

Energy Industry Initiative Draft Report

Presented by:

The Energy Industry Initiative Steering Committee
of the Governor's Workforce Investment Board

July 2009



Governor's Workforce Investment Board

James E. Rzepkowski
Peter Lowenthal
Co-Chairs

Energy Industry Initiative Steering Committee
Governor's Workforce Investment Board

Executive Summary

Maryland's economic and workforce development goals are the same: to create a prosperous, competitive and growing economy in which all residents participate to the fullest extent possible. Energy, needed to power industry and businesses, homes and buildings, and to transport goods and people, is critical to that prosperity, as is a highly trained and skilled workforce.

Most of Maryland's energy consumption is of electricity. The use of electricity has increased in the last 10 years and is projected to grow 21 percent over the next 20 years. The State's ability to produce and/or buy traditional power is constrained, so much so that the Maryland Energy Administration (MEA) has predicted rolling brown outs. The lack of reliable and affordable energy is a threat to economic development and, with it, workforce growth.

Workforce Challenges

There are initiatives to build new power generation plants and transmission lines to support this increased consumption. However, Maryland utilities lack enough skilled craft workers to build that infrastructure, install the equipment, operate the facilities or make repairs. Like other industries, a significant portion of the current energy workforce, potentially 50 percent, are eligible for retirement and will do so in increasing numbers over the next ten years. Furthermore, an insufficient number of skilled craft workers are coming through the training and development pipeline to meet replacement and growth needs.

The O'Malley-Brown Administration is also leading Maryland's effort to improve energy efficiency, conservation, and expand the use of renewable and alternative energy. Investments in these green initiatives have the potential to stimulate job growth across a wide range of industry sectors. Most jobs in the green economy will be built on the skill base of the existing workforce, and therefore will place greater demands on an already tight skilled trade workforce talent pool. Preparing a skilled workforce for green jobs also faces the challenge of creating a pipeline with the capacity to educate, train, and certify workers to meet industry needs and standards.

Outcomes

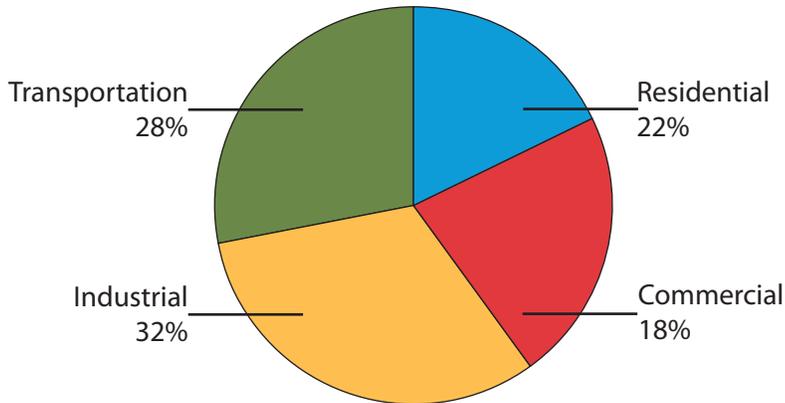
The Energy Industry Initiative Steering Committee (Steering Committee) of the Governor's Workforce Investment Board (GWIB) analyzed workforce demand and supply, identified the critical workforce issues that impact workforce development, and developed strategies to address these issues and that will assist the Governor, Maryland's workforce system and the industries of the green economy.

This report summarizes the Steering Committee's work and recommendations. As outlined below, the industry's critical workforce issues are: Workforce Attraction and Recruitment; Education, Training and Certification; Data Driven Policy Development; and Public Policy.

Maryland's Green Economy

Reliable, affordable, and, for many, domestic sources of energy are essential for economic and workforce development. Most of Maryland's energy use is for electricity.¹ Between 1980 and 2008, Marylander's use of electricity increased by 300 percent. Maryland is not alone.² The average American household uses at least

Graphic: U.S. Energy Picture



Source: EIA's Energy Outlook

21 percent more electricity now than was used 30 years ago. Consumption is expected to grow by 11 percent in the next 20 years. More households have HVAC systems and a plethora of other electronic equipment and devices from color televisions to automated coffeepots that need electricity to maintain and use.³

Maryland's electricity demand is higher than local supply. Consequently, Maryland must import approximately 32 percent of its electricity from out-of-state suppliers, who are part of the 13-state regional grid.⁴

In 2008, the MEA concluded that given current consumption patterns and existing generation capacity, Maryland could face electricity shortages and rolling blackouts as soon as 2011.⁵

Smart Grid / Smart Energy

SmartGrid/Smart Energy can be defined as the improvement of power delivery systems to be more efficient, reliable and safe. Occupations typically associated with this sector include power engineers and computer technicians to design, manufacture, and provide maintenance for these new systems.

Investments in Smart Grid could generate 280,000 new jobs from 2009-2012:

- Advanced Metering Infrastructure
- Transmission and Distribution Automation
- Energy Services
- In-home Automation

The U.S. Smart Grid Revolution. 2008
KEMA, Inc.

To meet Maryland's energy needs, the State is pursuing three related strategies:

- Increase electricity supplies through new sources of energy, and improvement to generating plants and transmission lines;
- Promote sustainability in an effort prevent, reduce, or remove environmental pollution, and restore damaged natural resources; and
- Conserve and use energy more efficiently.

Building and Improving

Ninety percent of Maryland's electricity is generated by coal and nuclear plants. The State generates a larger portion of its electricity from coal and nuclear fuel than the United States as a whole.

Increasing electricity supplies through new construction of and improvement to generating plants and transmission lines is one strategy the State is pursuing to meet increasing demand. The Maryland Public Service Commission (PSC) recently approved a proposed new nuclear energy facility at Calvert Cliffs in Lusby, Maryland. The Mid-Atlantic Power Pathway (MAPP) has proposed a major (500 kV) transmission line linking Virginia to New Jersey via the Delmarva Peninsula, with associated improvements

to connecting facilities. Maryland is proposing smart grid improvements which add electronics and "intelligence" to the generation, distribution, and consumption of electricity produced by Maryland utilities.

Protecting Maryland's Environment

Maryland's production and use of energy produces harmful greenhouse gas (GHG) emissions.⁶ The Maryland Commission on Climate Change concluded that if GHG emission rates continue, sea level will rise by over 2 feet along Maryland's 7,000 miles of shoreline during this century, flooding islands, wetlands, and coastal communities. Other impacts of GHG include the warming of Chesapeake Bay, devastating its fragile ecosystem, and an important economic engine for the region.⁷

The Climate Change Commission recommended reducing GHG emissions to 1990 levels by the year 2020. To achieve this goal, the State legislature established a renewable energy portfolio standard (RPS) for Maryland. The RPS requires that a portion of all retail electricity sales in Maryland come from renewable resources.

Such legislation is part of a second and larger sustainability strategy to prevent, reduce, or remove environmental pollution, restore damaged natural resources, ensure safe drinking water, maintain oceans and watersheds, and provide healthy aquatic habitats for humans, fish, plant and wildlife.

Renewable, Alternative, and Efficiency

A third strategy, and for many a transformational strategy, is energy conservation and efficiency. In 2008, the State passed the EmPOWER Maryland: Energy Efficiency Act. The Act commits the State to a 15 percent reduction in per capita electricity consumption by the end of 2015. To achieve this goal, the State is promoting renewable and alternative energy production, and energy efficiency programs.

Renewable, sometimes called clean, energy focuses on creating, installing, and maintaining technologies that generate energy from resources that are naturally replenished and generally do not emit the GHG that contribute to global warming. These include solar, wind and geothermal systems and technologies.⁸

A study conducted for the Maryland Clean Energy Center, stated that Maryland has enough renewable energy resources to produce from 30 to 137 percent of all the State's electricity needs.⁹ In 2007, there were 160 renewable energy facilities certified with the Maryland RPS Program providing over 4,100 MW of capacity. Approximately 700 MW of this capacity is located within the State. In addition to large scale renewable energy generation, Maryland provides incentives to residential customers to install solar photovoltaics and solar thermal systems.

