sources of energy to LEED certifications, heating and cooling systems, roofing materials and methods of construction, this center will prepare our workforce for jobs in the Green Economy.
Lake-Sumter Community College	Although not specific to alternative energy enterprises, Lake-Sumter Community College (LSCC) does offer Basic and Advanced Certificates and an Associate in Applied Science Degree in Electrical Distribution Technology. Regardless of the method of energy generation, transmission, and distribution to customers is an essential element of the energy industry. The Electrical Distribution Program at LSCC was created upon the request and financial support of several local energy industry partners – Sumter Electric Cooperative, City of Bushnell, and City of Leesburg. These partners were experiencing a shortage of skilled electrical line technicians (lineman). The AAS Degree program in Electrical Distribution Technology is designed to prepare graduates for competency as line workers in the electric utility industry. The program is constructed to provide training and practical experience for capable, but inexperienced persons desiring to enter the electric utility industry. Students will combine electrical distribution system classroom study, indoor and outdoor laboratory, and practical applications in the course of

COLLEGES	SURVEY RESPONSES (Verbatim from responders)
	study. Students will be expected to master competencies expected of the skilled tradespersons, such as electrical theory; overhead pole line and underground electrical construction operation and maintenance; and fundamentals of electric power systems distribution equipment installation and maintenance. Year Began offering: 2004/Number of Students: 75 students have participated in the program LSCC has been designated the Employ Florida Banner Center for Energy and has expanded training to additional industry partners such as Orlando Utilities Commission and New Smyrna Beach Utility Authority. Please see Florida Department of Education Curriculum Frameworks for Electrical Distribution Technology (Certificates and Degrees) At present, there is no industry recognized certification – line workers participate in apprenticeship programs unique to their respective employer and collective bargaining agreements with the International Brotherhood of Electrical Workers.
Manatee Community College	We plan to offer a specialization (technical certificate) within the proposed Engineering Technology degree if demand can be established. The newest and largest solar power facility in sunny Florida was switched on Monday at Rothenback Park in Sarasota County (February, 2008). The site is located on a former landfill that was closed in 1998 and is owned by the county. Our proposed program provides a basic core of coursework that will provide basic engineering skills necessary for employment success in a wide array of industries, including alternative energy.
Miami Dade College	Electrical Power Technology, A.S. degree The degree trains Nuclear Maintenance workers in the following areas: Instrumentation and Control Mechanical Maintenance Electrical Maintenance Florida Power and Light – guaranteed a pipeline of highly trained individuals to meet FPL's needs for the next 10 years. Current: nuclear maintenance workers and non-licensed operators. Future: Based on rate of expansion of the solar industry in South Florida, provide training for solar installers, energy auditors and other solar industry related workforce. • The Electrical Power Technology Program (EPT) Associate in Science degree is offered by Miami Dade College's School of Computer and Engineering Technologies, in partnership with Florida Power & Light (FPL). This skilled worker pipeline program was created to address the nationwide nuclear workforce shortage. The energy industry offers tremendous growth opportunities with high pay. This program stresses an understanding of power plant operations and technologies, equipment and systems maintenance, and health, safety, and environmental issues. The Instrumentation and Control option prepares students to service power plant control devices. The Electrical Maintenance option prepares students to service, repair, and maintain power plant electrical equipment and the Mechanical Maintenance option prepares students to service, repair, and maintain power plant mechanical equipment. This program was developed by cross mapping the State frameworks with the Nuclear Academy's (INPO) training documents and working directly with subject matter experts from Florida Power

COLLEGES	SURVEY RESPONSES (Verbatim from responders)
	and Light. *Year Began offering:* Spring 2006 *Number of Students:* • 12 graduates • 35 beginning 1st year • 22 beginning 2nd year • ***Continuing Education for Contractors and Construction Industry professionals and workers:*** 1. LEED Exam Review Workshop 2. Designing and Installing PVS Workshop 1. Designing and Installing Photovoltaic Systems Workshop – 40 participants;*2007-08:* 2. Designing and Installing Photovoltaic Systems Workshop – 52 participants; 3. Designing Photovoltaic Systems Workshop – 84 participants 4. Installing Photovoltaic Systems Workshop – 61 participants 5. LEED Technical Review Workshops: • Existing Buildings - 15 participants New Construction - 77 participants 1. LEED Technical Review Workshops: • Existing Buildings • New Construction • Commercial Interiors 2. Photovoltaic Systems: • Designing PVS • Installing PVS
Palm Beach Community College	In a partnership with Florida Power and Light, Palm Beach Community College offers an Electrical Power technology AS degree program. Although the program is primarily designed to train workers for conventional power generation facilities, students may be placed in internships at other FPL facilities around the nation that have wind turbine or other alternative energy technologies. This program is designed for the student who will seek immediate employment in the power technology field upon graduation or who is presently employed in power generation and allied fields and desires advancement. **Program Description** Course content includes core courses in power generation with special programs in instrumentation/control, electrical maintenance and mechanical maintenance. Year Began offering:2008 Number of Students:30 Curriculum was developed through FPL, State Course Numbering System. No industry Certifications. **SELECT ONE TRACK TO COMPLETE AS DEGREE:** **Instrumentation and Control Track** EET 2121C Electronics 1 4 EET 2122C Electronics 2 4 EST 2542 Programming Logic Controllers 1 3 EST 2544 Programming Logic Controllers 2 3 EST 2530 Procedural Control Technology 3 CET 2114 Circuit Analysis 3 **Total Instrumentation and Control Track 20** - or -

COLLEGES	SURVEY RESPONSES (Verbatim from responders)
	Electrical Maintenance Track EET 2121C Electronics 1 4 CET 2114 Circuit Analysis 3 EET 2515 Motor/Generators 3 EET 2543 Electrical Transmission and Distribution 3 EET 2547 Transformers and Power Distribution – 3 3 EET XXXX Electrical Codes, Drawings, Nomenclature & Regulations 4 **Total Electrical Maintenance Track 20** - or - **Mechanical Maintenance Track** ETI 1804 Rigging and Lifting 2 EET 1315 Pneumatic/ Hydrolic Procedures 3 ETI 1408 Weld/Solder/Brazing Processes 3 ETM 2201 Thermodynamics 3 ETI 2575 Industrial Machining 3 ETI 2452 Preventative Maintenance 3 ETI 2425 Metallurgical Properties and Dynamics 3 **Total Mechanical Maintenance Track 20** **Total Program Credits 68**
Polk College	Planned for the Future - Polk's Corporate College (non-credit division) is developing a Green/Sustainability Institute in conjunction with Engineering, Architecture and Construction businesses in Polk County. In addition, The Corporate College will be assuming responsibility for Green Partners, a non-profit organization that provides education and compliance training related to green issues.
St. Petersburg College	St. Petersburg College has a full slate of educational and workforce development programs in the field of sustainability to support a more sustainable future. The educational and training opportunities include: Certificate Program: Building Construction Technology Associate of Science Programs (2-year): Environmental Science Technology Parks and Recreation Architectural Design and Construction Technology Hospitality and Tourism with Green Lodging Bachelor's in Applied Science Degree (4-year) in Sustainability Management featuring: Sustainable Business Strategies Energy and Resource Management Sustainability in built and natural environments Legal Aspect of Sustainability Corporate Training Programs: A program in partnership with USGBC to develop on-line courses for LEED Certification In progress: Partnering with a major alternative energy provider, Progress Energy, and addressing needs for managers of alternative energy programs. **Other Sustainability Initiatives include**: Establishment of a Natural Habitat Park and Environment Center Periodic Seminars and conferences on best "green business" practices

COLLEGES	SURVEY RESPONSES (Verbatim from responders)
Tallahassee Community College*	Introduction to Solar Thermal Hot Water Systems (32 hrs non-credit clock hours) Introduction to Photovoltaic Systems(48 hrs non-credit clock hours) 2006-07: fall, 2008 (9 Completers) Introduction to Photovoltaic Systems 2007-08: Initiated fall, 2008 (34 Completers) May consider both a Certificate Program in Energy Technology and an AS in Energy Technology, but not definite yet. Solar Energy Demand demonstrated by area contractors and the local utility company Partner in Employ FL Alternative Energy Banner Center @ UCF/Florida Solar Energy Center (FSEC). Program was developed in response to initiative to bring de-centralize training to regions. Construction --year began offering 2008 – PV Session 1 and Solar Thermal Session 1 and 2 –Solar Thermal 3 to begin in October 2008. – used FSEC Curriculum and competencies.
ADDITIONAL RESPONSES	
Chipola College	We do not have any immediate plans to offer programs or courses but stand ready to do so. We could create a program to meet the workforce needs of Green Circle BioEnergy *wood products manufactured into wood pellets for energy generation" and Waste Management (solid waste disposal converted into methane gas).
Daytona State College	At this time we are not offering any specific programs related to alternative energy. However we are developing a couple of courses that we hope to develop into certificates and programs. The courses currently under development are related to solar and wind power generation, system size and configuration, and installation.

* Alternative Energy Banner Center Partner

SECTION 7: ALTERNATIVE ENERGY INDUSTRY WORKFORCE NEEDS

METHODOLOGY AND SCOPE

The Florida Department of Education's Division of Workforce Education is responsible for developing educational programs that will prepare individuals for the occupations that are important to Florida's economic development. In order to begin to identify the potential emerging "green-collar" occupations related to alternative energy industries Department staff conducted an industry survey. Previously, such a survey had not been conducted in Florida by any entity. The Department of Education's Alternative Energy Industry Workforce Liaisons provided input and recommendations regarding the development of the survey.

Department staff conducted the web-based survey of Florida companies engaged in the alternative energy sector between October 18 and November 15, 2008. For the purpose of this survey, the alternative energy industry sector was defined as businesses and industries associated with the manufacturing, distribution, management, and maintenance of biomass, geothermal, hydroelectric, hydrogen (produced by non-fossil fuels), nuclear, ocean, solar, and wind.

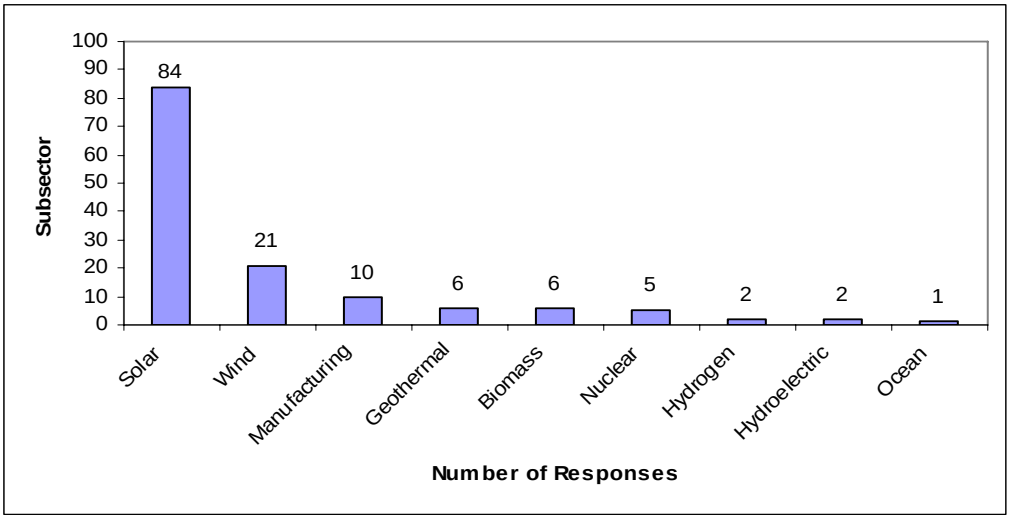
The purpose of the survey was to ascertain current and future alternative energy industry workforce needs. The Department of Education's Alternative Energy Industry Workforce Liaisons electronically distributed the survey to applicable businesses and industries. Department staff received complete and valid responses from 95 alternative energy businesses. Given that this is a first generation survey, findings from the survey reflect neither the entire alternative energy sector nor a representative sample. However, the results do provide valid and useful information concerning the 95 businesses that did respond to the survey. Three of the 95 responding companies indicated they were not-for-profit organizations. Additionally, of the 95 respondents 76% reported holding at least one license. The licenses were primarily for contracting and installation. Among all the employees reported in the survey, 85% were full-time, and 15% were part-time.

SURVEY FINDINGS

Alternative Energy Industry Survey Response Profile. Almost a quarter of the businesses surveyed indicated that they employ staff in more than one alternative energy industry sector. The majority (84%) of businesses that responded to the survey engage in the solar industry (Exhibit 1).

Exhibit 1

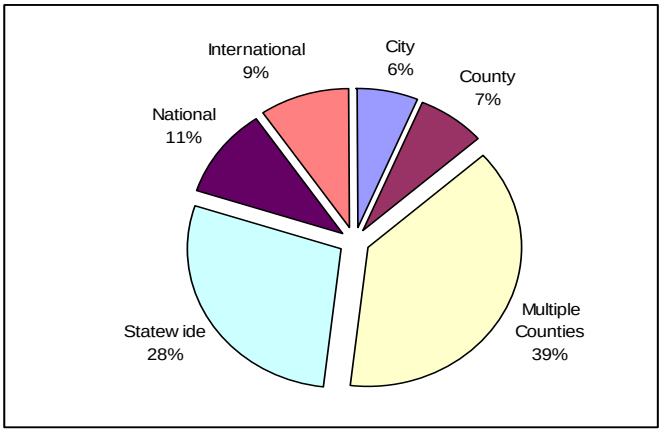
Alternative Energy Industry Survey Response Profile
(95 responses)



Alternative Energy Business Location and Service Areas. A little less than one fifth of the businesses surveyed reported having multiple business locations in Florida. Almost a quarter of the businesses reported having offices outside of Florida. Exhibit 2 shows the extent of service area among the businesses represented in the survey. Thirty-nine percent of the companies reported that they were engaged in business in multiple counties, and 28% indicated they had statewide operations.

