

Analysis of Clean Energy Workforce Needs and Programs in Oregon



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Analysis of Clean Energy Workforce Needs and Programs in Oregon

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For

**The Office of Governor Kulongoski
and the Oregon Employer Workforce Training Fund**



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Executive Summary

Oregon is poised to do something big. As conventional energy sources become more costly in both economic and environmental terms, the renewable energy and energy efficiency industries are burgeoning. Oregon possesses a tremendous diversity of renewable energy resources and a solid base of clean energy companies. The state has an opportunity to become a national leader in the clean energy economy generating innovative, family wage jobs and providing solutions to the pressing energy and environmental issues of our age. In order to do so it must develop a strong workforce for clean energy companies.

With a goal of developing a vibrant, robust clean energy workforce, the State of Oregon enlisted the Business Alliance for Sustainable Energy, a project of 3ES-strategies, to implement the Sustainable Oregon Workforce Initiative.

The first task of the Sustainable Oregon Workforce initiative was to conduct a gap analysis study of Oregon clean energy workforce needs. This report, *An Analysis of Clean Energy Workforce Needs and Programs in Oregon*, is the culmination of that study. This report defines the workforce needs of Oregon clean energy companies, describes the numerous clean energy training programs in Oregon, identifies the gaps between industry needs and available training programs and outlines a series of recommendations for addressing those gaps.



Photo Credit: Dennis Schwartz

Our findings revealed that Oregon has a robust, extremely diverse clean energy industry that is experiencing rapid growth. The industry is branching out to include a relatively new, and fast growing manufacturing sector in both the solar and fuel cell sectors. We also found that we have a surprisingly high number of clean energy workforce training programs ranging from multi-day certification courses to union apprenticeship programs to a full four year Bachelors degree.

Our investigations discovered some clear gaps in clean energy workforce needs and workforce availabilities. These include overarching gaps that apply to all of the clean energy sectors and some very sector specific needs. Examples include:

- Communication gaps between key stakeholders that are preventing training program development and collaboration and utilization of workforce resources by clean energy companies.
- A lack of renewable energy and energy efficiency core competencies in traditional high school and college curriculum.
- Difficulty finding employees that are “work ready”, with basic education, interpersonal skills and workplace discipline.
- A shortage of wind technicians to meet industry demands over the next three years.
- A shortage of manufacturing and assembly workers.

Executive Summary (cont'd)

To address these and the other identified workforce gaps, we recommend a series of actions and strategies including but not limited to:

- Strengthening capacity of the community college system to address short-term needs of clean energy industry and establish a sustainable funding mechanism for these programs.
- Implementing mechanisms for the State of Oregon to track employment and wage information for the clean energy industry using data elements that are aligned with overall state goals.
- Increasing collaboration between key stakeholders.
- Establishing industry internship and mentoring systems to strengthen existing programs and as key elements of any necessary new programs.
- Integrating clean energy elements into the core curriculum for conventional academic and technical programs such as engineering, electrician, plumbing, buildings sciences, meteorology and geology.
- Create pathways out of poverty into the clean energy industry and create career advancement pathways within industry sectors.

In order to rapidly develop a strong clean energy workforce, Oregon academic institutions, trade associations, labor unions, the Oregon Employment Department and the state workforce development system will need to make system level changes to many of their programs. For example, the Oregon Employment Department tracks labor market data based on the system administered by the federal Department of Labor. This ensures that all states track data in a consistent manner so that national labor market data is meaningful. However, the federal Department of Labor data definitions and guidelines are not well-suited to describing emerging industries with new occupational categories. A better means to track the development of the clean energy industry will need to be developed that meets the needs of the state of Oregon. In addition, the workforce development system will need to find ways to better inform the industry about their services. Academic institutions and labor unions will need to improve collaboration to avoid duplication and achieve maximum efficiency with resource allocations.

Clearly, there is a lot of work to do. But that work could yield big benefits, strengthening Oregon's economy, giving people opportunities to make good wages working in an exciting, forward-looking field and protecting our precious Oregon air, water and wildlife.