Smart, Green & Growing

is a State website where Marylanders are coming together to restore the Chesapeake Bay, preserve our land, revitalize our communities, create green jobs, improve transit, conserve energy and address climate change.

<http://www.green.maryland.gov/>

"The air we breathe, the water we drink, the land we use, the energy we consume – sustainability is our increasingly strong remembrance that we share a civic responsibility not only to our neighbors here and living, but to generations that have yet to be born."

Governor Martin O'Malley, 2007

Finding Incentives

DSIRE is a comprehensive source of information on state, local, utility, and federal incentives and policies that promote renewable energy and energy efficiency. Established in 1995, DSIRE is an ongoing project of the NC Solar Center and the Interstate Renewable Energy Council funded by the U.S. Department of Energy

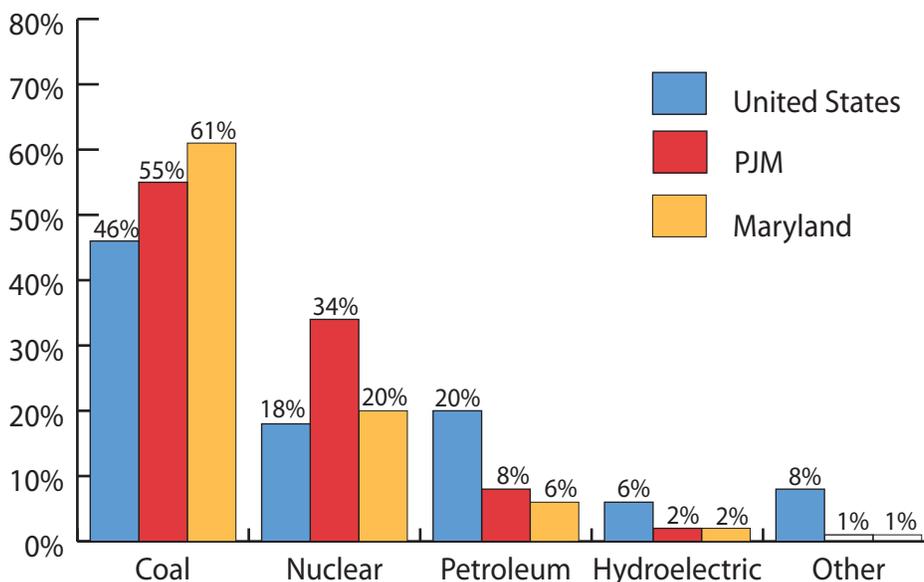
<http://www.dsireusa.org/>

Transforming the energy system with both large and small solar, wind, tidal and geothermal fuel sources will take time. These technologies are also expensive. Maryland has policies and incentives to promote renewable energy, but will need help with scientific breakthroughs from the network of Maryland university and federal laboratories. These R&D facilities fund basic and advance research in energy science and technology.

For example, The University of Maryland Energy Research Center (UMERC) is conducting a wide range of research projects that include producing fuels from biomass, fuel cell systems, and small-scale power systems. Research at the University of Maryland is also focusing on alternative fuels, biofuels, to be used in standard or modified

internal combustion engines. Maryland researcher's are exploring creating fuels from waste-water algae and growing plants like poplar trees, for fuel. Commercial development of Maryland-based energy science and technology research can lead to economic development and job creation.

Graphic: Energy Use by Fuel Type



Source: Energy Information Administration and PJM-2007 State of the Market Report

Maryland agriculture and food retailers can play a role, too. Maryland's most promising alternative fuel source is bio-diesel. Bio-diesel can be made from animal fats or recycled restaurant cooking oils, agricultural sources or waste food oil for use in diesel engines. Bio-diesel is produced locally in the Mid-Atlantic area with an estimated 7 million gallons per year of capacity. Additional bio-diesel refineries are being planned in Maryland and in surrounding states.

The main emphasis of EmPOWER Maryland is on energy efficiency, which is

defined as any reduction in power consumption resulting from increases in the efficiency of energy use, production, or distribution without affecting the services provided.

Most of the discussion about energy efficiency focuses on retrofitting homes and businesses to use less energy. However, energy efficiency is also achieved through a wide range of products (lighting, internal environment controls, insulation, etc.) and services (from architects to landscaping) applied to the production and use of energy in homes, businesses, and buildings. These products and services must be developed, manufactured, distributed, sold and installed through a complex cluster of industries and businesses. Promoting, attracting or developing such businesses in Maryland can be an important economic development strategy to build a stronger green economy.

Energy efficiency can have a positive impact on environmental quality when applied to processes that reduce the energy needed to produce new products. It also includes techniques to reduce waste, reuse or recycle; and techniques to convert used materials into new products.

The O'Malley-Brown Administration recognizes that solutions to the challenges of energy security and climate change lie the three related strategies discussed in this section: build new generating plants and the improve the transmission and delivery of electricity; promote energy efficiency, conservation, and expand the use of renewable energy; and improve, protect and clean up Maryland's air, water and natural resources.¹⁰ Implementation of these strategies requires money, policies and regulations, but more importantly, a highly trained and skilled workforce.

Maryland Clean Energy Center

Recognizing the need for a coordinated approach to building a strong clean energy economy in Maryland, the State legislature established the Maryland Clean Energy Center in the 2008. The Center's purpose is to promote clean energy economic development and jobs in the State; encourage deployment of clean energy technologies across Maryland; assist newly developed technologies with pilot projects; collect, analyze and disseminate industry data; and provide outreach and technical support to further the clean energy industry in Maryland.

The Center is structured as a not-for-profit quasi-governmental corporation supported by many state government agencies, including the Office of the Governor and the Maryland Energy Administration. The Center's Board of Directors was appointed by Governor O'Malley in October 2008.

Maryland's Green Economy

The nation is undergoing a shift in the way it produces, distributes and uses energy. Despite a severe recession, businesses, public institutions, communities, local and state government are and continue to work to lower GHG and use energy more wisely. They are creating sustainability councils, adopting new, local public policies and practices, and developing community projects that use green/clean materials and technologies.

The greening of the economy is also supported by the American Recovery and Reinvestment Act (ARRA), which is investing \$92 billion in clean technology; nearly \$33 billion in clean energy, and \$27 billion in energy efficiency nationwide.

Creating a sustainable future for Maryland with a combination of policies, regulations and incentives will stimulate economic and workforce development in what numerous policy papers are calling the “green economy.”

Cool Cities

More than 400 mayors representing 61 million Americans have signed the U.S. Mayors Climate Protection Agreement to achieve two important goals: 1) Get cities to take action with smart energy solutions that reduce global warming emissions, and 2) Energize, support and build local volunteer activism and influence, both inside and outside the Sierra Club.

Twelve Maryland cities have signed onto the Cool Cities initiative: Baltimore, Annapolis, Brunswick, Chestertown, Chevy Chase, Edmonston, Kensington, Rockville, Sykesville, Takoma Park, Riverdale Park, and Salisbury.

Maryland Cool Cities: Putting Together a Climate Action Plan. Maryland Chapter of the Sierra Club.

There are many definitions of “green,” but all are rooted in the development and use of products and services that promote energy security, defined as a supply of reliable, affordable, and increasingly, domestic energy, and/or environmental quality. From this core concept, GWIB’s Energy Industry Steering Committee defines Maryland’s green economy as:

The system of production, exchange, distribution and consumption of goods and services produced by any business or entity directly engaged in the research, development, manufacture, sale, distribution, installation, or application of products and/ or services that promote energy efficiency, energy conservation, renewable energy production, alternative energy production, or waste management and/ or organizations that are focused on environmental stewardship.