Exhibit 2

Breadth of Service Area
(95 Survey Responses)

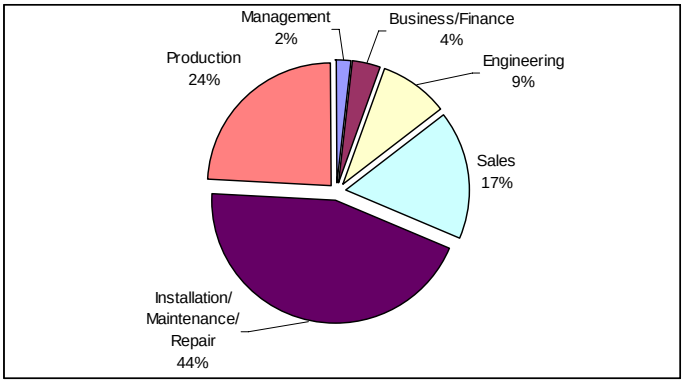


Industry Education Partners and Graduate Placements. Fewer than one fifth (14.7%) of the respondents reported partnering with a Florida public educational institution in the area of alternative energy to provide educational programs to students. However, 13 of the 14 businesses that do have a partnership with an educational institution reported placing completers/graduates from partner

institutions as employees.[36] Graduates were placed in a variety of occupations (see Exhibit 3). Most frequently (44% of placements), graduates were employed in installation, maintenance, and repair, followed by production (24% of placements), and sales (17% of placements).

Exhibit 3

Percentage of Placed Graduates from Partner Educational Institutions by Occupational Category

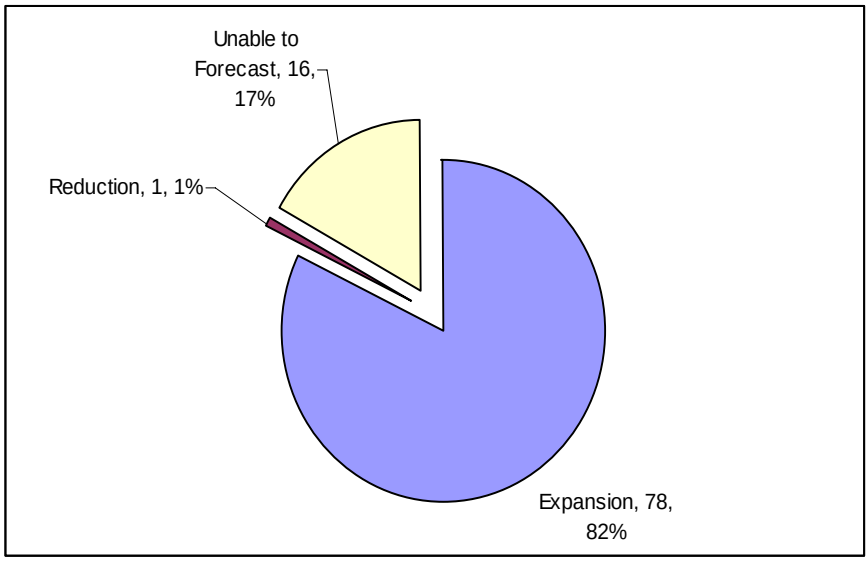


Anticipated Workforce Reduction or Expansion. Eighty-two percent of the respondents indicated that they expect an expansion of their workforce by January 1, 2010. Additionally, 17% of the businesses were unable to forecast whether their company would expand or reduce their workforce, and only one (1%) expected a workforce reduction. Among respondents who indicated that they anticipated workforce expansion, 83.3% were majority-solar businesses. This is close to the percentage of majority-solar businesses among the entire set of responses (88%), suggesting that there is little difference among sub-sectors with regards to expected employment growth. Refer to Exhibit 4.

[36]Partner institutions included state universities (Central Florida, Florida, Florida State), community colleges (Lake-Sumter, Manatee, Miami Dade), technical centers (Lively, Pinellas), school districts (Broward, Dade, Lee), and individual schools (DeLand High School).

Exhibit 4

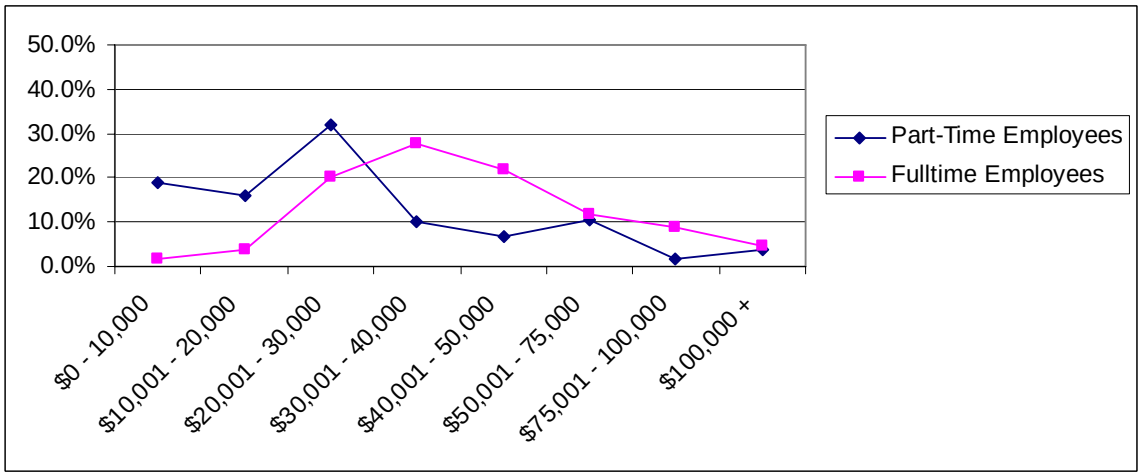
Workforce Expansion/Reduction by January 1, 2010



Annual Wages in Alternative Energy Businesses. Exhibit 5 displays annual wages of full-time and part-time employees across eight wage bands. A higher percentage of part-time workers are in the lower wage bands ranging from $0 to $30,000 or approximately 66% of the total, and then dropping sharply at the $30,001 – 40,000 middle wage band to 10%. In contrast, full-time workers reported a higher percentage (28%) of the total for this wage band.

Exhibit 5

Percentage of Part-Time and Full-time Employees Reported by Annual Wage Band



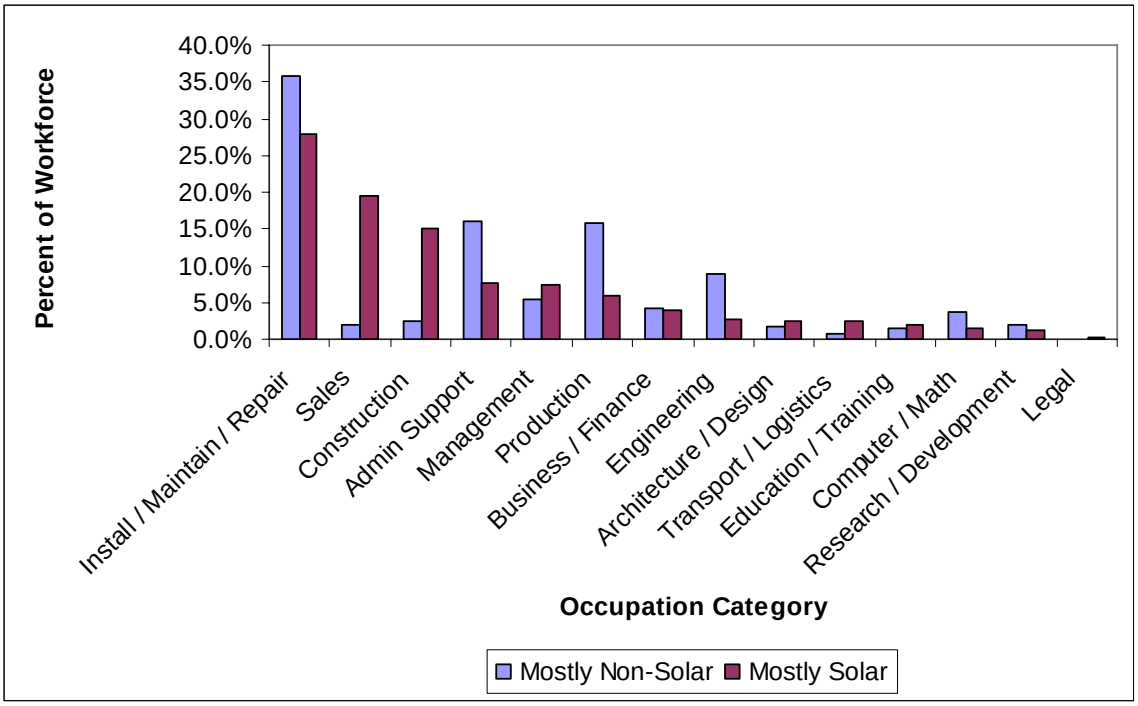
Some part-time and full-time workers were involved in both alternative and traditional energy sectors. Twenty-one respondents (22.1%) reported that a percentage of their part-time employees had responsibilities in both traditional and alternative energy sectors. On average, among these 21 respondents, the part-time employees working in both sectors represented 49.1% of the company's total workforce.

Forty-three respondents (45.3%) reported that a percentage of their full-time employees had responsibilities in both traditional and alternative energy sectors. On average, among these 43 respondents, the full-time employees working in both sectors represented 67% of the company's total workforce.

Alternative Energy Workforce Occupational Categories. Exhibit 6 displays the workforce by occupational category. Because solar energy providers represented such a large percentage of survey respondents, the data are disaggregated into respondents who reported mostly solar and mostly non-solar activity. Looking at the distribution of solar sub-sector employees by occupational category, the largest group of workers was in installation, maintenance, and repair followed by sales and construction. Among the non-solar respondents, installation, maintenance, and repair was also the top occupational category, but sales and construction were relatively low percentages compared to their solar counterparts. Instead, administrative support and production were the next largest occupational categories.

Exhibit 6

Distribution of Alternative Energy Workforce by Occupational Category

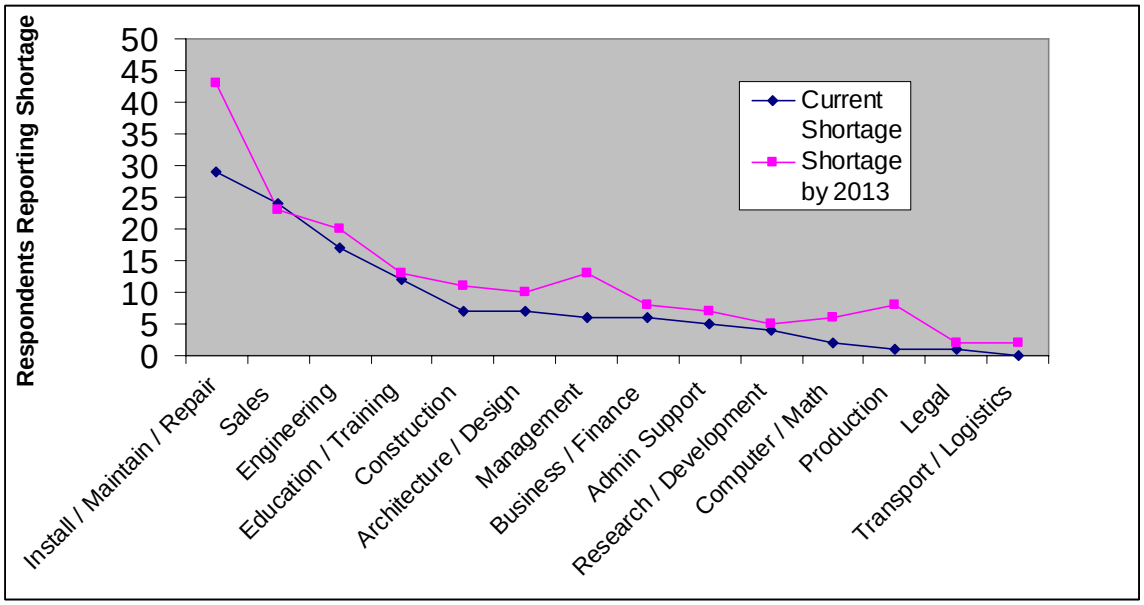


Alternative Energy Businesses Anticipated Occupational Shortage Areas. Survey respondents were asked to indicate the occupational categories in which their companies were currently experiencing a critical shortage and those that would experience shortages by the year 2013. Exhibit 7 shows that the top three shortage areas now and within the next five years are installation,

maintenance, and repair; sales; and engineering. There appears to be an expectation that the critical shortage of installation, maintenance, and repair technicians will worsen over time.