Through support provided by the state of Oregon, the Business Alliance for Sustainable Energy will move forward into phase 2 of the Sustainable Oregon Workforce initiative. In phase 2, we intend to begin addressing the gaps identified in this report. The Sustainable Oregon Workforce initiative is highly collaborative. We welcome your feedback, comments and suggestions. Please contact us at 541.617.9013 or Cylvia@3estrategies.org.

“Oregon academic institutions, trade associations, labor unions, the Oregon Employment Department and the state workforce development system will need to make system level changes to many of their programs.”

Background

Cylvia Hayes, executive director of 3EStrategies was the principal investigator and author of this report. Ms. Hayes has 19 years experience in the fields of clean energy, green building and economic development.

David Rafkind, Director of BASE coordinated investigation of clean energy training and education programs throughout the state and researched the current status and trends of the clean energy and energy efficiency industries in Oregon.

Barbara Byrd, of Oregon AFL-CIO was an instrumental support researcher and author. Ms. Byrd has a strong background in development of family wage jobs and more recently has been involved in the emerging green collar jobs opportunities.

Oregon has embarked on a plan to transform its workforce education and training system to keep pace with economic changes including globalization, an aging workforce, advancing technology, shifting worker attitudes and a significant loss of family wage jobs.¹ To accomplish this, the State has identified three strategies:

- Strengthen employer consortia and industry-led training to produce highly skilled and innovative workers who are able to earn a family wage and benefits.
- Prepare an agile and innovative workforce able to continuously adapt to technology changes.
- Build a flexible, demand-driven workforce education and training system that is outcome-based, customer-focused, accessible, adequately funded and grounded in public-private partnerships.

The Oregon Workforce Investment Board has invested in three targeted public-private partnerships to implement statewide, targeted sector strategies.

- Oregon Healthcare Workforce Institute, Oregon Simulation Alliance and partners – developing statewide policies and targeted investments to overcome the healthcare workforce shortage.
- Oregon's Manufacturing Workforce Strategy – Led by the Northwest High Performance Enterprise Consortium to expand career opportunities and the economic value of manufacturing to Oregon.
- Clean Energy – Led by the Business Alliance for Sustainable Energy (BASE) in partnership with the Oregon AFL-CIO to assist education and workforce partners in developing training programs for the clean energy industry.

The clean energy partnership is the newest, established in early 2007, when the state of Oregon, via the Governor's Strategic Training Fund, contracted the Business Alliance for Sustainable Energy (BASE) to implement the Sustainable Oregon Workforce initiative. BASE is a consortium of sustainable energy companies and stakeholders and is a project of 3EStrategies, an Oregon not-for-profit corporation.

The goal of the Sustainable Oregon Workforce Initiative (SOW) is to accelerate development of the sustainable energy industry in Oregon by coordinating and enhancing clean energy workforce development programs across the state. The primary undertaking in 2007 was to perform a gap analysis identifying existing clean energy workforce training programs and the top clean energy industry workforce needs. This report, *An Analysis of Clean Energy Workforce Needs and Programs in Oregon*, includes a compilation of the information gathered from clean energy companies and workforce education and training providers, an identification of the top near-term needs of clean energy employers and a set of recommendations and next steps.

Methodology

A key priority of the Sustainable Oregon Workforce initiative is to ensure that clean energy businesses are intimately involved with development of workforce training programs so that those programs produce employees that meet the real, on-the-ground needs of clean energy companies. Therefore, our methods were heavily reliant upon direct contact with clean energy businesses of diverse size across the state. The information in this report was gathered through a combination of regional focus and feedback meetings, electronic surveys, interviews and direct research.

Regional Focus and Feedback Meetings

During the course of this study, BASE conducted meetings in Portland, Bend, Klamath Falls and The Dalles. These meetings were designed to gather feedback from training providers and employers and to promote communication between the stakeholders.