GWIB understands that no green definition is perfect.¹¹ For the purposes of this report, the green economy includes those businesses that solve Maryland’s energy and environmental challenges.

There is a strong demand that Maryland count green businesses and jobs, and forecast growth. The goal is to aid State policy makers with

qualitative and quantitative analysis of green economic and workforce development efforts. Labor market programs across the country face this challenge.¹²

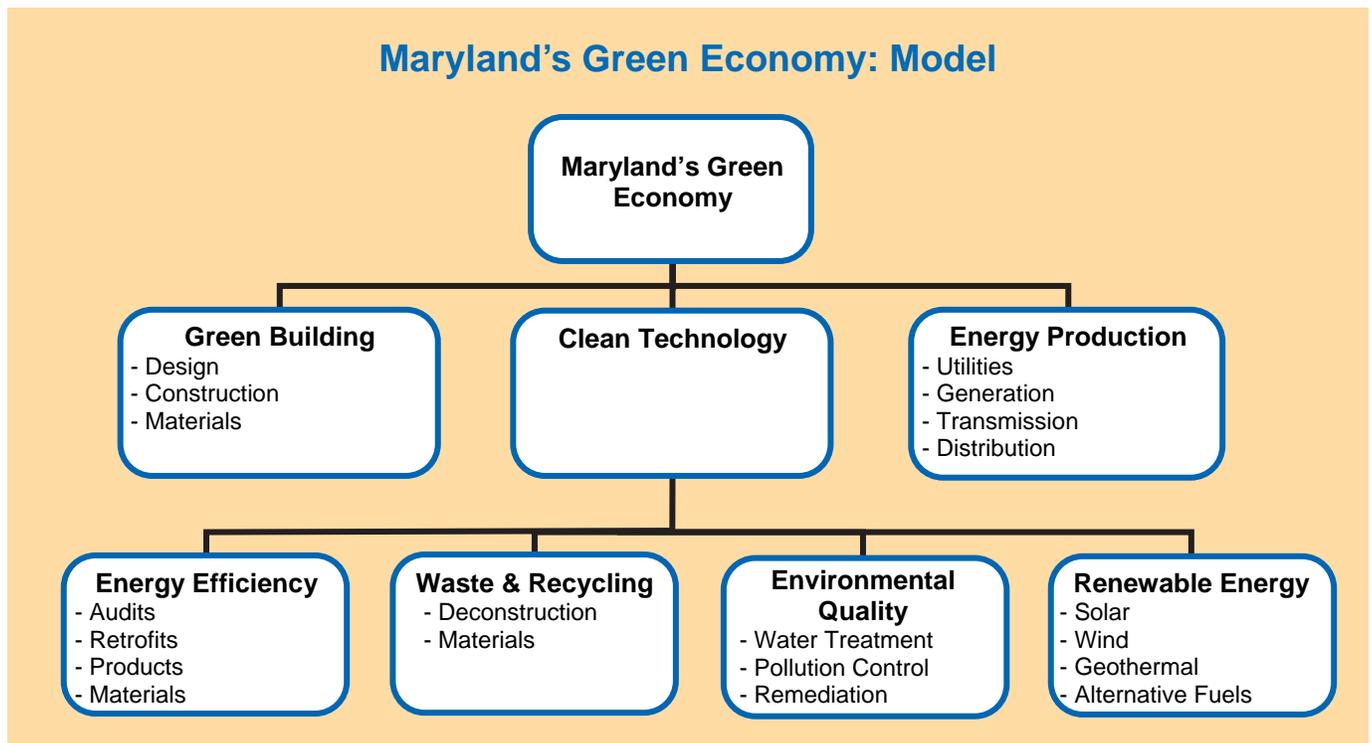
The standard method for counting businesses is the North American Industry Classification System (NAICS), which classifies business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy. There are no green industry NAICS codes.¹³ In fact, green cuts across many traditional industry sectors defined in NAICS: manufacturing, construction, utilities, specialty

trade contracting, business services and agriculture.

Using the green definition as a guide, GWIB's Energy Industry Steering Committee created a green economy model that organizes businesses into three broad categories:

- Green building;
- Clean technology; and
- Energy production, distribution and transmission.
- Clean technology is composed of four categories: energy efficiency, waste and recycling, environmental quality, and renewal/alternative energy.

In an effort to provide fact-based data to measure the scope of Maryland's green economy, GWIB's Energy Industry Steering Committee, following a methodology suggested by California's Employment Development Department, has identified NAICS codes that are closely aligned with the proposed green economy model.¹⁴ (See Appendix A).



Based on this methodology, and the evaluation of available NAICS data prepared by the Department of Labor, Licensing and Regulations (DLLR), it is estimated that Maryland's green economy includes 22,000 business units, directly employing 249,296 people and generating total wages of \$14.6 billion dollars. Half of Maryland's green economy is related to green building which includes businesses that design, construct and supply materials for residential and commercial constructions. Energy efficiency accounts for 42 percent of the green economy. These are businesses that weatherize buildings, or provide environmental controls that reduce energy use, or manufacture/sell/install other products that reduce energy use.

It needs to be emphasized that this is just a starting point for defining the size and scope of Maryland's green economy. More research and better data collection must be developed. GWIB's Energy Industry Steering Committee recommends that the State workforce system improve data collection in order to help guide the development of policy, and evaluate workforce initiatives.

Jobs in the Green Economy

Jobs in the green economy are employment opportunities in industry categories of the green economy model: green building, clean technology, and energy production. These jobs are directly engaged in the research and development, manufacture, sale and distribution, installation, operation and maintenance, and application of products and services related to energy efficiency, renewable or clean energy sources, energy production, and/or environment quality.¹⁵

The majority of green jobs will not be new occupations. These jobs will include construction workers, cost estimators, financial analysts, computer technicians, accountants, manufacturing workers, truck drivers, salespersons, scientists, engineers, and many others — as long as those jobs have something to do with energy efficiency and conservation, or increasing the supply of renewable or clean energy sources, or protecting the environment.^{16 17 18}

There are no “green” O*NET or SOC codes.¹⁹ However, unlike NAICS, the National Center for O*NET Development is working to develop “definitional boundaries for green employment.”²⁰ The goal is one, to tag current occupational as “green” and, two, to identify new and emerging “green jobs.” The Center has identified 12 green occupational sectors, five of which match Maryland green economy model.

Occupation and Industry Classification

O*NET and SOC, the Standard Occupational Classification system, classifies over 820 occupations according to their occupational definition. The system uses a numeric code for each occupation.

- Renewable Energy Generation (utilities)
- Green Construction
- Energy Efficiency
- Environmental Protection
- Recycling and Waste Reduction

Potential High Demand Occupations

GWIB’s Energy Industry Steering Committee compiled a list of occupations for each category of the green economy model (see Appendix B). In some instances, occupations on the Committee’s list match those that the National Center for O*NET Development calls, “increasing in-demand green jobs”. GWIB will continue to perform occupational research on all potential green jobs to determine which of these jobs exist in Maryland, or have the potential to develop/growth in the State.

Green Building

Green Building increases the efficiency with which buildings use resources — energy, water, and materials — while reducing building impacts on human health and the environment during the building's lifecycle, through better site selection, design, construction, operation, maintenance, and removal.