Exhibit 7

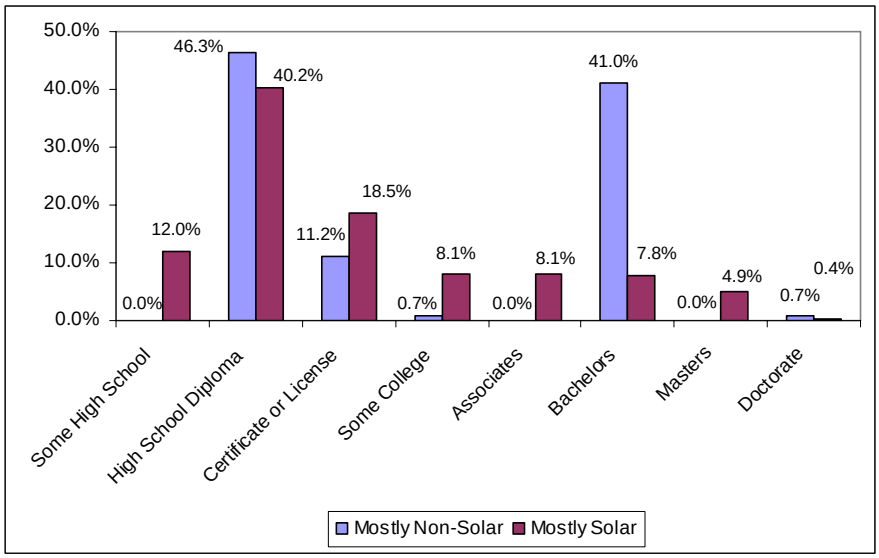
Respondents Reporting Critical Shortage of Employees by Occupational Category, Current and by the Year 2013



Minimum Education Requirements. Survey respondents were asked about the minimum educational requirements for the positions in their workforce. Exhibit 8 shows that the most common minimum requirement for positions in both solar and non-solar businesses is a high school diploma. A much higher percentage of positions in non-solar businesses require at least a bachelor's degree (40.1%) than among positions in solar businesses (7.8%). Among positions in solar businesses, 78.8% required less than a college degree compared to 58.2% among positions in non-solar businesses.

Exhibit 8

Current Minimum Required Educational Credentials for Alternative Energy Workforce



SECTION 8: FLORIDA'S ALTERNATIVE ENERGY RESEARCH

The development path of the alternative energy industry will likely mirror the growth of other high tech industries like IT and the life sciences, with research-driven innovation leading to eventual product commercialization.[37] This section of the report provides information on the Florida Energy System Consortium, Florida's Renewable Energy Technologies Grants Program and Florida's Farm to Fuel Initiative.

FLORIDA ENERGY SYSTEM CONSORTIUM

The 2008 Legislature passed House Bill 7135 which contained a provision which created the Florida Energy Systems Consortium.[38] The Florida Energy Systems Consortium was created to promote collaboration among experts in the State University System for the purposes of sharing energy-related expertise and assisting in the development and implementation of a comprehensive, long-term, environmentally compatible, sustainable, and efficient energy strategic plan for the state. The consortium was directed to focus on the research and development of innovative energy systems that will lead to alternative energy strategies, improved energy efficiencies, and expanded economic development for the state. The consortium consists of the state universities and is administered at the University of Florida by a director who is appointed by the President of the University of Florida.

The Florida Energy Systems Consortium's[39] vision is: "*World leader in energy research, education, technology, and energy systems analysis.*"

A panel of 12 of Florida's leading energy technologists have determined that the initial research of the FESC should be aligned with six thrusts if Florida is to meet its future energy needs, and at the same time sustain a robust economy. The Consortium has identified it's thrust areas as the following:[40]

- Developing Florida's Biomass Research
- Harnessing Florida's Solar Resources
- Ensuring Nuclear Energy and Carbon Constrained Technologies for Electric Power
- Enhancing Energy Efficiency and Conservation
- Securing our Energy Delivery Infrastructure
- Energy Systems and their Environmental and Economic Impacts - overarching

Additionally, the FESC has selected 12 initial tasks, or projects, in alignment with these thrusts that the State University System has the highest potential of generating near term impact, given its current makeup of SUS expertise and infrastructure. These tasks are described below in Table 4.

[37] Enterprise Florida, Emerging Technology Brief – Alternative Energy (Summer 2007)
[38] Section 1004.648, Florida Statutes
[39] Note: the information provided about the Florida Energy Systems Consortium was obtained from the following source – A presentation by James Fenton, Issa Batarseh and Philip Fairey titled "UCF's Florida Energy Systems Consortium," A Research Institute of the University of Central Florida, September 2008.
[40] Florida Energy Systems Consortium, Science and Technology Thrusts

Table 4

TASK	DELIVERABLE	RESEARCHERS
1. An Integrated Florida Bio-Energy Industry	A Pilot-Scale Plant that integrates hydrogen and synthetic fuels and/or feed stocks from biomass and solid waste.	Lonnie Ingram (UF), William Lear (UF), Ali Raissi (UCF), Anjane Krothapalli (FSU), Babu Joesph (USF)
2. Photovoltaic (PV) Plug-in Hybrid Vehicle	Photovoltaic covered parking spot at UCF Orlando and Florida Solar Energy Center	Eric Wachsman (UF), Issa Baratarseh (UCF), Jim Fenton (UCF), C. Edrington (FSU), S, Reich (USF)
3. Solar Thermal Power for Bulk Power and Distributed Generation	Two Modules of Solar Thermal Electric. Expanded Solar Thermal Testing Facilities for Domestic Hot Water.	Yogi Goswami (USF), David Hahn (UF), Bob Reedy (UCF), Anjane Krothapali (FSU)
4. TBD		
5. Florida Based Low Cost Manufacture of Photovoltaic (PV) Systems	CVD Equipment	Tim Anderson (UF), Bob Reedy (UCF), D. Morel (USF)
6. Advanced Photovoltaic Device Program	3 new lab facilities at Florida Solar Energy Center; 4 Net Zero Energy Portables at Florida Solar Energy Center; Photovoltaic covered parking spots at UCF Orlando and Florida Solar Energy Center with plug in hybrids	Bob Reedy (UCF), Neelkanth (UCF), C. Ferekides (USF)
7. Photovoltaic Energy Conversion and System Integration	Photovoltaic on portables with integrated power electronic inverters	Issa Baratesh (UCF), E. Stefanankos (USF), John Shen (UCF), Jenshan Lin (UF), H. Li (FSU)
8. Integrated Photovoltaic/Storage and Photovoltaic/Lighting Systems	A Photovoltaic covered parking spot at UCF Orlando with a Photovoltaic/Storage/Lighting System	Issa Batarseh (UCF), John Shen (UCF), Dr. Franky So (UF), E. Stefanakos (USF)
9. Solar and Biomass Fuels to Fuel Cell Emergency Power Backup	5 kw Photovoltaic/Water Electrolysis/Hydrogen Storage/Fuel Cell Power plant and Photovoltaic to Water Electrolysis for H_2 Production for Fuel Cell Research Lab	Jim Fenton (UCF), Dr. Juan Ordenez (FSU), Y. Goswami (USF)
10. Energy Efficient Building Technologies and Zero Energy Homes	3 Side-by-Side Homes, Energy Efficiency Studies	Philip Fairey (UCF), Subrato Chandra (UCF), Dr. James Heaney (UF), J. Ordonez (FSU), Brenton Greska (FSU), S. Russell (USF), Y. Goswami (USF)
11. Establishing an Efficient and Reliable Energy Delivery Infrastructure	Optimization Study	David Cartes (FSU), A. Domijan (USF), Philip Fairey (UCF), Robin Vieira (UCF)
12. Carbon Capture and Sequestration		Lonnie Ingram (UF), Ali Raissi (UCF), Nazim Muradov (UCF), M. Stewart (USF)

For additional information on alternative energy research in Florida refer to Appendix C.

FLORIDA RENEWABLE ENERGY TECHNOLOGIES GRANTS PROGRAM[41]

On October 13, 2008, Governor Charlie Crist invited companies and organizations to submit grant proposals for the Renewable Energy and Energy-Efficient Technologies Grant Program. The program is designed to stimulate capital investment in Florida and promote and enhance the statewide utilization of renewable energy and energy-efficient technologies. The State of Florida will award $15 million in grant funding to eligible projects, with at least $8 million for bioenergy projects. The Governor's announcement comes as Florida joins the federal government and other states to observe October as Energy Awareness Month. This year's theme is Working to Secure a Clean Energy Future.[42]

> ***Renewable Energy.*** *Section 366.91(2)(d), F.S., states, "Renewable energy" means electrical energy produced from a method that uses one or more of the following fuels or energy sources: hydrogen produced from sources other than fossil fuels, biomass, solar energy, geothermal energy, wind energy, ocean energy, and hydroelectric power. The term includes alternative energy resources, waste heat, from sulfuric acid manufacturing operations.*

As of the fall 2008, the following renewable energy projects are currently under development in Florida:[43]

Solar Energy. Seminole Electric and Spain's Renovalia announced the beginning of negotiations for a new solar plant in Florida. Florida Power & Light will install a total of 110 megawatts of solar energy, positioning Florida as the second leading state in the nation for solar energy production. Florida Gulf Coast University received $8.5 million to construct a solar photovoltaic (PV) array to help power its campus.

Wind Energy. Florida Power & Light has proposed a wind farm of six windmills in St. Lucie County that would produce 13.8 megawatts of power.

Wave Energy. The University of South Florida is exploring how to create electricity from the continual motion of the sea. Florida Atlantic University is learning more about how we can gain energy from the Gulf Stream Current.

Ethanol and Biofuels. New Generation Biofuels announced locating their corporate headquarters in Lake Mary. Projections estimate that by 2010, ethanol will make up ten percent of Florida's total gasoline supply. Florida continues to support grants to develop Florida's potential bioenergy sources, including switchgrass, citrus waste and sugarcane bagasse. The University of Florida received $20 million in 2007 to construct a commercial-scale cellulosic ethanol plant.

Waste-to-Energy. Controlsud International Group, based in Brazil, announced a $182-million agreement with Renewable Fuels of Tallahassee LLC to convert waste into energy. Progress Energy, along with Biomass Gas & Electric, is building the largest wastewood biomass plant in the United States in Liberty County.

[41] Florida Department of Environmental Protection's Web site (http://www.dep.state.fl.us/energy/energyact/grants.html)
[42] Executive Office of the Governor, Governor Charlie Crist, Press Release, October 13, 2008
[43] Executive Office of the Governor, Governor Charlie Crist, Press Release, September 25, 2008

The Florida Energy Act established the Renewable Energy Technologies Grants Program to provide renewable energy matching grants for demonstration, commercialization, research and development projects relating to renewable energy technologies. The grant program is designed to stimulate capital investment in the state and promote and enhance the statewide utilization of renewable energy technologies.

The 2008 Florida Legislature appropriated $15,000,000 for the Renewable Energy and Energy-Efficient Technologies Grant Program. A request for grant proposals is expected to be issued sometime before October 31, 2008. The 2007 Florida Legislature appropriated $12.5 million for the grant program for projects that generate or utilize other renewable energy resources, including hydrogen, biomass, solar energy, geothermal energy, wind energy, ocean energy, waste heat and hydroelectric power. Grant funds are available to Florida municipalities and county governments, established for-profit companies licensed to do business in Florida, universities and colleges in Florida, utilities located and operating within Florida, not-for-profit organizations, and State of Florida agencies.

2007 REQUEST FOR GRANT PROPOSALS. The Florida Energy Office received proposals for matching funding towards research, development, demonstration and commercialization projects related to renewable energy technologies. For this funding opportunity, "renewable energy" means electrical, mechanical, or thermal energy produced from a method that uses one or more of the following fuels or energy sources: hydrogen, biomass, solar energy, geothermal energy, wind energy, ocean energy, waste heat, or hydroelectric power.

The Renewable Energy Technologies Grant Program recipients (announced in February 2008) were:

- **Central Florida Regional Transit Authority (LYNX), "Go Renewable Energy Efficient Next-Generation Biodiesel Fleets" ($2,500,000) –** Located in Central Florida, this partnership will implement a large-scale alternative fuel research and demonstration project that provides biodiesel blending at a central fueling location. By 2010, Orange County, LYNX and Orlando Utilities Commission will have transitioned their entire diesel fleet to biodiesel blended fuel.
- **Exceed Corporation, "Dollars & Sense: Renewable Energy for Florida Builders & Developers" ($990,000) –** This project, located in Pinellas County, will develop a profitable model for replication that will provide solutions to up-front cost barriers for renewable energy investments for Florida developers.
- **Florida Power and Light, "St. Lucie Wind" ($2,500,000) –** This project will construct the first wind energy facility in Florida. As proposed, wind turbine generation units would be placed in St. Lucie County and are expected to have the potential capacity of 20 megawatts of electrical power.
- **Florida Solar Energy Research and Education Foundation, "Building Florida's Solar Infrastructure" ($1,688,216) –** This statewide project will accelerate the use of solar energy in Florida by reducing market barriers and strengthening the solar industry infrastructure. Through solar demonstrations, combined with public awareness and information outreach, this program will educate Florida consumers, builders and businesses about solar technologies, policies and incentives.
- **Orange County Government, "Photovoltaic Demonstration and Research Facility and Climate Change Education Center" ($697,433) –** This project enables the completion of a demonstration, research and education program through the installation of the largest solar photovoltaic (PV) system in the South, a one-megawatt solar PV system located at the Orange County Convention Center.

- **Progress Energy Florida, "Small-Scale Wind Power in Florida" ($123,868) –** This project will evaluate inland opportunities for wind energy generation in Florida by using five wind turbines at five different locations across the state, providing more than 15,000 kilowatt hours of wind generation annually.
- **Renergie, Inc., "Development of Florida's Ethanol Industry Using Sweet Sorghum" ($1,500,483) –** This project, concentrated in the Florida Panhandle, will design and build Florida's first sweet sorghum mechanical harvesting system. In addition, the company will develop and construct a sweet sorghum-to-ethanol facility capable of producing five million gallons of ethanol annually.
- **Vecenergy, "Production of Biodiesel Using Multiple Feedstocks" ($2,500,000) –** Located in Manatee County, the project includes construction and operation of a biodiesel facility capable of producing 37.5 million gallons of biodiesel per year.