The meetings included representatives from Oregon academic institutions including the Oregon Institute of Technology, Central Oregon Community College, Columbia Gorge Community College, Lane Community College and Gladstone High School. Also in attendance were representatives from the following labor organizations: International Brotherhood of Electrical Workers, Locals 125 & 659; Plumbers and Steamfitters, Local 290; International Assn. of Machinists-Woodworkers; NW Line Apprenticeship Program, Oregon Tradeswomen, Inc. Industry employer representatives included fuel cell, solar installation and manufacturing, and geothermal companies, wind developers and farmers, utilities, woodworkers, window manufacturers and green building product providers. Additionally, regional economic development agencies, chambers of commerce, workforce agency representatives and local and county elected officials participated.

Electronic Surveys

A survey was developed and delivered to each academic and training provider in the state. We collected surveys from twenty-eight training programs, ranging from multi-day certification courses, to union apprenticeships to a full four year degree. These are described later in this report. In addition, we partnered with the Athena Institute to inject workforce-related questions into a clean tech industry survey being administered in Oregon and Washington. Some of these preliminary results are incorporated into this report.



Electricians wiring switches and reactors at wind farm substation.
Photo credit: John Demoss

Methodology (cont'd)

We are confident that we have compiled a comprehensive data set on the clean energy agency, academic, union and trade association related training programs in the state. However, as this is the first such inventory of these programs we may have missed some. Any omission is unintentional.

We are less confident about the thoroughness of our data about the clean energy employment status and workforce needs. This information is difficult to obtain because no state agency gathers it effectively and clean energy companies are diverse and sometimes resistant to providing wage information. This report will address ways in which this can be remedied going forward.

Interviews

At this point, it is very difficult to obtain clean energy employment and wages data because the industry is very diverse and does not align well with Oregon Employment Department tracking codes. Therefore, in order to obtain information on employment numbers and average wages we relied upon phone interviews to clean energy companies, trade associations and certain training providers. A list of interview participants is shown in the references section of this report.

“it is very difficult to obtain clean energy employment and wages data because the industry is very diverse and does not align well with Oregon Employment Department tracking codes”

Why Focus on the Clean Energy Sector?

Oregon has an unparalleled diversity of renewable energy resources including wind, wave, solar, geothermal, tidal and biomass and biofuel feedstock and is already home to dozens of clean energy companies. The state has the potential to become a major leader in the sustainable energy industry. However, several conditions are hindering development of Oregon sustainable energy companies.

First, while communities are beginning to take steps to develop local clean energy resources and businesses, they are working in relative vacuums. Many are largely unaware of the efforts underway in neighboring communities and are missing opportunities to leverage additional resources. Second, the industry's workforce needs are varied, and most academic and workforce training institutions are unaware of the diverse industry needs. Third, in the rush to grow, employers may seek short-term training fixes that fail to lead to full-time, stable, family wage employment for workers. Numerous other states are already working to assume leadership in the clean energy sector and Oregon must move quickly to establish ourselves as capable of growing this industry.

Accelerating the development of the clean energy industry in Oregon by building a strong clean energy workforce will be beneficial to Oregonians on several fronts including:

- Positioning Oregon to become a leader in the burgeoning global clean energy economy, growing businesses, revenues and family wage jobs
- Protecting Oregon communities from escalating energy costs
- Reducing carbon dioxide emissions
- Complementing the state's investment in developing the manufacturing workforce

Business Revenues and Jobs

Fully embracing the sustainable energy industry is an economic opportunity of massive proportions. The wind, solar, hydrogen and biofuels sector reached \$55.4 billion in 2006, making these combined sectors larger than the international music industry. These four are projected to be \$226 billion by 2016.²

Energy efficiency products will likely generate equally significant economic impacts. Large companies such as GE, Honeywell and Johnson Controls are increasing their business efforts in efficiency, which will drive job growth in this area. And, efficiency as a business service, a longtime growth opportunity for engineering consultants in the US, is now gaining traction in China.²



Students in the Two-Year A.A.S. Renewable Energy Technician Program at Lane Community College participating in the design and fabrication of Photovoltaic and Solar Thermal systems. LCC/NEEI

Why Focus on the Clean Energy Sector? (cont'd)