Table 1: Green Building: High Demand Occupations in Maryland

Occupation	Jobs in Maryland	Median Annual Wages
Architectural and civil drafters	1,700	\$45,300
Boilermakers	Data not available	\$51,240
Helpers--carpenters	2,320	\$26,790
Carpenters	18,640	\$40,490
Cement masons and concrete finishers	3,350	\$38,270
Operating engineers and other construction equipment operators	6,480	\$41,650
Electricians	16,170	\$49,060
Industrial truck and tractor operators	9,770	\$31,680
Helpers--installation, maintenance, and repair workers	4,620	\$25,990
Insulation workers, floor, ceiling, and wall	420	\$33,590
Structural iron and steel workers	950	\$53,830
Laborers and freight, stock, and material movers, hand	39,180	\$24,570
Structural metal fabricators and fitters	1,240	\$33,410
Operating engineers and other construction equipment operators	6,480	\$41,650
Heating, air conditioning, and refrigeration mechanics and installers	5,780	\$45,850
Welders, cutters, solderers, and brazers	3,050	\$36,790

Energy Efficiency

Energy efficiency is achieved with reduction in power consumption resulting from increases in the efficiency of energy use, production, or distribution without effecting the services provided. Based on current State policy and the recent ARRA federal funds, Maryland's green jobs will be concentrated in the energy efficiency sector, with growth also expected in the renewable energy sector.²¹

Table 2: Energy Efficiency: High Demand Occupations in Maryland

Occupation	Jobs in Maryland	Median Annual Wages
Stationary engineers and boiler operators	1,380	\$55,500
Boilermakers	Data not available	\$51,240
Electrical power-line installers and repairers	1,310	\$57,760
Insulation workers, floor, ceiling, and wall	420	\$33,590
Insulation workers, floor, ceiling, and wall	420	\$33,590
Heating, air conditioning, and refrigeration mechanics and installers	5,780	\$45,850

Environmental Quality

Environmental Quality and Remediation included the prevention and reduction of environmental pollution, as well as restoration of the environment. GWIB's Energy Industry Steering Committee has included Water Conservation and Treatment in this category as it refers to products, processes and activities that ensure safe drinking water, maintain oceans and watersheds, and provide healthy aquatic habitats for humans, fish, plant and wildlife.

Table 3: Environmental Quality: High Demand Occupations in Maryland

Occupation	Jobs in Maryland	Median Annual Wages
Environmental scientists and specialists, including health	2,760	\$60,390
Fish and game wardens	170	\$71,040
Forest and conservation workers	540	\$22,970
First-line supervisors/managers of farming, fishing, and forestry workers	230	\$44,910
Hydrologists	150	\$73,220
Natural sciences managers	2,210	\$115,090
Forest and conservation technicians	270	\$38,510
Zoologists and wildlife biologists	240	\$89,280
Forest and conservation technicians	270	\$38,510

Renewable Energy

Renewable Energy is supplied by sources that are naturally and continuously replenished, without being depleted.

Table 4: Renewable Energy: High Demand Occupations in Maryland

Occupation	Jobs in Maryland	Median Annual Wages
Power distributors and dispatchers	330	\$65,950

Energy Production

Energy production refers to the generation, distribution and transmission of electricity by Maryland’s public and private utilities. Several industry associations, most notably the Center for Energy Workforce Development (CEWD), have conducted employer-based surveys on workforce composition and future needs. Based on the CEWD study, the critical occupational areas for electrical utility operations are:

- Lineworkers
- Power Plant Operators
- Technicians (T&D)
- Technicians (Generation)
- Pipefitters & Pipelayers (T&D, and Generation)
- Power Engineers
- All Other Engineers (non-electrical systems, processes, equipment and facilities involved in electric and natural gas energy services. It includes people involved in the planning, research, design, development, construction, installation and operation of equipment, facilities and systems for the safe, reliable and economic generation/supply, transmission, distribution, consumption and control of electricity and natural gas)

Workforce Demand

Projecting job growth is difficult. For established industries and well-documented occupations, projections prepared by the Bureau of Labor Statistics (BLS) are based on historical patterns which can distort current realities.

A case in point are the utilities, who have done little hiring due in the past decade, in part to high retention rates of its incumbent workforce. Therefore, BLS projections through 2014, which are based on low, past hiring rates, mask what the industry, and the U.S. Department of Labor (DOL), acknowledge as the pending shortage of skilled workers. In 2007, the DOL concluded that the energy industry lacked enough skilled craft workers to build the infrastructure, install equipment, operate generating facilities or make repairs.²²

The CEWD studies confirmed that the utility workforce is higher than the average age of the U.S. workforce and that a significant portion of the current energy workforce, potentially 50 percent, are eligible for retirement and will do so in increasing numbers over the next ten years.²³ Furthermore, an insufficient number of skilled craft workers are coming through the training and development pipeline to meet replacement and growth needs. According to CEWD, the coal and gas powered utilities nationally will need to replace 95,000 technicians, operators, engineers, pipe fitters and line workers due to retirements. Demographics for Maryland's 9,400 utility workers are consistent with CEWD's national data and therefore the State may anticipate replacing 2,000 to 3,000 skilled workers in traditional energy over the next five years.²⁴

Projecting job growth in the green economy is more difficult as it is not based on historical job data, rather it is based on varying assumptions and economic input models. Nearly all studies reviewed by GWIB's Energy Industry Steering Committee used a "what-if" model to conclude that green job creation will depend on a combination of regulation and incentives to stimulate demand, as well as training investments to create a pipeline of skilled workers.

Most estimates of green job creation are focused on energy efficiency and renewable energy areas, and are national in scope. However, there are three studies that assessed potential energy efficiency and renewable energy job creation in Maryland.

According to the American Council for an Energy-Efficient Economy, investments in energy efficiency and renewable energy would create 8,000 new direct and indirect jobs (both trade and professional green jobs) by 2015.²⁵ Covering more of the green economy and with a longer time frame, a 2006 study for the Baltimore Development Corporation stated that State investments in energy efficiency and renewable energy would create 144,000 jobs over the next twenty years.²⁶ A more recent report by the Center for American Progress study predicts that Federal investments in building a low carbon economy could benefit Maryland by creating a total of 36,739 jobs.²⁷

Skills for the Green Economy

As noted earlier, many jobs in the green economy will not be new occupations. These jobs will include construction workers, cost estimators, financial analysts, computer technicians, accountants, manufacturing workers, truck drivers, salespersons, scientists, engineers, and many others. GWIB's Energy Industry Steering Committee stressed that both incumbent workers and those applying for these jobs need, what DLLR Secretary Tom Perez called, the indispensable skills: dependability, attention to detail, good communication skills, and the ability to work well with a broad spectrum of customers and coworkers. Workers also need to have the flexibility to change as the industry evolves with the desire to constantly learn new skills.

Necessary Skills

“Despite the need for some specialized green skills, employers in the focus groups stressed that workers still need the basics. Green skills are an overlay of new skills and knowledge; and learners cannot access the new knowledge without the requisite foundation. Skills in science, technology, engineering and math will be important, and positions with these skills may be most difficult to fill.”

Michigan Green Jobs Report, page 5.

Many of the jobs in the green economy are middle skill jobs, requiring more than high school but less than a college degree. They require a range of academic competencies that include math and science. The Michigan Green Jobs Report, published by the Michigan Department of Energy, Labor & Economic, found that employers emphasized the need for workers to have a foundation of basics including math and reading, with additional skills to be acquired on the job or in school.²⁸ GWIB's Energy Industry Steering Committee drew similar conclusions.

On the foundation of these indispensable and academic skills, the industry needs to develop competency models for a wide range of occupations. Career One Stop, a career information website sponsored by the DOL, provides an on-line Competency Building Block

model designed to provide a consistent definition of the competencies required to work in the industry. CEWD used this tool to develop an Energy/Generation, Transmission and Distribution Competency Model. GWIB's Energy Industry Steering Committee recommends that GWIB work with other industry partners to develop additional occupation models to help workers, workforce professionals, students and teachers understand the competencies required to work in the green economy.