FLORIDA'S FARM TO FUEL® INITIATIVE

In 2006, the Farm to Fuel® Initiative was statutorily created to enhance the market for and promote the production and distribution of renewable energy from Florida-grown crops, agricultural wastes and residues, and other biomass; and to enhance the value of agriculture products or expand agribusiness in the State.[44] In 2006, 2007, and 2008 the Florida Department of Agriculture and Consumer Services hosted "Farm to Fuel® Summits." These summits helped Florida take the next step in promoting the production, distribution, and use of renewable fuels, particularly ethanol. These high-profile events featured speakers and panelists representing international, national and state perspectives on issues of research, production and distribution of biofuels and bioenergy.

In 2007, the Florida Legislature established the Farm to Fuel® Grants Program to provide $25 million in matching grants for demonstration, commercialization, research and development projects relating to bioenergy. The Program intends to stimulate investment in energy projects that produce bioenergy from Florida-grown crops or biomass.

Below is a list of the 2008 Farm to Fuel® Grant winners:

Commercialization Projects

- United State EnviroFuels, LLC – Venus/Highlands County, Construction of a Commercial Sugar-to-Ethanol BioRefinery, $7,000,000
- Gulf Coast Energy of Walton, LLC – Mossy Head/Walton County, Tandem Biodiesel and Ethanol Production Facility, $7,000,000
- Liberty Industry, Inc. – Hosford/Liberty County, Low-Cost Co-Production of Ethanol and Electricity Using Forestry Waste Products, Row-Crop Residues and Municipal Solid Waste, $4,000,000
- Agri-Source Fuels, LLC – Pensacola/Escambia County, Biodiesel Production Plant, $4,000,000

Research and Development or Demonstration Projects

- Southeast Biofuels , LLC/Xethanol – Auburndale/Polk County, Citrus Waste to Ethanol, $500,000

[44] Florida Department of Agriculture and Consumer Services "Farm to Fuel" Web site http://www.floridafarmtofuel.com/

- University of Florida – Mechanical and Aerospace Engineering Gainesville/Alachua County, Fischer-Tropsch Conversion of Florida Woody Biomass Generated Synthesis Gas to Biodiesel $500,000
- Sigarca, Inc./Southeastern Livestock Pavilion – Ocala/Marion County, Bioenergy and Agricultural Products from Animal Waste, $499,500
- University of Central Florida/Florida Solar Energy Center – Cocoa/Brevard County, Thermochemical Conversion of Biomass to Liquid Hydrocarbons As Substitutes for Petroleum-Based Fuels, $498,000
- Florida Institute of Technology – Vero Beach/Indian River County, A Novel Process for the Production of Biofuels and Animal Feed from Microalgae, $415,120
- Applied Research Associates, Inc. – Panama City/Bay County, Hydrothermal Saccharification for Cellulosic Ethanol Production, $203,130
- Applied Research Associates, Inc. – Panama City/Bay County, Conversion of Crop Oils to Biofuels, $182,832
- Neptune Industries, Inc. – Florida City/Dade County, Development of Floating Algae/Biodiesel Product of System In Quarry Lakes Utilizing Fish Production Effluent as the Nutrient Source $158,270

SECTION 9: OTHER STATES' SELECT INFORMATION

This section briefly describes the Michigan Green Jobs Initiative, provides information on a few educational programs in Arizona, Michigan and Wisconsin, and identifies Green Jobs workforce development legislation in state legislatures across the country.

GREEN JOBS INITIATIVE

The Michigan Green Jobs Initiative is designed to help make sure the emerging industries and green economy have the trained workers they need to grow and prosper.[45] Green jobs are defined as all occupations necessary to sustain and grow these emerging sectors. Michigan is targeting the following specific alternative energy production and efficiency green jobs as part of its Green Job Initiative:

Automotive Industry
- Automotive Engineers
- Automotive Technologists
- Diesel Technologists

Energy Production Industry
- Photovoltaic Installers
- Geologists
- Welders

Research and Design Industry
- Chemical Engineers
- Electrical Engineers
- Mechanical and Industrial Technologies
- Mechanical Engineers

EDUCATION INITIATIVES AND PROGRAMS

Arizona-Texas Consortium for Alternative and Renewable Energy Technologies Advanced Technological Education (ATE) Project (http://atcaret.org/)

Arizona State University's (ASU) Electronic Systems Department at the Polytechnic campus was awarded a $900,000 National Science Foundation grant recently to develop alternative energy programs and courses in conjunction with community colleges in Arizona and Texas. Known as the Arizona-Texas Consortium for Alternative and Renewable Energy Technologies Advanced Technological Education (ATE) Project, ASU's Electronic Systems Department will partner with education, government and industry, including Austin Community College, Mesa Community College, Pima Community College, the state of Arizona, Austin Energy, Arizona Public Service, BP Solar, Georgetown Utility Systems, Global Solar Energy, Tucson Electric Power, Salt River Project, Southwest Gas and Trico Electric Cooperative Inc.

[45] www.michigan.gov – Green Jobs Initiative

The ATE Project will help develop programs that better prepare and increase the number of students completing associate of applied science degrees, certificate programs and bachelor's degrees to meet the workforce needs of the energy, transportation and electronic industries. In addition, the ATE Project will create industry internships, provide training to improve the skills of the existing workforce, offer professional development activities to teachers in grades 9-16, and serve as a nationwide and statewide public awareness vehicle.

ASU has started its efforts with the introduction of a new concentration in alternative energy technologies at ASU's Polytechnic campus. Beginning this fall, students will have the option of focusing on alternative energy technologies in the undergraduate and graduate degree programs offered by ASU's Electronic Systems Department. All courses will have a practical component and will rely on project-based teaching methodology fostered at ASU's Polytechnic campus. In addition, students will have opportunities to conduct and participate in a wide spectrum of research projects. With access to the Photovoltaics Testing Laboratory, one of three in the world, and fuel cell research on the campus, students will gain firsthand knowledge about various systems and how they work.

St. Clair Community College (Michigan)

The Alternative Energy Technology program is intended for people who wish to develop a working knowledge of alternative energy power generation and delivery systems. It is expected that students in this program intend to pursue a career that includes the design, building, and maintenance of energy systems such as, but not limited to, wind energy, passive solar energy, and photovoltaic power.

2008-09:

Suggested Course Sequence

FIRST year - 1st Semester		**Semester Hours**
AET 181	Planning a Sustainable Alternative Energy System	3
ELT130A	Fundamentals of Direct Current Electronics	2
ELT130B	Fundamentals of Alternating Current Electronics	2
IA 100	Electrical Power & Control Circuits I	3
IA 143	Fluid Power & Control Circuits I	3
NTR 100	I Introduction to Sustainable Energy	4
		17
2nd Semester		**Semester Hours**
AET 182	Installation & Control of Energy Systems	4
AET 183	National Electrical Code (NEC Handbook)	2
ELT 236	Microcontrollers: Energy Control Systems I	4
IA 102	Programmable Logic Controls	3
		13

Total Credit Hours = 30, Total Contact Hours = 45

Wisconsin's Mid-State Technical College (http://www.mstc.edu/)

Wisconsin's Mid-State Technical College is offering three new renewable energy degree programs. These will include biorefinery technology, renewable electricity technician and renewable thermal energy technician training. Ronald Zillmer, associate dean of MSTC's technical and industrial division hopes the courses are the beginning of new trends in green energy education. "The college is investing in programs for jobs that will be here 100 years from now. This is not a short-term endeavor; folks feeling the effects of globalization and being displaced from their jobs are looking for stability."[46]

[46] Alternative Energy News – Get a Degree in Renewable Energy, May 8, 2008

Biorefinery Technology Program: The Biorefinery Technology program prepares technicians to perform operations and maintenance tasks in the expanding biofuel and biogas production and biorefining industries. The curriculum emphasizes learning and performing the mechanical processes of biofuel production and biorefining, as well as plant operations, systematic troubleshooting, logical problem-solving and safety. Expected starting salary range: $33,280-$43,680.

Renewable Electricity Technician: The Renewable Electricity Technician program prepares technicians who design, install, operate and maintain solar and wind electricity generating systems for both residential and light commercial applications. Technicians will perform site assessments and integrate new renewable electricity systems with current existing energy sources. Renewable electricity technicians may be involved in the sale or marketing of solar PV and wind energy technologies. Expected starting salary range: $37,440-$43,680.

Renewable Thermal Energy Program: The Renewable Thermal Energy Technician program prepares technicians who design, install, operate and maintain solar, geothermal and biomass heating systems for both residential and commercial applications. Technicians will perform site assessments and integrate new renewable thermal systems with current existing energy sources. Renewable thermal energy technicians may be involved in the sale or marketing of solar, geothermal and biomass thermal energy technologies. Expected starting salary range: $39,520-$43,680.

Cape Cod Community College (http://www.capecod.edu/web/guest)

Cape Cod Community College offers three environmental technology certificates (Solar Thermal Technology, Photovoltaic Technology and Small Wind Technology). The “clean energy cluster” is a large and fast-growing segment of the Massachusetts economy.

Solar Thermal Technology: This certificate provides a solid understanding of solar hot water technology, site analysis, system design, and installation methods. Courses in this certificate count towards training requirements for the North American Board of Certified Energy Practitioners Solar Thermal Installer Certification. This certificate appeals to anyone interested in learning more about solar energy and applying that knowledge to their home, business or career.

Photovoltaic Technology: This certificate provides a solid understanding of photovoltaic technology, site analysis, system design, and installation methods. Students completing ENV173 and ENV178 are qualified to take the North American Board of Certified Energy Practitioners Entry Level Photovoltaic Certificate of Knowledge Exam. This certificate appeals to anyone interested in learning more about solar energy and applying that knowledge to their home, business, or career.

Small Wind Technology: This certificate provides a solid understanding of small wind technology, site analysis, system design, and installation methods. This certificate appeals to anyone interested in learning more about wind energy and applying that knowledge to their home, business, or career.

GREEN JOBS LEGISLATION[47]

The National Conference of State Legislatures compiled the following information on "Green Jobs" state legislation that was filed during 2007-08 legislative sessions. The legislation below was identified by a Westlaw search of 50-state bill database for bills active since January 1, 2007, and containing the terms "renewable energy" and "workforce development" in the same paragraph. Additionally, state legislative Web sites were reviewed. Please refer to each state legislature's Web site to obtain additional information and to ascertain whether the legislation became law, was vetoed, or died during the legislative process.

California (S.B. 1672)
Enacts the Renewable Energy, Climate Change, Career Technical Education, and Clean Technology Job Creation Bond Act of 2010 to authorize the issuance and sale of state general obligation bonds to fund 1) the construction of new facilities or the reconfiguration of existing facilities to provide pupils with the skills and knowledge necessary for careers directly related to clean technology, renewable energy, or energy efficiency, and 2) for loans to be awarded for capital outlay projects undertaken to provide job training and development in this area. Creates the Renewable Energy, Climate Change, Career Technical Education, and Clean Technology Job Creation Council who would oversee the implementation of this act.

California (A.B. 2147)
Provides financial assistance to energy efficiency and renewable energy worker training programs for individuals, including at-risk youth and formerly incarcerated individuals. Establishes the Green Jobs Corps Grant Program, to be administered by the Labor and Workforce Development Agency in order to award grants to community-based organizations, local agencies, and service providers, or their partners, to establish and operate energy efficiency and renewable energy worker training programs.

California (A.B. 2224)
Requires the Labor and Workforce Development Agency to establish standardized clean energy curriculum and provide outreach, assistance, and guidance to schools on creating clean energy training programs. Establishes the California Clean Energy Curriculum and Training Initiative sub account within the Labor and Workforce Development Fund. Requires the Public Utilities Commission to collaborate with all industry stakeholders to disseminate information on successful innovations for labor market services and worker training with respect to clean energy technologies and to facilitate the connection of clean industry stakeholders with training programs recognized by the Labor and Workforce Development Agency.

Colorado (H.B. 1025)
Creates the Governor's Energy Office and tasks the office to develop renewable energy curricula in collaboration with the Department of Higher Education to serve the work force needs of the renewable energy industry. Specifies that such collaboration may include research institution, state colleges, community colleges, and trade organizations. Provides that these institutions may partner with organizations that currently have curricula and training programs on renewable energy in developing new curricula.

Connecticut (S.B. 23)
Establishes a "green-collar jobs program" to be offered through the state-wide system of regional vocational technical schools. Specifies that such program may include, but not be limited to, training for

[47] Compilation of State Legislation on Green Jobs (2007-08) by NCSL's Energy, Environment and Transportation Department.

energy efficient building, construction and building retrofit trades and industries; residential, commercial or industrial energy efficiency assessment; renewable energy technologies; and sustainable climate change and environmental compliance strategies. Limits funding for the program to one hundred twenty-five thousand dollars for FY 2008.

Connecticut (H.B. 5724)
Requires the Renewable Energy Investments Board to convene a working group, in consultation with the Department of Public Utility Control, to develop a plan to maximize the use of solar power and create a self sustaining solar industry in Connecticut. Specifies that the plan include recommendations regarding workforce development and job training necessary to build an instate solar workforce and regarding coordination with other programs where appropriate.

Florida (H.B. 7135)
Mandates the consortium of state universities focused on research and development of innovative energy systems leading to alternative energy strategies, improved energy efficiencies, and expanded economic development to develop education and outreach programs to prepare a qualified energy workforce. Directs the faculty associated with the consortium to coordinate a statewide workforce development initiative focusing on college-level degrees, technician training, and public and commercial sectors awareness of alternative energy. Further directs the development of specific programs targeted at graduates with a background in energy, continuing education courses for technical and non technical professionals, and modules, laboratories, and courses for the universities to share. Requires the consortium to work with the Florida Community College System to coordinate and design industry-specific training programs for technicians.

Massachusetts (S.B. 2262)
Order authorizing an investigation of bill's revenue and tax impact – 05/01/2008. Creates a tax incentive for renewable energy technology job creation by providing a tax credit for direct manufacturing or professional services performed by an employee of renewable energy technology company during a calendar year that consists of research, development, production or provision for renewable energy.

Massachusetts (S.B. 2540)
Subject to appropriation, directs the secretary of labor and workforce development, in consultation with the secretary of energy and environmental affairs, to establish and administer programs and incentives to foster manufacturing and development in the renewable energy and energy efficient sectors. At a minimum, the secretary of labor and workforce development is required to develop workforce development and training programs to increase the number of trained skilled workers in the economic sectors of emerging clean energy, renewable energy, energy efficiency and demand resources, with a focus on training for low income and disadvantaged adults. Directs the program to identify and maintain well-trained skilled workers and address emerging skills gaps in the clean energy industry. Provides that the program include, but not be limited to, grants to state universities, state colleges, community colleges, vocational and technical schools and organized labor for educational and certification programs.

Minnesota (S.F. 3540)
Creates the Green Economy Transformation Task Force to advise and assist the governor and legislature regarding activities to transform the state's economy, and to develop a statewide action plan. Specifies that the task force is to be made-up of legislators, state agency representatives, and members representing the utility industry, financial institutions, environmental organizations, and a local economic development authority. Requires the task force to analyze labor force needs relative to the green economy, including educational, training, and retraining needs.

North Carolina (H.B. 2718)
Establishes the NC Green Business Fund to attract and leverage private-sector investments and entrepreneurial growth in environmentally conscious clean technology and renewable energy products and businesses. Includes the provision of no-interest loans to enhance workforce development in these businesses. Establishes the NC Green Business Fund for grants to private businesses with less than 100 employees, nonprofit organization, local governments, and State agencies to help grow a green economy in the state. Specifies that funds are to be made available for workforce development in the priority areas of the biofuels industry, the green buildings industry, and environmentally conscious clean technology and renewable energy products and businesses.

Pennsylvania (S.B. 14)
Establishes a Green Work Force Training Program to promote job training related to the energy efficiency and renewable energy industries. Requires the Department of Labor and Industry to consult with the Department of Environmental Protection, representatives from eligible industries and labor organizations, to ensure that the training programs will teach relevant skills and competencies and that any certificates and credentials resulting from completed job training are recognized by employers.

Rhode Island (H.B. 7884/ S.B. 2629)
Creates an economic and technology advancement advisory committee to recommend programs and incentives to foster energy efficiency and renewable energy workforce development and training programs, to increase the number of trained skilled workers in the economic sectors of emerging clean energy, renewable energy, energy efficiency, and demand resources. Requires that the programs and incentive be designed to promote growth of the clean energy economy by helping build a pipeline of well trained skilled workers and addressing emerging skills gaps in both clean energy development and adoption.

Vermont (H.B. 885)
Formulates a strategy for environmental technology sector workforce development and training with the goal of developing programs that promote and market the sector and create a competitive workforce equipped with the needed skills and competencies. Directs the commissioner of labor and the secretary of commerce to analyze the geographic distribution of existing businesses and anticipated opportunities for business recruitment using the inventory of green business developed by the agency of commerce and the North American Industry Classification System (NAICS). Defines “environmental technology sector” as businesses and organizations in or related to waste management; natural resource protection and management; energy efficiency or conservation; clean energy, including solar, wind, wave, hydro, geothermal, hydrogen, fuel cells, waste-to-energy, or biomass; and any other environmental technology certified by the secretary of commerce and community development.

Vermont (H.B. 520)
Tasks the commissioner of labor to develop a green building, energy efficiency, and renewable energy workforce development plan that includes the following:

(1) Comprehensive recommendations for recruiting and training individuals for employment in the green building and renewable energy and energy efficiency fields. The recommendation is to include goals for secondary and postsecondary schools, other educational institutions, workforce development organizations, and apprenticeship programs.
(2) Recommendations for expanding certification programs for green builders and designers and installers of energy efficiency and renewable energy devices and systems.
(3) Recommendations for incorporating energy efficiency and renewable energy training into apprenticeship and other training programs for electricians, plumbers, and other skilled trades persons.

(4) Curricula for business development training and technical assistance for businesses that include green builders, energy efficiency designers and developers, and manufacturers of renewable energy and energy efficiency products.
(5) Enhanced training programs for green builders and designers and weatherization professionals, including how to utilize state-of-the-art tools and materials.

Virginia (S.B. 446)
Directs the Secretary of Commerce and Trade to develop a Green Jobs program that will train workers for jobs in new industries related to alternative energies, including the manufacture and operation of products used to generate electricity.

Washington (S.B. 6605)
Creates the Washington energy efficiency worker training program within the department of community, trade, and economic development. Requires the provision of occupational skills training in the energy efficient building, construction, and retrofit industries to help individuals, including at-risk youth, prepare for jobs in these industries. Defines occupational skills training as curriculum development, on-the-job training, classroom training, and safety and health training. Provides for internship programs in fields related to energy efficiency and renewable energy.

Washington (H.B. 2815,S.B. 6516)
Establishes the clean energy jobs growth initiative with the goal of increasing the number of clean energy sector jobs in the state. Requires an analysis of the current labor market and projected job growth in clean energy sectors, the wage and benefits ranges of these jobs, and the education and training requirements of entry-level and incumbent workers within those sectors. Directs the designation of certain industries as high-demand green industries, and the designation of high-wage occupations within those industries. Specifies that these designations inform the planning and strategic direction of the selected industry skill panels and the selection of recipients of green-collar job training account grants. Provides that the green energy industry skill panels consist of business representatives from industry sectors related to clean energy, labor unions representing workers in those industries or labor affiliates administering state approved, joint apprenticeship programs or labor management partnership programs that train workers for these industries, employer associations, educational institutions, and local workforce investment boards, and other key stakeholders.

APPENDIX A

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APPENDIX B

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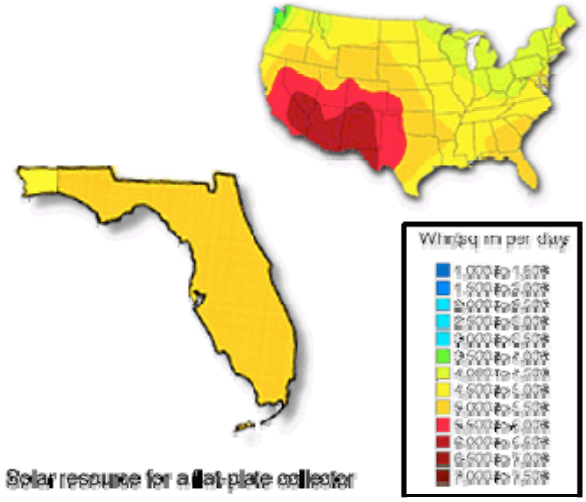
APPENDIX C

Efficiency and Energy Renewable Strategies
Jobs by Occupation and State with Average Wage (May 2007)

The University of Massachusetts researchers used present data on total employment in each state for each of the occupations and the average wage that workers earn in these occupations in the tables that follow. Nearly all of the median wage and employment estimates they provide in their tables are taken directly from the data reported in the May 2007 Occupational Employment and Wage Estimates tables of the Occupational Employment Statistics (OES) of the Bureau of Labor Statistics (BLS) (state data: www.bls.gov/oes/current/oessrcst.htm; national data: www.bls.gov/oes/current/oes_nat.htm). Throughout the main text the term “average wage” refers to a median wage.

Solar Resource for a Flat-Plate Collector

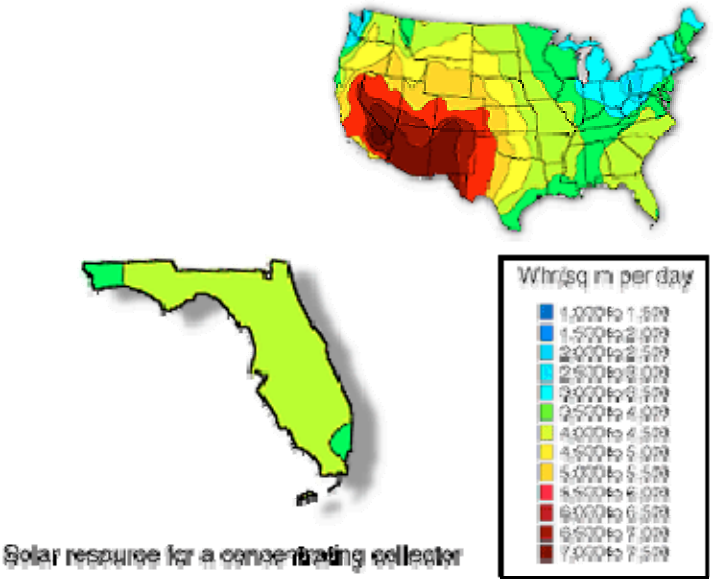


Solar resource for a flat-plate collector

Flat-plate collectors are typically fixed in a tilted position and can be mounted on a roof or on the ground. These collectors use both direct and reflected sunlight. For flat-plate collectors, Florida has a good available resource throughout the state.

Solar Resource for a Concentrating Collector

Concentrating collectors are typically on a tracker, so they always face the sun directly. Since concentrating collectors focus the sun's rays, they only use the direct rays coming straight from the sun. For concentrating collectors, Florida could pursue some types of technologies, but large-scale thermal utility systems are not effective with this resource.



Solar resource for a concentrating collector

Efficiency Strategy: Building Retrofitting
Jobs by Occupation and State with Average Wage (May 2007)

	Florida	Indiana	Minnesota	Missouri	Nebraska	New York	Ohio	Oregon	Pennsylvania	Tennessee	Virginia	Wisconsin
Electricians												
# Employed	44,140	15,000	11,570	11,850	5,230	34,340	25,560	7,480	23,280	12,020	19,760	12,440
Average Wage	$17.51	$23.87	$27.49	$23.77	$19.18	$28.19	$22.20	$28.16	$23.59	$18.78	$20.13	$24.04
Heating/Air Conditioning Installers												
# Employed	24,560	5,990	2,640	4,970	2,270	17,980	9,230	3,210	12,710	6,290	10,470	5,200
Average Wage	$16.97	$18.24	$23.33	$18.41	$17.90	$21.18	$17.94	$18.53	$19.42	$14.53	$17.32	$19.86
Carpenters												
# Employed	68,570	23,860	18,920	25,200	8,020	53,830	29,370	17,240	44,920	11,770	29,200	20,630
Average Wage	$15.61	$17.70	$19.78	$20.25	$14.55	$21.88	$17.33	$17.47	$18.31	$14.54	$16.77	$18.32
Construction Equipment Operators												
# Employed	22,020	10,050	9,330	8,900	2,860	14,640	11,540	4,070	16,320	7,240	12,760	8,790
Average Wage	$15.24	$20.25	$23.70	$20.98	$16.13	$26.34	$22.49	$20.98	$19.84	$14.73	$16.46	$23.60
Roofers												
# Employed	15,670	2,920	1,550	2,920	540	4,420	4,430	2,250	4,510	1,910	3,280	2,540
Average Wage	$14.63	$16.41	$24.06	$19.78	$14.05	$17.55	$16.31	$14.53	$18.33	$14.09	$15.09	$18.56
Insulation Workers												
# Employed	1,240	550	410	630	340	1,050	1,140	540	650	513	860	270
Average Wage	$14.35	$13.99	$18.82	$15.22	$17.45	$17.05	$14.52	$15.06	$15.85	$14.92	$14.75	$15.51
Carpenter Helpers												
# Employed	7,310	1,480	1,450	1,810	790	8,170	1,270	1,030	4,050	1,510	5,460	1,020
Average Wage	$11.52	$11.85	$11.78	$13.68	$11.14	$11.40	$11.29	$12.09	$12.10	$10.84	$12.30	$12.37
Industrial Truck Drivers												
# Employed	24,220	21,550	10,030	17,030	2,530	19,130	30,860	10,140	33,540	19,140	15,890	16,500
Average Wage	$12.16	$14.14	$15.67	$12.96	$13.61	$14.92	$13.72	$14.46	$14.29	$12.95	$12.70	$14.46
Construction Managers												
# Employed	19,560	3,830	2,710	3,140	1,630	13,140	5,450	3,600	5,120	4,440	5,570	2,730
Average Wage	$37.36	$36.71	$39.86	$33.02	$29.48	$52.73	$39.21	$37.44	$37.58	$26.63	$39.95	$38.40
Building Inspectors												
# Employed	6,680	1,140	1,670	2,090	310	5,670	3,580	1,270	5,120	1,160	3,620	1,140
Average Wage	$23.57	$18.66	$25.85	$21.91	$19.96	$23.79	$20.82	$26.73	$20.39	$19.26	$23.88	$24.25

Sources: May 2007 State Occupational Employment and Wage Estimates, Bureau of Labor Statistics; IMPLAN input-output modeling system, Bureau of Economic Analysis 2005 Annual Input-Output Accounts. See Methodology section for details.