Education and Training

Education and training programs for jobs in the green economy are provided by Maryland's apprenticeship training programs, community colleges' continuing education and for-credit programs, and four-year institutions. Industry, including many small businesses, also conducts significant amounts of on-the-job training. Preparing workers for some jobs in the green economy will require a greener curriculum, in other words, existing courses with something added.²⁹

An example of how this might be accomplished can be found in a Green Collar Job Certification program developed by Christy Bozic, Purdue University.³⁰ The program certifies green manufacturing generalists or specialists. The training includes these topics:

- Sustainable Development (reuse, reduce, recycle – materials, energy, water)
- Waste Hierarchy and Waste Stream Management
- Energy Basics (audits, alternative energy sources)
- Environmental Regulations
- Green Tools (ISO, green supply chain, green marketing, audit process, etc.)
- Accreditation and Certification

Another example of greening an existing curriculum can be found in the Maryland electrical apprentice and journey electrician training programs. In addition to the regular electrician training materials provided by National Joint Apprenticeship Training Committee (NJATC), there are these “green” NJATC courses:

- Green Building Fundamentals
- Photovoltaics, Wind Turbine Orientation, Fuels Cells
- Building Automation and Programmable Logic Controllers
- Power Quality Analysis

Programs may also explore the standards set by industry or non-profit organizations, for example, the U.S. Green Building Council’s Education Provider Program.³¹ USGBC evaluates professional education programs that “further enrich the knowledge and understanding of green building theory, techniques, and trends for building professionals.” This may be as simple as accurately presenting the LEED rating system, but could include material on building design, construction and operation that enables “an environmentally and socially responsible, healthy environment that improves the quality of life.” Nonprofit organizations, service providers and universities with continuing education programs may apply to be USGBC recognized education providers.

Green building demands a range of specialized knowledge that most builders don’t have -- everything from where to obtain recycled materials to how to orient a building to maximize natural heating and cooling. So, contractors, architects and other pros are rushing to get up to speed, often through their trade groups, which have started offering more training in green techniques.

“Green Gap,” November 16, 2008. Sari Krieger. *Wall Street Journal*.

When responding to a new, acute workforce need, existing curriculum may be imported for use in the State. The Construction and Energy Technologies Education Consortium (CETEC), representing Maryland’s community colleges, developed a training program for weatherization technicians, energy analysts and auditors based a Department of Energy approved Weatherization Training Center program at the Pennsylvania College of Technology.³² These are short-term, continuing education courses now available in all of Maryland’s community colleges.

Secondary Education - Career and Technical Education

The K-12 system is the beginning of the State’s workforce pipeline. The State puts great emphasis on preparing the next generation of workers. Maryland’s education system ranks highly against many national measures, including graduation rates, and Advanced Placement (AP) participation and scores.

Additionally, enrollments in and completion rates of Maryland’s Career and Technology Education (CTE) programs are increasing. This increases the pipeline of technically-skilled workers. CTE is a rigorous program of career and technical study that prepares students for both college and careers in high wage / high-skill occupations. CTE can lead to industry certification and increased articulation opportunities with postsecondary programs.

CTE is focused around 11 career clusters. Three of the clusters, construction, manufacturing and environmental science, are most closely aligned

Leadership in Energy and Environmental Design (LEED)

LEED is a rating system for green building. LEED promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.

with Maryland's green economy definitional framework. GWIB's Energy Industry Steering Committee recommended that an energy cluster be added to current CTE program, or that concepts about energy, green building, and clean technology be added to the existing clusters.

Maryland One-Stop Workforce Centers

Maryland maintains a robust workforce system designed to match qualified workers with employers. Maryland's system of ³³ One-Stop Workforce Centers, located in every county, have the tools and resources available for training, preparing and placing workers into jobs. The One-Stop system is designed to serve Maryland's businesses and dislocated workers, unemployed (and underemployed) adults and youth entering the workforce. Nearly \$22-billion of ARRA funding allocated to Maryland for job training will be administered by the local workforce boards. GWIB's Energy Industry Steering Committee recommended that industry develop partnerships with local workforce investment boards.

Certification Options

Although not all green jobs require certification, several certification programs have been created to ensure workers have a clear understanding of what it means to be green in their respective fields or to help make the transition into a green career. These programs target a variety of professions and require varying degrees of skills and education; all of them focus on building an individual's green knowledge and expertise through education and/or hands-on training. Some of the most recognized certifications and training programs available may be found in Appendix C.

Career Pathways

A career pathway is like a map. It targets an industry or employment sector, and provides a framework for workforce development by showing connections or by integrating the education and training programs, industry certification, and workforce agencies. The ultimate goal is for pathways to provide a seamless system of career exploration, preparation, and skill upgrades linked to academic credits and credentials, available with multiple entry and exit points spanning middle school, secondary, postsecondary, adult and workplace education.³⁴

Several pathway examples exist, including an Energy Career Cluster Map developed by CEWD, and a green pathway model discussed in Greener Pathways.³⁵ GWIB's Energy Industry Steering Committee recommended that GWIB develop career pathway models for clean technology industry sectors.

Workforce Issues and Recommendations

Businesses in Maryland's green economy face many of the same challenges other industries face in trying to increase the pipeline of workers such as an aging workforce, negative image of the trades, and individuals who lack the necessary work readiness or technical skills to gain employment.

GWIB's Energy Industry Steering Committee, composed of stakeholders from utilities, manufacturing, construction, specialty trade contracting, and business services, education, unions, and state and local government, met and conducted focus group sessions between May 2008 and May 2009. As result, the Committee defined five broad workforce issues and identified dozens of possible solutions that the State, Industry and Education might adopt and champion.

Issue: Workforce Attraction and Recruitment

For more than ten years, a stable, mature workforce has limited the need for utilities to hire large numbers of workers. As a result, potential employees are either unaware of the variety of career opportunities available in the industry, or have a fundamentally inaccurate and inadequate perception about working conditions, career choices, advancement, benefits, and compensation. Despite the good press about jobs in the green economy, few truly understand what these jobs are, how to train for them, or the potential for career growth. High school and college counselors are unaware of the need for skilled and technical workers and are consequently not informing students about these opportunities. Workforce professionals also lack information about high paying and entry level jobs in energy.

On the other hand, industry has overlooked a valuable potential population of workers that includes senior citizens, immigrants, individuals with disabilities, veterans, youth, and ex-offenders. These populations are currently being served by a wide variety of state workforce development programs, but industry has not easily connected with them.

Recommendation 1

Create a buzz about Maryland green jobs, clean energy research, and innovation targeting varied audiences: youth, parents, working adults, dislocated workers.

Implementation Strategies

1. Establish an annual "Maryland Green Innovation Awards" to publicly celebrate and honor Marylanders in STEM fields of importance to the State and who have made a major impact to their field.
2. Create an energy ambassador program that brings industry and students together.
3. Create hands-on mobile lounge to demonstrate energy and green technologies.
4. Create a speakers bureau, sending the industry's younger workers as representatives to speak to students.
5. Get youth (all ages) interested and excited about energy careers using current "social networking" systems like Facebook, and YouTube.

Recommendation 2

Develop and disseminate energy career ladders or lattices.

Implementation Strategies

1. Focus on critical pathways and support structures (education, pre-apprenticeship, apprenticeship).
2. Build competency models for targeted occupations that establish common skills sets across all sectors with links to degree options.
3. Define the transferable skills from other industries to those in energy.
4. Publish "Jobs in the Green Economy Guidebook" to help to emerging workers, career changers, parents, and career advisors with clear, up-to-date job descriptions with salary data.

Recommendation 3

Develop local industry-One-Stop partnerships.

Implementation Strategies

1. Share information and data on who is looking for work between One-Stops and community colleges.\
2. Use data to help the State focus training resources.
3. Create outreach to business including business tours of One-Stops and target marketing campaign aimed at business.
4. Create new business services including pre-employment testing, and integrated industry short training programs (boot camps, OJT programs, etc.).
5. Build stronger collaborative programs that include community forums throughout the State and sector partnerships of One-Stops and Industry (workforce task force or skill alliances).
6. Recruit workers through the WIB One-Stops.