Renewable Energy Strategy: Wind Power
Jobs by Occupation and State with Average Wage (May 2007)

	Florida	Indiana	Minnesota	Missouri	Nebraska	New York	Ohio	Oregon	Pennsylvania	Tennessee	Virginia	Wisconsin
Environmental Engineers												
# Employed	2,680	520	570	1,230	230	3,770	1,700	440	2,580	1,040	1,770	1,040
Average Wage	$31.35	$31.60	$35.41	$32.83	$33.21	$35.64	$35.45	$35.11	$36.50	$37.20	$33.75	$33.48
Iron and Steel Workers												
# Employed	3,120	1,970	650	1,830	710	4,040	2,760	400	2,880	1,040	1,970	1,370
Average Wage	$19.17	$23.46	$27.84	$24.09	$19.36	$34.79	$25.82	$22.24	$22.48	$18.39	$17.44	$27.04
Millwrights												
# Employed	1,430	2,700	1,200	1,020	260	1,160	4,120	1,670	1,850	1,890	1,020	1,610
Average Wage	$17.82	$25.70	$26.77	$22.79	$15.22	$24.42	$29.09	$19.89	$19.13	$20.50	$19.29	$24.95
Sheet Metal Workers												
# Employed	9,750	5,160	3,730	4,620	1,040	6,120	5,330	3,340	4,760	3,600	5,360	4,060
Average Wage	$16.07	$19.51	$25.99	$20.34	$22.29	$26.59	$22.00	$19.82	$21.60	$15.49	$17.33	$23.84
Machinists												
# Employed	9,230	14,630	9,020	10,880	2,110	14,480	29,610	3,970	21,190	11,600	6,820	16,580
Average Wage	$16.05	$17.05	$18.79	$14.94	$15.35	$17.29	$16.39	$19.41	$17.15	$17.12	$17.51	$17.38
Electrical Equipment Assemblers												
# Employed	11,650	5,910	5,810	4,570	1,340	14,670	7,820	6,920	9,320	3,660	4,350	6,910
Average Wage	$11.84	$10.72	$12.90	$13.16	$13.00	$12.73	$12.96	$12.95	$13.51	$11.34	$12.63	$12.16
Construction Equipment Operators												
# Employed	22,020	10,050	9,330	8,900	2,860	14,640	11,540	4,070	16,320	7,240	12,760	8,790
Average Wage	$15.24	$20.25	$23.70	$20.98	$16.13	$26.34	$22.49	$20.98	$19.84	$14.73	$16.46	$23.60
Industrial Truck Drivers												
# Employed	24,220	21,550	10,030	17,030	2,530	19,130	30,860	10,140	33,540	19,140	15,890	16,500
Average Wage	$12.16	$14.14	$15.67	$12.96	$13.61	$14.92	$13.72	$14.46	$14.29	$12.95	$12.70	$14.46
Industrial Production Managers												
# Employed	2,980	6,310	4,350	2,260	1,010	5,490	8,690	2,670	6,180	3,470	2,370	4,930
Average Wage	$40.40	$35.84	$39.31	$38.56	$34.56	$42.38	$36.94	$36.99	$36.96	$31.10	$39.35	$35.61
First-Line Production Supervisors												
# Employed	20,780	25,270	15,280	10,790	4,280	27,640	38,360	8,890	29,320	18,080	13,610	21,220
Average Wage	$23.61	$22.65	$23.86	$22.89	$22.35	$24.75	$23.23	$23.13	$24.38	$20.56	$23.54	$23.57

Sources: May 2007 State Occupational Employment and Wage Estimates, Bureau of Labor Statistics; IMPLAN input-output modeling system, Bureau of Economic Analysis 2005 Annual Input-Output Accounts. See Methodology section for details

Renewable Energy Strategy: Solar Power
Jobs by Occupation and State with Average Wage (May 2007)

	Florida	Indiana	Minnesota	Missouri	Nebraska	New York	Ohio	Oregon	Pennsylvania	Tennessee	Virginia	Wisconsin
Electrical Engineers												
# Employed	7,430	2,470	3,210	2,590	590	8,480	4,170	1,380	6,330	1,860	7,140	3,490
Average Wage	$36.00	$34.75	$37.99	$36.58	$35.27	$38.45	$32.36	$36.82	$36.15	$36.38	$38.70	$34.83
Electricians												
# Employed	44,140	15,000	11,570	11,850	5,230	34,340	25,560	7,480	23,280	12,020	19,760	12,440
Average Wage	$17.51	$23.87	$27.49	$23.77	$19.18	$28.19	$22.20	$28.16	$23.59	$18.78	$20.13	$24.04
Industrial Machinery Mechanics												
# Employed	9,080	10,040	6,850	5,330	1,570	9,410	12,280	4,270	16,210	7,640	7,410	7,270
Average Wage	$19.39	$22.41	$21.40	$19.81	$17.59	$20.85	$22.51	$21.30	$19.42	$17.93	$20.37	$21.43
Welders												
# Employed	14,090	12,010	8,710	10,310	4,000	9,410	15,710	5,570	17,520	9,530	8,000	12,900
Average Wage	$15.48	$15.06	$17.02	$14.69	$13.95	$16.23	$15.26	$15.79	$16.14	$14.76	$16.96	$16.26
Metal Fabricators												
# Employed	3,790	4,380	1,000	1,830	960	3,260	2,660	2,220	6,360	2,320	2,330	3,330
Average Wage	$14.04	$15.49	$17.51	$14.65	$13.12	$15.42	$15.08	$16.11	$15.46	$15.04	$13.94	$16.88
Electrical Equipment Assemblers												
# Employed	11,650	5,910	5,810	4,570	1,340	14,670	7,820	6,920	9,320	3,660	4,350	6,910
Average Wage	$11.84	$10.72	$12.90	$13.16	$13.00	$12.73	$12.96	$12.95	$13.51	$11.34	$12.63	$12.16
Construction Equipment Operators												
# Employed	22,020	10,050	9,330	8,900	2,860	14,640	11,540	4,070	16,320	7,240	12,760	8,790
Average Wage	$15.24	$20.25	$23.70	$20.98	$16.13	$26.34	$22.49	$20.98	$19.84	$14.73	$16.46	$23.60
Installation Helpers												
# Employed	8,600	2,430	2,600	1,720	400	9,230	3,810	1,560	7,100	3,240	5,000	2,020
Average Wage	$10.42	$11.45	$11.28	$11.31	$10.48	$13.57	$10.43	$12.00	$11.50	$11.41	$11.93	$10.27
Laborers												
# Employed	128,330	70,040	35,150	45,250	14,770	92,180	122,830	27,180	109,580	82,600	50,050	52,500
Average Wage	$9.85	$10.86	$11.83	$10.70	$10.94	$11.14	$10.74	$11.31	$11.26	$9.77	$10.58	$11.39
Construction Managers												
# Employed	19,560	3,830	2,710	3,140	1,630	13,140	5,450	3,600	5,120	4,440	5,570	2,730
	$37.36	$36.71	$39.86	$33.02	$29.48	$52.73	$39.21	$37.44	$37.58	$26.63	$39.95	$38.40

Sources: May 2007 State Occupational Employment and Wage Estimates, Bureau of Labor Statistics; IMPLAN input-output modeling system, Bureau of Economic Analysis 2005 Annual Input-Output Accounts. See Methodology section for details

Renewable Energy Strategy: Cellulosic Biofuels
Jobs by Occupation and State with Average Wage (May 2007)

	Florida	Indiana	Minnesota	Missouri	Nebraska	New York	Ohio	Oregon	Pennsylvania	Tennessee	Virginia	Wisconsin
Chemical Engineers												
# Employed	350	480	450	550	90	1,450	1,800	310	1,060	900	790	320
Average Wage	$35.88	$37.42	$34.89	$36.74	$27.20	$40.06	$37.74	$40.56	$35.69	$39.89	$42.48	$34.13
Chemists												
# Employed	2,220	2,230	1,690	1,580	320	5,190	3,800	490	4,900	1,030	1,740	1,800
Average Wage	$23.93	$24.77	$30.57	$28.38	$22.91	$31.95	$28.62	$26.06	$30.12	$29.37	$35.09	$25.17
Chemical Equipment Operators												
# Employed	800	1,020	280	500	210	1,140	2,770	540	4,220	1,580	670	850
Average Wage	$19.15	$21.85	$15.87	$20.27	$14.48	$20.74	$20.11	$19.99	$20.54	$20.60	$18.62	$21.22
Chemical Technicians												
# Employed	1,800	1,810	890	680	230	3,200	3,210	380	4,490	1,250	970	1,750
Average Wage	$16.95	$16.84	$18.95	$19.75	$16.48	$19.64	$19.24	$17.25	$19.40	$21.24	$21.53	$17.60
Mixing and Blending Machine Operators												
# Employed	7,150	3,920	2,210	3,980	1,460	10,830	8,380	880	6,180	2,950	3,350	4,130
Average Wage	$12.82	$15.47	$15.81	$15.58	$13.93	$16.80	$16.23	$14.19	$16.11	$13.78	$15.06	$15.75
Agricultural Workers												
# Employed	30,550	8,192	14,000	8,175	5,903	11,738	10,047	19,388	13,547	7,948	8,499	14,706
Average Wage	$8.85	$10.77	$10.56	$9.83	$11.92	$10.04	$9.43	$9.08	$10.29	$8.37	$9.15	$10.03
Industrial Truck Drivers												
# Employed	24,220	21,550	10,030	17,030	2,530	19,130	30,860	10,140	33,540	19,140	15,890	16,500
Average Wage	$12.16	$14.14	$15.67	$12.96	$13.61	$14.92	$13.72	$14.46	$14.29	$12.95	$12.70	$14.46
Farm Products Purchasers												
# Employed	360	350	420	450	340	640	320	340	490	220	130	520
Average Wage	$24.27	$25.41	$26.54	$19.69	$24.71	$35.25	$23.68	$24.27	$21.13	$20.45	$30.48	$17.77
First-Line Agricultural and Forestry Supervisors												
# Employed	1,050	190	270	250	160	300	310	670	450	180	480	230
Average Wage	$19.55	$18.14	$20.51	$21.83	$18.68	$19.30	$21.02	$20.17	$23.31	$16.31	$21.77	$22.11
Agricultural Inspectors												
# Employed	490	200	300	370	320	350	410	190	350	350	340	240
Average Wage	$17.64	$18.75	$20.08	$18.16	$19.88	$22.60	$20.35	$15.12	$19.75	$16.62	$21.10	$19.86

Sources: May 2007 State Occupational Employment and Wage Estimates, Bureau of Labor Statistics; IMPLAN input-output modeling system, Bureau of Economic Analysis 2005 Annual Input-Output Accounts. See Methodology section for details

APPENDIX D

Excerpts from House Bill 7135

Renewable Energy Devices within a Condominium Unit (s. 163.04, F.S.) – Extends the protection of the Florida Solar Rights Act to condominiums and provides that condominium governing documents cannot prohibit unit owners from placing renewable energy devices within the boundaries of the condominium unit, and removes the three-story height restriction for installation of solar collectors on residential properties. The law, first enacted in 1980, prohibits ordinances and private regulations that impair the ability of a consumer or business to install solar energy equipment.

State Comprehensive Plan/Energy and Climate Change (s. 186.007 and 187.201, F.S.) – Amends provisions relating to air quality, energy, and land use goals and policies of the State Comprehensive Plan. Includes encouragement of the development of low carbon emitting electric power plants, and includes under the land use goal, the siting of nuclear power plants to meet the state's determined need for electric power generation. It also requires that local government comprehensive plans include an energy element.

Property Tax Exemption for Renewable Energy Source Devices (ss. 196.012(14) and 196.175, F.S.) – Removes the expiration date of the property tax exemption for real property on which a renewable energy source device is installed and is being operated, thereby allowing property owners to once again apply for the exemption, effective January 1, 2009. Retains the period of each exemption at 10 years. Revises the options for calculating the amount of the exemption for properties with renewable energy source devices by limiting the exemption to the amount of the original cost of the device, including the installation cost, but not including the cost of replacing previously existing property.

Sales Tax Exemption for Renewable Energy Technologies (s. 212.08, F.S.) – Makes revisions to the existing sales and use tax exemption for renewable energy technologies. Revises the definition of "ethanol" to mean anhydrous denatured alcohol produced by the "conversion of carbohydrates" rather than by the "fermentation of plant sugars." Specifies that items eligible for the sales tax exemption are limited to one refund and requires a purchaser who receives a refund to notify a subsequent purchaser on the sales invoice or other proof of purchase that the item is no longer eligible for a tax refund. Transfers current responsibilities of the Department of Environmental Protection (DEP) to the Florida Energy and Climate Commission.

Capital Investment Tax Credit (s. 220.191, F.S.) – Makes revisions to the existing capital investment tax credit section to provide for the transferability of tax credits for a project that includes locating a new solar panel manufacturing facility in the state that generates a minimum of 400 jobs within six months with an average salary of at least $50,000. Limits credit that can be transferred to the lesser of the qualifying business' tax liability for that year or the credit amount granted for that year.

Renewable Energy Technologies Investment Tax Credit (s. 220.192, F.S.) – Makes revisions to the existing corporate income tax credit provision for investment costs associated with hydrogen vehicles and hydrogen vehicle fueling stations, commercial stationary fuel cells, and biofuels, including biodiesel and ethanol. Provides for the transferability of tax credits and authorizes existing tax credits to be passed through to underlying partners, members, or owners by written agreement. Transfers current responsibilities of the Department of Environmental Protection (DEP) to the Florida Energy and Climate Commission.

Renewable Energy Production Tax Credits (s. 220.193, F.S.) – Makes revisions to the existing corporate renewable energy production tax credit provision to include electricity "sold" as well as electricity "used" by the producer when the producer would have otherwise been required to purchase the electricity. Clarifies that corporations that own an interest in a partnership can claim the tax credits earned by those partnerships for generating renewable energy. Allows taxpayers using the alternative minimum tax process to also utilize the credit. Provides for retroactivity of the amendments to the section (to the effective date of the law establishing the credit) so that entities that have been prohibited from taking advantage of the production tax credits, due to a lack of clarification, may now claim such credit.