Recommendation 4

Partner with programs and agencies currently serving women and other nontraditional populations to promote energy careers.

Implementation Strategies

1. Increase Summer Youth Employment Opportunities and Work Experiences by enlisting energy/green business support and participation.
2. Link local youth programs with pre- apprenticeship or apprenticeship training, and whenever possible to healthcare, energy, manufacturing, construction or other high growth industry sectors.
3. Adopt/adapt other successful job training models: Job corps, law enforcement recruitment of women.

Issue: Education, Training, and Certification

The industry finds potential employees, from high school graduates to non-traditional populations served by Maryland's workforce development system, need stronger job-readiness skills and technical skills. Potential workers are unable to pass pre-employment qualification standards (clean driving records, criminal background checks) and basic math and literacy tests. Further, there are not enough academic programs focusing on renewable energy in order to prepare a trained workforce for the industry.

Recommendation 1

Increase the number of school systems and schools using the CTE program.

Implementation Strategy

1. Develop energy basic courses for students in K to 12.

Recommendation 2

Develop partnerships among trade groups, Maryland One-Stops and secondary education to increase the number of students applying for apprenticeship training programs.

Implementation Strategies

1. Enhance or create new certificate and apprenticeship programs for targeted energy and clean technology jobs.
2. Develop home energy auditor and weatherization technician apprenticeship programs.

Recommendation 3

Identify and develop short term training courses that are aligned with industry needs and will prepare workers for jobs in the green economy.

Implementation Strategies

1. Develop continuing education programs for incumbent workers in the skilled trades (electrician, HVAC, plumbing, and constructions) to provide skill updates in green building methods, materials, and energy efficiency standards.
2. Create and/or adopt existing training programs, like the BG&E Utility 101, to incorporate into the community college curriculum.
3. Train meter readers and other in-house incumbent workers for in-demand positions.
4. Promote a green layering strategy for existing curricula.

Recommendation 4

Establish energy industry training centers.

Implementation Strategy

1. Establish a weatherization training center in Maryland.
2. Create partnership with the proposed Maryland Center for Construction Education and Innovation (MCCEI).

Recommendation 5

Expand access to pre-employment programs through Maryland's community colleges.

Implementation Strategies

1. Create State and industry trade association partnerships to align refresher courses and other employment preparation assessments.
2. Create internships that extend from high school to college.
3. Create pre-apprenticeship programs for emerging youth, and (other target populations).

Recommendation 6

Develop partnerships among industry, national and regional associations, and community colleges in order to help more students obtain education, training, certifications and other credentials.

Implementation Strategies

1. Develop a Bachelor in Technical and Professional Studies (BTPS) degree that continues a professional pathway (including apprenticeships, certifications, OJT, certificates, and associate degrees), for a variety of technicians to increase their skills along common skill sets and specific content areas.
2. Identify cross-sector (energy, manufacturing, construction, etc.) skill sets to assist in the development of a broad professional pathway for technicians.
3. Align Regional Higher Education Centers (RHEC's) or other facilities with BS/BA and/or BTPS (Bachelor in Technical and Professional Studies) programming with critical community college pathways.
4. Create articulation agreements and MOU's between credentialing organizations and 2-year and 4-year schools to facilitate a BTPS pathway.
5. Increase the number of industry experienced instructors at community colleges and other institutions to train workers.

Issue: Data Driven Policy Development

There is a strong demand for Maryland to measure the size, scope and trends of green businesses and jobs, and forecast growth. Labor market programs across the country face this challenge. GWIB's Energy Industry Steering Committee recommends that the State workforce system improve data collection in order to help guide the development of policy, and evaluate workforce initiatives.

Recommendation 1

Develop an inventory of jobs in the green economy.

Implementation Strategies

1. Identify those jobs that already exist in Maryland that are “green” or related to clean energy.
2. Identify areas where there is potential to grow and Maryland has the resources or existing infrastructure or businesses that allow for capitalization.
3. Target emerging energy technologies such as: Fuel-cell, Wind Power, Hydro Power, Biofuels, Solar Power, Nuclear, among others.

Recommendation 2

Gather and promote the sharing of information and best practices about research, and training programs.

Implementation Strategies

1. Catalogue all current research in Maryland-based laboratories (government, university, and industry) related to clean energy or green technologies.
2. Work with MHEC to inventory existing training programs.
3. Survey Maryland companies and match data with current DLLR statistics.

Issue: Public Policy

For the clean energy cluster (solar/wind manufacturing/distribution/installation), State and local regulation, and State and federal policy are the drivers of economic and workforce growth. Maryland needs a energy economic strategy that maps the State’s economic and workforce assets and targets industry sectors to develop, promote or attract to the State.

Federal and State incentives (such as tax credits, rebates or renewable energy certificate trading programs) drive sales mainly for residential, but also some small commercial. Policy/incentive strategies for solar and thermal are not on equal footing with other forms of cheaper energy sources.

Recommendation 1

State and local workforce development systems should vigorously engage in an energy sector strategy (or “industry partnerships”), in collaboration with their institutions of higher education, community colleges, other local agencies and training providers, where appropriate.

Implementation Strategies

1. Develop locally-focused economic analysis on green business, and the impact of government investments in partnership with University of Maryland.
2. Develop green business incubators to help develop and grow small businesses.
3. Create and support local research universities, technology developers, and business incubators in clean technology research.
4. Educate businesses about clean technology, how to become greener, and how to train their staff to be greener.

Recommendation 2

The renewable energy and efficiency industry needs incentives to drive and sustain the business.

Implementation Strategies

1. Create a simple, stable, long-term and consistent program of credits, grants and other incentives for the installation of alternative energy and energy efficient products (solar panel, geothermal systems, small wind and lighting.)
2. Create a program to allow a property owner to receive credit for excess/unused energy by selling it back to the local utility, creating an income stream as collateral against loan to install solar.
3. Create innovative financing proposals to help residential property owners and commercial end-users to buy and install energy efficiency and renewable energy upgrades (solar, geothermal).
4. Streamline the process and time needed for home owners to apply, get approval and/or reimbursement

for grants and other incentives.

Recommendation 3

Develop uniform state-wide standards for the procurement, installation and inspection of alternative energy and energy efficient products (solar panel, geothermal systems, small wind, and lighting) for both residential and commercial retrofits and new construction.

Implementation Strategies

1. Improve green building codes on statewide basis for new and retrofit construction.
2. Create a whole, healthy house program that focuses on energy efficiency, lead, mold, and other health risks in homes.
3. Develop energy performance auditing standards for small buildings.
4. To maximize job creation and stimulate the local economy, recommend that the State and its political subdivisions/local governments strictly follow the guidelines set forth in Section IV of the ARRA in using stimulus funding to retrofit government and other public buildings and grant priority to manufacturers, suppliers and contractors located in the State of Maryland in the procurement process

Appendix A: Selected NAICS Codes that Align with the Maryland Green Economy Model

Green Building: Total Employment = 108,314 Jobs

NAICS Code	Industry Title
236220	Commercial building construction
236115	New single-family general contractors
444190	Other building material dealers
238312	Nonresidential drywall contractors
238912	Nonresidential site preparation contractors
541310	Architectural services
238142	Nonresidential masonry contractors
238992	All other nonresidential trade contractors

Energy production: Total Employment = 21,894 Jobs

NAICS Code	Industry Title
221122	Electric power distribution
926130	Utility regulation and administration
423610	Elec. equip. and wiring merchant wholesalers
237130	Power and communication system construction
221112	Fossil fuel electric power generation
237120	Oil and gas pipeline construction

Energy Efficiency: Total Employment = 96,344 Jobs

NAICS Code	Industry Title
541712	Research and Development in the Physical, Engineering, and Life Sciences
238212	Nonresidential electrical contractors
238222	Nonresidential plumbing and HVAC contractors
236118	Residential remodelers
238221	Residential plumbing and HVAC contractors
238211	Residential electrical contractors
238152	Nonresidential glass and glazing contractors
333415	AC, refrigeration, and forced air heating

Waste & Recycling: Total Employment = 9,634 Jobs

NAICS Code	Industry Title
237110	Water and sewer system construction
562111	Solid waste collection
423930	Recyclable material merchant wholesalers

Environmental Quality: Total Employment = 12,818 Jobs

NAICS Code	Industry Title
236220	Commercial building construction
236115	New single-family general contractors
444190	Other building material dealers
238312	Nonresidential drywall contractors
238912	Nonresidential site preparation contractors
541310	Architectural services
238142	Nonresidential masonry contractors
238992	All other nonresidential trade contractors

Appendix B: Examples of Related Green Economy Jobs

Energy Efficiency

- Engineers
- Building Inspectors
- Building Operator/Building Technician
- Energy Analysis and Auditors
- Energy and Indoor Air quality Auditor
- Insulation Workers
- Resource Conservation/Efficiency Manager
- Systems Technician

Environmental Quality

- Remediation Engineer
- Environmental Engineer, Scientist
- Geologist, Hydrogeologist
- Civil Engineer
- Environmental Technician, Planner
- Environmental Regulatory Compliance Consultant
- Environmental Program Manager
- Water & Natural Resources Scientist
- Stream Restoration Specialist
- Water Conservation Director
- Water Supply/Utility Manager
- Water Consultant
- Water Operator
- Water Quality Laboratory Technician
- Water Treatment Manager
- Water Production Operator

Waste Management and Recycling

- Hazardous Materials Removal Workers
- Water Recycling Plant Operations Supervisor
- Deconstruction Manager
- Environmental Waste & Water Engineer
- Waste Management Tech (Biomass)
- Chemists
- Engineers

Renewable Energy

- System Designer (Solar, Wind, Ocean)
- Test Technician (Solar, Wind, Biomass, Ocean)
- Plant Maintenance Technician (Solar, Wind, Biomass, Ocean)
- Instrument Tech. (Solar, Wind, Biomass)
- Coastal Hydraulic Engineer (Ocean)
- Marine Engineer (Ocean)
- Solar Cell and Module Manufacturers
- Photovoltaic Equipment Manufacturers
- Solar technician
- Solar Energy Engineer
- Solar Energy System Installer
- Solar Energy Foreman
- Solar Installation Operation
- Wind Turbine machinists
- Wind Turbine electrical engineer
- Wind field technician
- Wind field operations
- Wind generator installer
- Numerous administrative, managerial and support occupations that directly serve renewable energy and energy efficiency organizations

Appendix C: Relevant Certifications

	Certification	Description
	Green Advantage Environmental Certification www.greenadvantage.org	Tests understanding and familiarity with the latest in "green" building practices, technologies and techniques.
US Green Building Certification Institute	LEED Green Associate www.gbci.org	Tests knowledge and skills to support green design, construction, and operations. It is a precursor for professionals pursuing LEED AP.
	LEED Accredited Professional (AP) www.gbci.org	Tests detailed knowledge of LEED certification process and command of integrated design principles. Exam measures proficiencies in sustainability and process for specific LEED project certifications (i.e., new construction, commercial interiors, etc). To maintain LEED-AP status, individuals must complete CEA credits each year.
Association of Energy Engineers	Certified Energy Auditor www.aeecenter.org/certification	Tests knowledge of the principles and practices of energy auditing and compliance with prescribed standards of performance and conduct.
	Certified Energy Manager (CEM) www.aeecenter.org/certification	Tests and recognizes high levels of experience, competency, proficiency in the energy management profession as well as compliance with prescribed standards of performance and conduct.
	Certified Sustainable Development Professional www.aeecenter.org/certification	Tests knowledge and technical competency in energy management and environmental practices and compliance with prescribed standards of professional performance and conduct.
	Certified Green Building Engineer www.aeecenter.org/certification	Tests knowledge of the principles and practices of green building engineering, design and construction and compliance with standards of performance and conduct.
	Certified CarbonReduction Manager www.aeecenter.org/certification	Tests knowledge of the principles and practices of carbon reduction and compliance with prescribed standards of professional performance and conduct.
	Certified Lighting Efficiency Professional www.aeecenter.org/certification	Tests knowledge of development and implementation of efficient lighting solutions within commercial, industrial, institutional and governmental buildings. Facility Managers, Electricians
Building Performance Institute	Certified Building Analyst www.bpi.org/content/contractors/certification-types.html	Written and field exam designed to test an individual's ability to conduct a thorough home performance evaluation, taking into account systems, physical conditions and other energy and non-energy characteristics of the home.
Residential Energy Services Network	Home Energy Rater www.natresnet.org/	Tests knowledge and compliance with the Home Energy Rating System (HERS) to inspect and evaluate a home's energy features consistent with RESNET standards. Rater prepares home energy rating report and provides energy improvement recommendations.
National Assn of Home Builders	Certified Green Professional	Tests the knowledge and ability incorporate green building principles into housing development.
	Green Verifier	Training and certification testing that complies with NAHB green standards.
National Assn of Remodeling Industry	Green Certified RemodelingProfessional	NARI designation to promote the highest standards of green remodeling through green credentialing of remodeling professionals.

Endnotes

1. The United States consumed 101.9 quadrillion British thermal units (BTU) of energy in 2007 to power industry and businesses, homes and buildings, and to transport goods and people. Of this, Maryland consumed about 1.5 percent of the total or 1.452 trillion BTU, most of which is for electricity. Source: *Maryland Quick Facts*. Energy Information Administration, Office of Integrated Analysis and Forecasting, U.S. Department of Energy
2. Factoring in the current economic recession, projected annual consumption of energy will still grow by a rate of increase of 0.5 percent per year through 2030. This rate of increase will escalate with economic recovery. *The Annual Energy Outlook 2009 (AEO2009), Executive Summary*. Energy Information Administration, Office of Integrated Analysis and Forecasting, U.S. Department of Energy.
3. *Understanding Maryland's Need for Improve Electricity Infrastructure*. 2008. H. Russell Frisby. Marylanders for Reliable Power.
4. "Maryland is part of the PJM power grid. PJM (formerly the Pennsylvania, New Jersey and Maryland interconnection) has steadily expanded and now encompasses 13 states and the District of Columbia. This centrally dispatched system has an installed capacity of 163,000 MW, serving over 51 million people. While Maryland is a net importer of energy, the PJM pool is a net exporter." *Energy Transition Report 2007*.
5. *Governor's Energy Summit Summary Proceedings*. 2007. Maryland Energy Administration.
6. The State produced 31 billion metric tons of carbon dioxide, 1.2 percent of the U.S. total, in 2007 *Maryland Quick Facts*.
7. *Climate Action Report*. 2007. Maryland Commission on Climate Change.
8. *Preparing the Workforce for a "Green Jobs" Economy*. 2009. Jennifer Cleary and Allison Kopicki, Heldrich. Center for Workforce Development.
9. *Economic Development Potential of Clean Energy Technology in Maryland and Feasibility Study for a Maryland Clean Energy Center*. 2006. John Spears and Andre Van Rest, International Center for Sustainable Development. Baltimore Development Corporation.
10. *Maryland Strategic Electricity Plan*. 2008. Maryland Energy Administration.
11. *Green Collar Workers and Other Mythical Creatures*. 2008. Marc Anderburg. Texas Workforce Commission.
12. *Understanding the Green Economy: A Shared Experience*. 2009. Steve Saxton. California Employment Development Department.
13. NAICS is an industrial classification system that group establishments into industries based on activities in which they are primary engaged. Under the NAICS system there are twenty sectors and 1,170 industries in the United States.
14. *Digest of Green Report, Green Analyses of Occupations and Industries*. 2009. California Employment Development Department website: www.labormarketinfo.edd.ca.gov.
15. *Putting Renewables to Work: How Many Jobs Can the Clean Energy Industry Generate?* 2004. Daniel Kammen, Kamal Kapadia, and Matthias Fripp. University of California, Berkeley.
16. *Growing Green Collar Jobs, Energy Efficiency*. 2008. Urban Agenda for the NYC Apollo Alliance.
17. *Renewable Energy and Energy Efficiency: Economic Drivers for the 21st Century*. 2008. Roger Bezdek. Management Information Services, Inc. for the American Solar Energy Society.