DMS/DOT Biofuel Analysis (s. 287.16, F.S.) – Directs the Department of Management Services (DMS) to conduct, in coordination with the Department of Transportation (DOT), an analysis of fuel additive and biofuel use by the DOT through its central fueling facilities. Directs the DMS to encourage other state government entities to analyze transportation fuel usage and report such information to the DMS.

Innovation Incentive Program (s. 288.1089, F.S.) – Authorizes the Office of Tourism, Trade, and Economic Development to provide incentive awards to alternative and renewable energy projects. Establishes criteria for these projects, authorizes Enterprise Florida, Inc., to evaluate proposals for the awards, and requires Enterprise Florida, Inc., to solicit comments and recommendations from the Florida Energy and Climate Commission for alternative and renewable energy project proposals.

Energy Efficiency and Conservation (s. 366.81 and 366.82, F.S.) – Revises the Florida Energy Efficiency and Conservation Act (FEECA), to explicitly allow efficiency and conservation investments across generation, transmission, and distribution as well as efficiencies within the user base; to encourage the development of demand-side renewable energy; and to provide criteria the Public Service Commission (PSC) is to consider when evaluating proposed conservation and efficiency measures.

Net Metering (s. 366.91, F.S.) – Expands the term "biomass" to include waste, byproducts or products from agricultural and orchard crops, waste or co-products from livestock and poultry operations, and waste or byproducts from food processing. Requires investor-owned utilities to develop a standardized interconnection agreement and net metering program for customer-owned renewable generation on or before January 1, 2009, and directs municipal electric utilities and rural electric cooperatives that sell electricity at retail to develop a standardized interconnection agreement and net metering program for customer-owned renewable generation, as well. Directs each governing authority to establish requirements relating to such. Requires that if a utility is purchasing power generated from biogas produced by the anaerobic digestion of agricultural waste, including food waste and other agricultural byproducts, that net metering be available at a single metering point or be available as a part of conjunctive billing of multiple points for a customer at a single location on the condition that the provision of such service is not projected to result in higher costs of electric services to the general body of ratepayers or adversely affect the adequacy or reliability of electric service to all customers.

Renewable Portfolio Standard (s. 366.92, F.S.) – Directs the Public Service Commission (PSC) to adopt a rule for a renewable portfolio standard (RPS) requiring each provider, which includes an investor-owned utility, but not a municipal electric utility or a rural electric cooperative, to supply renewable energy to its customers, either directly, by procuring, or indirectly providing through the purchase of Renewable Energy Credits (RECs). Requires the PSC to present the draft rule for legislative consideration by February 1, 2009, and prohibits the rule from being implemented until ratified by the Legislature. Authorizes the PSC to approve projects and power sales

agreements with renewable power producers, and the sale of renewable energy credits which are needed to comply with the RPS. Directs municipal electric utilities and rural electric cooperatives to develop standards for the promotion, encouragement, and expansion of the use of renewable energy resources and energy conservation and efficiency measures.

Florida Energy and Climate Commission (s. 377.601 - 377.806 and 377.901, F.S.) – Provides for a transfer of the Florida Energy Commission from the Office of Legislative Services (and authorizes four [4] FTEs) and the State Energy Program from the Department of Environmental Protection (DEP) to the Florida Energy and Climate Commission (commission) in the Executive Office of the Governor and repeals the Florida Energy Commission. Clarifies that the definition of "energy resources" includes "energy converted from solar radiation, wind, hydraulic potential, tidal movements, geothermal sources, biomass, and other energy sources the commission determines to be important to the production or supply of energy."

Florida Renewable Fuel Standard Act (s. 526.06, ss. 526.201 - 526.207 and 206.43(2)(b), F.S.) – Establishes the Florida Renewable Fuel Standard Act (act). Provides that beginning on December 31, 2010, all gasoline sold or offered for sale in Florida by a terminal supplier, importer, blender, or wholesaler shall be blended gasoline. Defines blended gasoline as a "mixture of 90 to 91 percent gasoline and 9 to 10 percent fuel ethanol, by volume." The ethanol portion may be derived from any agricultural source. Refer to the statutory cite for a list of exemptions.

Florida Building Code (s. 553.73, F.S.) – Directs the Florida Building Commission to select the most recent International Energy Conservation Code as a foundation code. Provides for modification of the code by the commission to achieve the efficiency levels of the Florida Energy efficiency Code for Building Construction.

Florida Energy Systems Consortium (s. 1004.648, F.S.) – Establishes the Florida Energy Systems Consortium (consortium), consisting of all eleven state universities. The consortium is designed to promote collaboration between experts in the State University System for the purposes of sharing energy-related expertise and assisting in the development and implementation of a "comprehensive, long-term, environmentally compatible, sustainable, and efficient energy strategic plan for the state."

Woody Biomass Economic Study (s. 113) – Directs the Department of Agriculture and Consumer Services, in conjunction with the Department of Environmental Protection, to conduct an economic impact study on the effects of granting financial incentives to energy producers who use woody biomass as fuel. Requires study to include an analysis of effects on wood supply and prices, impacts on current markets, and on forest sustainability. Requires results of the study to be submitted to the Governor, the President of the Senate, and the Speaker of the House of Representatives no later than March 1, 2010.

Recognition Program for Green Schools (s. 116) – Requires the Department of Education and the Department of Environmental Protection (DEP) to develop a program to provide awards or recognition for outstanding efforts in conservation, energy and water use reduction, environmental enhancement, and conservation-related educational curriculum development; authorizes students, classes, teachers, schools, or district school boards to be eligible for such awards or recognition; encourages the departments to seek private sector funding for the program.

APPENDIX E

Alternative Energy Related Next Generation Standards

In the sample listing below, the benchmark number tells you that it is a science benchmark ("SC"), which grade level (for example, 2 = 2nd grade, 912 = high school), the science discipline (N = Nature of Science, E = Earth Science, L = Life Science, P = Physical Science), followed by a big idea number and the benchmark number.

Grade 2	
SC.2.E.7.2	Investigate by observing and measuring, that the Sun's energy directly and indirectly warms the water, land, and air.
SC.2.P.10.1	Discuss that people use electricity or other forms of energy to cook their food, cool or warm their homes, and power their cars.
Grade 3	
SC.3.E.5.2	Identify the Sun as a star that emits energy; some of it in the form of light.
SC.3.E.6.1	Demonstrate that radiant energy from the Sun can heat objects and when the Sun is not present, heat may be lost.
SC.3.L.17.2	Recognize that plants use energy from the Sun, air, and water to make their own food.
SC.3.N.3.1	Recognize that words in science can have different or more specific meanings than their use in everyday language; for example, energy, cell, heat/cold, and evidence.
SC.3.P.10.1	Identify some basic forms of energy such as light, heat, sound, electrical, and mechanical.
SC.3.P.10.2	Recognize that energy has the ability to cause motion or create change.
Grade 4	
SC.4.E.6.6	Identify resources available in Florida (water, phosphate, oil, limestone, silicon, wind, and solar energy).
SC.4.L.17.3	Trace the flow of energy from the Sun as it is transferred along the food chain through the producers to the consumers.
SC.4.P.10.1	Observe and describe some basic forms of energy, including light, heat, sound, electrical, and the energy of motion.
SC.4.P.10.2	Investigate and describe that energy has the ability to cause motion or create change.
SC.4.P.10.4	Describe how moving water and air are sources of energy and can be used to move things.
Grade 5	
SC.5.P.10.1	Investigate and describe some basic forms of energy, including light, heat, sound, electrical, chemical, and mechanical.
SC.5.P.10.2	Investigate and explain that energy has the ability to cause motion or create change.
SC.5.P.10.4	Investigate and explain that electrical energy can be transformed into heat, light, and sound energy, as well as the energy of motion.
Grade 6	
SC.6.E.7.5	Explain how energy provided by the sun influences global patterns of atmospheric movement and the temperature differences between air, water, and land.
SC.6.P.11.1	Explore the Law of Conservation of Energy by differentiating between potential and kinetic energy. Identify situations where kinetic energy is transformed into potential energy and vice versa.
Grade 7	

SC.7.P.11.2	Investigate and describe the transformation of energy from one form to another.
SC.7.P.11.3	Cite evidence to explain that energy cannot be created nor destroyed, only changed from one form to another.
Grade 8	
SC.8.L.18.3	Construct a scientific model of the carbon cycle to show how matter and energy are continuously transferred within and between organisms and their physical environment.
High School	
SC.912.E.6.6	Analyze past, present, and potential future consequences to the environment resulting from various energy production technologies.
SC.912.E.7.1	Analyze the movement of matter and energy through the different biogeochemical cycles, including water and carbon.
SC.912.L.17.11	Evaluate the costs and benefits of renewable and nonrenewable resources, such as water, energy, fossil fuels, wildlife, and forests.
SC.912.P.10.1	Differentiate among the various forms of energy and recognize that they can be transformed from one form to others.
SC.912.P.10.2	Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.
SC.912.P.10.4	Describe heat as the energy transferred by convection, conduction, and radiation, and explain the connection of heat to change in temperature or states of matter.
SC.912.P.10.6	Create and interpret potential energy diagrams, for example: chemical reactions, orbits around a central body, motion of a pendulum.
SC.912.P.10.8	Explain entropy's role in determining the efficiency of processes that convert energy to work.
SC.912.P.10.11	Explain and compare nuclear reactions (radioactive decay, fission and fusion), the energy changes associated with them and their associated safety issues.

In addition to the science standards listed above, the Florida Course Code Directory has some courses specifically related to learning about alternative energy sources at the high school level including classes in solar energy and nuclear energy.

For more information about the Next Generation Sunshine State Standards, you may visit http://www.floridastandards.org

For more information about the Florida Course Code Directory, you may visit http://www.fldoe.org/articulation/CCD/.

APPENDIX F

Florida Energy and Education Partnerships

High School Career Academies:

- Dunnellon H.S. – "Power Industry Academy" (Marion County)
- Marion Technical Institute (H.S.) – "Electrical/Lineman Academy" (Marion County)
- Dixie County H.S. – "Welding Career Academy" (Dixie County)
- Crystal River H.S. – "Utility Operator Academy" (In the planning stages) (Citrus County)
- Chiefland H.S. – "Plumbing/Pipe Fitting Academy" (In the planning stages) (Levy County)
- Williston H.S. – "Welding Career Academy" (In the planning stages) (Levy County)
- Anclote H.S. – Power Industry Academy in partnership with TECO (In the planning stages) (Pasco County)

Community Colleges:

- Central Florida Community College (CFCC) – "Power Industry Engineering Program" (Citrus County)
- Withlacoochee Technical Institute – In conjunction with the CFCC program (Citrus County)
- Lake-Sumter Community College – Lineman Boot Camp (Sumter County)
- Indian River State College – Radiation protection program in partnership with FP&L (Indian River)
- Community Technical & Adult Education, CTAE – Instrumentation & Control program (Marion County)

Gulf Power Company

High School Career Academies:

- Gulf Power Academy at West Florida High School of Advanced Technology – Pensacola
- Gulf Power Construction Academies at Locklin Tech – Milton
- Gulf Power Institutes at Laurel Hill High School – Laurel Hill

Purpose: To raise student awareness of, interest in, and preparedness for Gulf Power careers, including craft, technical, and professional.

JEA

High School Career Academies:

- Energy, Manufacturing and Construction Academy - Duval
- Stellar Academy of Mechanical Engineering – St. Johns
- Bartram Academy of Architectural Design – St. Johns
- Creekside Academy of Environmental and Urban Planning – St. Johns
- Building, Engineering, Architecture and Manufacturing Academy - Duval
- Middleburg Academy of Architecture and Construction - Clay
- Orange Park Academy of Engineering and Design - Clay
- Pedro Menendez Academy of Architectural and Building Sciences – St. Johns
- Robert E. Lee Engineering Academy - Duval
- Terry Parker Coastal and Environmental Sciences Academy - Duval

Purpose: Collaborative efforts with business and education in the Jacksonville region will prepare the next generation of utility workers for successful entry to the workforce and/or higher education.

Lakeland Electric

High School Career Academies:

- Lakeland Electric Power Academy at Tenoroc H.S. in Lakeland. (Polk County) ...Construction, electrical, mechanical and utility career awareness.

Florida Power & Light

Community Colleges

- Indian River State College – Power Plant Technology Institute / Electronics Engineering Technology – Instrumentation and Control Technicians, Mechanical and Electrical Maintenance Technicians.

  Currently under development:
  Nuclear Energy: Non-licensed Operators, Radiation Protection Technicians, Chemistry Technicians.
  Fossil and Hybrid Power Plants: Bridge program between nuclear and fossil/hybrid for maintenance workforce.
  Alternative Energy: Specializations in Solar, Wind, Biomass and Fuel Cell Technologies.
  Energy Efficient Building Design: LEED Certifications, Energy Conservation, Heating and Cooling systems.

- Miami Dade College – Electrical Power Technology - Instrumentation and Control Technicians, Mechanical and Electrical Maintenance Technicians.

  Currently under development:
  Nuclear Energy: Non-licensed Operators.
  Alternative Energy: Solar Energy Specializations, LEED Certifications.

APPENDIX G

Enterprise Florida
Alternative Energy Research Compendium

Solar Energy

Although solar energy generation technologies have been around for more than 30 years, much variety and room for innovation exist in this sector, as it attracts further market acceptance and becomes a viable option in a well-managed energy portfolio.

Florida is one of the best places for solar energy generation technologies because the Sunshine State averages roughly 240 days of year-round sunshine and receives 85% of the maximum solar resource available in the U.S. Not surprisingly, a large number of industry facilities and research centers, as well as some of the leading "green" utility companies in the nation such as FPL, have chosen Florida as their base for developing and deploying the next generation of solar energy technologies.

Areas of Excellence: Florida has a strong network of companies that produce photovoltaic (PV) module and systems components and solar thermal equipment that give it the potential to become a leader in these fields. For example, with more than 430 companies and nearly 16,000 workers, Florida has one of the largest concentrations in the U.S of suppliers of silicon, solar PV module components, and balance of systems components and ranks among the top five states in the production of solar thermal collectors. In addition, Florida researchers are already developing next generation photovoltaic technologies, like thin film PV based on amorphous silicon, cadmium telluride, CIS/CIGS, and other emerging and nano materials.

R&D Assets: The state's commitment to green technologies has attracted many talented researchers, engineers and other industry professionals to Florida, where their innovative work is supported through a number of R&D centers and programs, including:

Clean Energy Research Center (CERC) at the University of South Florida – Tampa

Researchers at CERC are active in thin and thick films, silicon carbide materials and processing, photovoltaic and hybrid systems, tandem solar cells using organic polymers and inorganic materials, and roof top systems. CERC scientists were the first in the world to exceed 15% efficiency for a thin film PV cell (using cadmium telluride).

Florida Institute for Sustainable Energy (FISE) at the University of Florida – Gainesville

Areas of strength for FISE in solar R&D include fundamental materials research and advanced process development for thin-film CIS-based PV; organic-based PV material research, optical designs, and device physics for efficiency improvement; and thermochemical conversion for hydrogen production.

Florida Solar Energy Center (FSEC)/ University of Central Florida – Cocoa / Orlando

FSEC's 95 scientists have particular expertise in solar PV and solar thermal R&D and testing activities including the development of CIGSS thin film cells, photoelectrochemical (PEC) cells, and tribiological coatings.

Sustainable Energy Science and Engineering Center (SESEC) at Florida State University – Tallahassee

Biomass Energy and Fuels

SESEC is dedicated to developing lower emission energy systems through industry, government, and academic collaboration. SESEC is focused on the development of off-grid zero emission buildings, which utilize solar-thermal tri-generation systems.

Given its rich base of natural resources and industry expertise, Florida is poised for leadership in the area of biofuels—transportation fuels made from biomass materials, including cellulosic ethanol and biodiesel, among others. Florida's high volume of biomass feedstock accounts for 10% of total U.S. cellulosic biomass output, by some estimates. Indeed, Florida is the nation's largest producer of biomass, and leads in the production of sugarcane and citrus, forest residues, and urban wood waste.

Areas of Excellence: Biomass and biofuels projects are as numerous in Florida as they are diverse. From the original cellulosic ethanol technology developed at the University of Florida, to start-ups looking to produce energy from a number of other sustainable biomass materials such as jatropha, algae, citrus peel, and sugar cane bagasse, Florida has no shortage of innovators in the field. Their biomass energy R&D is supported by Florida's complimentary strengths in biotechnology, chemistry, agricultural science and engineering, and other fields.

R&D Assets: Some of the best biomass energy research is conducted in Florida centers such as:

Applied Research Center at Florida International University – Miami

Scientists at the Applied Research Center conduct R&D in biomass gasification for hydrogen production, co-combustion, and pretreatment processes for cellulosic ethanol production for sugarcane bagasse.

Clean Energy Research Center (CERC) at the University of South Florida – Tampa

Researchers at CERC evaluate and promote new biomass energy technologies including landfill gas utilization with microturbines.

Florida Institute for Sustainable Energy (FISE) at the University of Florida – Gainesville

FISE has extensive experience in biomass energy technologies housed in three specialized centers:

- The **Florida Center for Renewable Chemicals and Fuels** is a leader in the development of biocatalysts and enzymes (through microbial metabolic engineering) for the production of fuel ethanol and chemicals from renewable biomass.
- The **Bioprocess Engineering Research Laboratory** has expertise in thermochemical biomass gasification and pyrolysis processes and other gasification technologies.
- The **Bioenergy and Sustainable Technology Laboratory** focuses on anaerobic microbiology and anaerobic digestion technology for biogas production, including digester design utilizing an on-site demonstration facility.

Institute for Food and Agricultural Sciences (IFAS) at the University of Florida – Gainesville

IFAS brings together more than 100 scientists and extension faculty involved in bioenergy-related areas of interest including the development of energy crops, environmental assessment of energy systems, agricultural economics and policy, and resource efficiency and energy conservation.

Florida Solar Energy Center (FSEC) at the University of Central Florida – Cocoa

Researchers have extensive experience in solar, electric and hybrid-electric vehicle technologies. FSEC in conjunction with the Clean Cities program at the center provides training on electric drives systems, ethanol and biodiesel fuels as well as natural gas. Technical assistance is provided for implementation of transportation project for future job market development in vehicle production, maintenance and infrastructure.

Fuel Cells and Hydrogen Technology

Fuel cells promise to offer a highly efficient, reliable, continuous, and consistent source of power in a variety of stationary or portable applications, including powering electronics, medical devices, cars, utility power stations, buildings, industrial facilities, hospitals, and more. As industry activity expands, Florida's research and business communities are well-positioned to make the state a leading center of innovation in the industry.

Areas of Excellence: Florida has several long-standing advantages that give it an edge in the fuel cells and hydrogen technologies field, including PEM fuel cells, SOFC, hydrogen production and storage, and membrane technologies. Florida's successful track record of collaboration with government agencies and industry has resulted in a strong network of academic research programs in the field and a cadre of world-class talent in materials science, electrical and chemical engineering and other related fields.

R&D Assets: These and other Florida centers frequently collaborate with NASA and the Department of Energy on fuel cells and hydrogen technologies research:

Florida Solar Energy Center (FSEC) / University of Central Florida (UCF) – Cocoa / Orlando

FSEC is a leading center for hydrogen and fuel cell R&D—especially PEM fuel cell R&D—and has been a U.S. DOE-designated Center of Excellence in Hydrogen Research and Education for over a decade. FSEC researchers hold over 40 patents in hydrogen production, storage, cryogenics, detection, and fuel cell applications. Scientists within UCF's department of Mechanical, Materials, and Aerospace Engineering provide additional expertise in hydrogen use in advanced turbines.

University of Florida – Gainesville

The University of Florida (UF) is considered by the U.S. Department of Energy to have one of the preeminent Solid Oxide Fuel Cell (SOFC) research programs in the U.S., and has been active in Phosphoric Acid (PAFC) and Proton Exchange Membrane Fuel Cells (PEMFC) for transportation for over a decade. Overall UF hydrogen research strengths include hydrogen production, transport, storage, leak detection/sensors, fuel cell electrolytes and cathodes, and high temperature electrochemistry.

University of South Florida – Tampa

Scientists at the University of South Florida conduct research in hydrogen production, improved hydrogen storage (using advanced materials, nanotechnology and carbon-based nanotubes), and proton exchange membrane fuel cells.

Florida International University (FIU) – Miami

FIU scientists are pursuing stationary and mobile fuel cell applications through research in novel electrode-electrolyte systems, catalyst performance, and fuel cell stack evaluation.

Additional hydrogen and fuel cell R&D is being conducted at **Florida A&M University** (Tallahassee), **Florida State University** (Tallahassee), and the **University of West Florida** (Pensacola).

Ocean Energy

Ocean energy technologies are emerging as an area of significant R&D, and Florida is at the forefront of this trend. Inspired by the abundance of this natural resource in the state and by the world-class expertise in the field that has been generated over decades, ocean energy research is now booming in the state. Florida scientists and companies are already developing the ocean energy technology systems and components of tomorrow.

Areas of Excellence: Florida's extensive coastline and proximity to the Gulf Stream, the most energy-dense ocean current, make it ideally situated for a range of ocean energy R&D and deployment activities. For example, the Florida Center of Excellence in Ocean Energy Technology at Florida Atlantic University is developing ocean energy technologies to generate electricity, hydrogen, and potable water, as well as to provide alternative methods for residential cooling. Several other companies are pursuing the commercialization of proprietary technologies for ocean energy generation or providing engineering services and hardware for such projects.

R&D Assets: Promising ocean energy research is done at Florida centers such as:

College of Marine Science at the University of South Florida – St. Petersburg

Physical oceanographers at the College of Marine Science use computer models, real time data, satellite remote sensing, and in situ data from moored arrays, coastal and island tide gauges, and other methods to study a wide range of issues, including tide and current prediction.

Florida Center of Excellence in Ocean Energy Technology at Florida Atlantic University – Dania Beach

The Center for Ocean Energy Technology is a synergistic partnership among academia, industry, and government laboratories combining expertise in ocean engineering and science, fabrication and testing to foster the research, design, development, implementation, testing, and commercialization of cutting-edge ocean energy technologies that are cost-competitive with existing fossil-fuel-based power generation. Ocean current, thermal, wave, and tidal-based energy are focus areas for development as renewable power sources.

Department of Ocean Engineering at Florida Institute of Technology – Melbourne

Florida Institute of Technology scientists conduct R&D in coastal engineering, hydrographic engineering, marine vehicles, marine materials and corrosion, biofueling, and underwater technology.

Oceanographic Center at Nova Southeastern University (NSU)– Dania Beach

Nova's ocean researchers excel in marine biology and observational and theoretical oceanography, including modeling large-scale ocean circulation, coastal dynamics, ocean-atmosphere coupling, surface gravity waves, biological oceanography, chemical oceanography. NSU's area of particular expertise for ocean energy technology R&D is assessing the environmental impact of projects.

Rosenstiel School of Marine & Atmospheric Science at the University of Miami – Miami

Rosentiel's scientists offer expertise in numerical modeling of coastal ocean circulation, marine ecosystem dynamics, air-sea interaction, remote-sensing meteorologic research, ocean model development, and high-frequency radar studies that map coastal surface currents and waves.

SeaTech Institute of Ocean and Systems Engineering at Florida Atlantic University – Dania Beach

SeaTech's 15 faculty, 27 engineers and technicians and 40 graduate students are engaged in federally and industry sponsored ocean engineering research and technology development in the areas of acoustics, marine vehicles, hydrodynamics and physical oceanography, and marine materials and nano-composites.

SRI International - St. Petersburg – St. Petersburg

SRI International's Marine Technology Program specializes in the study of surface and subsurface marine environments. These studies involve experiments, R&D, deployment, and operations of advanced sensors and their systems. The staff conducts research and engineering in optics, acoustics, MEMS, mass spectrometry, and related marine sciences.

More than Renewables

The clean energy industry will rely not just on renewables, but on a wide range of complimentary and supporting technologies. All of them are part of the growing cleantech sector and range from energy efficiency, distribution and storage to power generation, "green" building technologies and others.

Many Florida utilities, cleantech companies, and large Original Equipment Manufacturers (OEMs) have embraced eco-friendly innovation. For example, two of the world's top power generation equipment manufacturers headquartered here, Mitsubishi Power Systems and Siemens Power Generation, have expanded their local R&D operations into clean technologies. The recently established Siemens Center of Excellence: Advanced Turbines and Energy Systems Research at UCF, will focus on all energy systems above 20 kW power rating, including wind turbines and renewable energy systems, carbon capture, and solid oxide fuel cells. Mitsubishi Power Systems Americas recently expanded with a new manufacturing facility for turbine parts, which includes a center of excellence capabilities for combustion turbine blades and vane component manufacturing.

Areas of Excellence: From more efficient power distribution systems to turbines with fuel flexibility and high energy density batteries, Florida companies and research centers are innovating and commercializing cleantech products. Partnerships among these organizations are frequent and fruitful, underlying Florida's particular talent for fostering a climate of cooperation among academe and business.

R&D Assets: Some Florida research centers focused on more than renewables include:

Center for Advanced Power Systems – Tallahassee
Researchers at the Florida State University / Florida A&M University Center for Advanced Power Systems (CAPS) are developing a range of power converter technologies and using their power systems simulation capabilities to better integrate renewable energy sources into the grid. CAPS is a leading research center in the areas of grid reliability, capacity, efficiency, security, and superconductivity for power distribution.

Center for Advanced Turbines and Energy Research (CATER) at the University of Central Florida – Orlando

CATER scientists advance energy conversion and power generation technologies including turbines with fuel flexibility / alternative fuels and related systems for higher efficiencies and lower emissions, as well as their usage in centralized power generation, aero-propulsion, and distributed generation. CATER scientists work with a range of industry partners including Siemens Power Generation, Pratt & Whitney, Mitsubishi Power Systems, Boeing, Lockheed Martin, and more.

Florida Power Electronics Center at the University of Central Florida – Orlando
Researchers at the Power Electronics Center develop high frequency power electronics systems to improve power density, efficiency and performance; develop power electronics interface systems for photovoltaic arrays and fuel cells; and design high frequency dc-to-dc resonant converter topologies.

Nuclear Engineering at the University of Florida – Gainesville

The University of Florida's nuclear engineering faculty have a national reputation in advanced nuclear fuel research and simulation. Other research areas include Generation IV power reactors, reactor physics, and

numerical techniques and parallel computing. The University of Florida has a training reactor and is working to design, license, and construct a fully digital reactor control system to serve as a center for testing advanced digital control and training nuclear reactor operators.

Power Center for Utility Explorations at the University of South Florida – Tampa

Power Center for Utility Explorations' scientists work with major utilities to explore and address issues in energy transmission, distribution, and generation systems. Key focus areas for the Center include demand side management, distributed renewable power systems and their interface to the utility grid, biomass power production, microgrids, and weather and reliability.

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Report Number: WE101 Greenforce Florida

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