18. *Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy*. 2008. Center for American Progress.
19. The O*NET system is a source of occupational information, providing comprehensive information on key attributes and characteristics of workers and occupations. SOC, the Standard Occupational Classification system, classifies workers into one of over 820 occupations according to their occupational definition. To facilitate classification, occupations are combined to form 23 major groups, 96 minor groups, and 449 broad occupations.
20. *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations*. 2009. Dierforff, Norton, Drewes, Kroustalis, Rivkin and Lewis. The National Center for O*NET Development.
21. *Preparing the Workforce for a "Green Jobs" Economy*. 2009. Jennifer Cleary and Allison Kopicki. Heldrich Center for Workforce Development.
22. *Southeast Skilled Trades Summit Whitepaper*. 2007. Energy Skilled Trades Summit.
23. *Gaps in the Energy Workforce Pipeline, Executive Summary*. 2007. Center for Energy Workforce Development.
24. GWIB's Energy Steering Committee continues to gather and evaluate labor market data.
25. *Energy Efficiency: The First Fuel for a Clean Energy Future*. 2008. American Council for an Energy-Efficient Economy.
26. *Economic Development Potential of Clean Energy Technology in Maryland and Feasibility Study for a Maryland Clean Energy Center*. 2006. John Spears and Andre Van Rest, International Center for Sustainable Development. Baltimore Development Corporation.
27. *Green Recovery: A Program to Create Jobs and Start Building a Low Carbon Economy*. 2008. Center for American Progress.
28. *Michigan Green Jobs Report*. 2009. Michigan Department of Energy, Labor and Economic Growth.
29. "Revamp existing programs...by infusing them with green principles." *Green Collar Jobs: The Next Industrial Revolution*. Summer 2008. Sherrie Negrea, Trustee Quarterly.
30. This summary taken from a PowerPoint presentation provided by Ms. Bozic to GWIB. Additional information is available on line at <http://www.insideindianabusines.com/newsitem.asp?ID=28274>.
31. Additional information available on line at <http://www.greenbuild365.org/>
32. The Construction and Energy Technologies Education Consortium (CETEC), representing Maryland's Community Colleges, worked in partnership with the Maryland Department of Housing and Community Development, Local Weatherization Agencies, Maryland Energy Administration and the Governor's Workforce Investment Board.
33. This section is taken from a pending Governor's Workforce Investment Board policy paper prepared Noreen Beatley.
34. *Career Pathways as a Systemic Framework, Re-Thinking Education for Student Success in College & Careers*. 2006. National Council for Workforce Education Fall Conference, Albuquerque, New Mexico.
35. *Greener Pathways*. 2008. Sarah White and Jason Walsh. Center for American Progress, Center on Wisconsin Strategy, The Workforce Alliance and the Apollo Alliance.

Governor's Workforce Investment Board

Energy Industry Initiative Steering Committee

Committee Cochairs:

Constellation Energy
James E. Rzepkowski

Solar Energy Industries Association Maryland
Peter Lowenthal

Committee Members:

AES Corporation
Lou Anatrella

Air Conditioning Contractors of Maryland
Marie Anderson
Coral Landis

Allegheny Energy
David Bedard
Diane Liska
Mary Lou Sekeras

Allied Environmental Services Inc.
Adam Santry
Jerry Santry

Atlantic Electric Supply
Darek Coen

Baltimore Gas & Electric
Scott Trapp
Brian Recor
Jen Trott

Bechtel Construction Operations, Inc
Art Stover

Blue Wing Environmental Solution and Technologies
Ted Gattino

BP Solar
William Poulin
Bill Rever

Chalk Point Generating Station
Wayne Hale

Chesapeake Solar
Jeff Gilbert

Competitive Power Ventures Inc
Sharon Segnar

Constellation Energy
David E. Brzozowski
Pete Buote
Mark Stephen Dolle
Thomas Tringali

Dominion
Tammye Burnette

Evolve Energy Systems LLC
Carlton Haas

Havtech
John Bergman

Home Builders Association of Maryland
John Kortecamp

IEC / Chesapeake
Grant Shmelzer

Innovative Energy Solutions
John Doyle

Maryland Green Power Company
Dennis Meizys
Mirant Corporation
Derrick Pflibsen

Maryland Plumbing, Heating & Cooling
Contractors Inc
Jim Berndt

Maryland State AFL-CIO
James Strong

PEPCO Holdings Inc
Reginald J. McCauley
Karen Boyd
Kim Watson

SMECO
Frank D. Mudd

Solar Energy Services Inc
Roger Perry
Lisa Walsh

Spiralcat of Maryland
Carol Collins

SunEdison
Carole Jacolick
Jigar Shah

Terralogos Green Home Services Inc.
Frank Lee

Trigen-Baltimore Energy Corporation
John Gibson

UniStar Nuclear Energy
Anna Keener
Phil Polefrone

Washington Gas
Stephanie Briggs
Joe Spellicy
Bruce I Trask

Wheelabrator Baltimore, LP
Gary Kennedy

Abell Foundation
Beth Harber
Melanie Styles

Anne Arundel Community College
Dr. Richard Cerkovnik

Annie E. Casey Foundation
Michael Shaw

Arlington Employment Center
Laurie J. Hedlund

Baltimore City Sustainability Commission
Beth Strommen
Sarah Zaleski

Biodiesel University, Inc.
Dan Goodman

Center for Energy Workforce Development
Ann Randazzo

College of Southern Maryland
Alan Kutz
Jeff Tjiputra

Community College Baltimore County
Beth Arman
Michael Carey

Frederick Community College
Advanced Workforce Training Center
David Croghan

Frederick County Workforce Services
Laurie Holden

Green Building Certification Institute
Beth Holst

Job Opportunities Task Force
Jason Perkins-Cohen

Maryland Clean Energy Center
Kathleen Magruder

Maryland Department of Business and Economic Development
Roger Satin

Maryland Department of Labor, Licensing and Regulation
Roger M. Lash

Maryland Department of Public Safety and Correctional Services
Jeff Beeson

Maryland Energy Administration
Ross Tyler

Maryland Higher Education Commission
Dean Kendall

Maryland State Department of Education
Lynne M. Gilli

Mayors Office of Employment Development
Rosalind Howard
Susan Tagliaferro

Meridian Ventures Inc.
James B. Lynn

Montgomery County Department of Environmental Protection
Eric Coffmann

Prince Georges County EDC
Patricia N. White

Shaw Group
Bill Weaver

U.S. Department of Labor - Veterans Employment
Stan Seidel

U.S. Green Building Council Maryland
Joe Maheady

GWIB Staff:
Rafael Cuebas
Bernard Reynolds



Governor's Workforce Investment Board
1100 North Eutaw Street, Room 108
Baltimore, Maryland 21201
410-767-2408 1-866-408-5487
gwib@mdworkforce.com
<http://www.mdworkforce.com>

The Governor's Workforce Investment Board is the Governor's chief policy-making body for workforce development.

Martin O'Malley, Governor
Anthony G. Brown, Lt. Governor

William G. Robertson, Chair

Thomas E. Perez, Secretary
Department of Labor, Licensing and Regulation

Eric M. Seleznow, Executive Director
Governor's Workforce Investment Board