Combined, the fields of efficiency and renewable energy will continue to increase in economic importance. A report by the American Solar Energy Society (ASES) estimates that renewable energy and energy efficiency in the United States \$970 billion in revenue, more than \$100 billion in industry profits and over \$150 billion in increased local through federal tax revenues. The report suggests with strong policy support the industry could be generating as much as \$4.5 trillion in revenue by 2030.³

The rapid growth in the clean energy sector provides opportunities for strong job growth. The ASES report noted above estimates that renewable energy and energy efficiency is currently generating 8.5 million jobs could reach 40 million U.S. jobs by 2030.³

In addition to sheer numbers, the clean energy industry appeals to both young people entering the job market and older workers seeking a career change. This diversity is important given that 78 million baby boomers are now in the retirement pipeline. This massive reduction in workforce will impact all industries and will require diverse workforce capacity building programs to overcome.

Wind development offers a good example of the rapid growth taking place in the clean energy industry. Between October 2005 and October 2006, seven new wind farms were completed in the Northwest, providing 954 megawatts of new wind power capacity. According to the Renewable Northwest Project, this one year span of wind development resulted in nearly 1,400 construction jobs during peak construction periods and approximately 80 new permanent family-wage jobs for operation and maintenance. In addition, the Ports of Vancouver and Longview, Washington have become the major ports of entry for wind turbine components. The ILWU, Local 4, unloads turbines at the Port of Vancouver and reports that the increased volume of turbines arriving through the port generated more than 25,000 labor hours in the past two years and created about 30 new family wage jobs.⁴

In an increasingly globalized economy, with energy becoming an ever more important economic sector, establishing Oregon as a preferred location for clean energy companies is a strategic economic development goal.

According to the Renewable Northwest Project, this one year span of wind development resulted in nearly 1,400 construction jobs during peak construction periods and approximately 80 new permanent family-wage jobs for operation and maintenance

Why Focus on the Clean Energy Sector? (cont'd)

Reducing Energy Costs, Protecting the Environment and Keeping More Money in the Oregon Economy. In addition to the economic advantages of attracting clean energy companies, Oregon stands to benefit by developing our local clean energy resources and lessening dependence on out-of-state fossil fuels. The state is particularly vulnerable to fossil fuel dependence because it imports 100% of both oil and natural gas and, despite our massive hydro system, still generates 49% of its electricity from fossil fuels, primarily coal burning plants in Wyoming.

In the past few years retail electricity rates have risen by more than 30% in Oregon. Costs for heating oil, on-highway diesel and regular gasoline have seen similar increases. Natural gas rates have skyrocketed, with retail costs doubling. Oregonians spend nearly \$10 billion on energy annually; 85% of that money leaves the state. That means every year Oregon residents send enough energy-related dollars out of state to equal more than twice what they spend on education.

Oregon is also directly vulnerable to climate change. Climate change related drought, reduced snow pack and decreased river flows is leading to increased disease and catastrophic wildfires in our forests, crises in our salmon fisheries and water shortages for farmers.

Making the rapid transition to clean energy is an investment in Oregon communities. According to the Renewable Northwest Project (RNP), every \$100 million invested in renewable energy results in \$200 million in economic benefits, and increases tax revenues by app. \$1 million.⁴

Why Focus on the Clean Energy Sector?

(cont'd)

“With the addition of SolarWorld and Solaicx, Oregon is now home to the largest solar manufacturing presence in the country”

Wind is the best studied example so far. The RNP report noted above states that seven wind farms installed in the northwest have had the following economic impacts:⁴

- \$1.38 billion in new capital investment
- \$2 million to \$3 million in annual royalty payments to rural landowners
- \$5.8 million to \$6.8 million each year in local property tax revenues

Developing our clean, home grown energy resources will increase local control over energy costs, keep more dollars in the Oregon economy, and decrease carbon dioxide emissions.

Complement State Investment in Building a Manufacturing Workforce

As mentioned in the introduction to this report, the state of Oregon has targeted the manufacturing industry as one of its top three workforce development clusters. This is an especially opportune time to invest in the clean energy workforce because the industry is now developing a strong production presence in Oregon. With the addition of SolarWorld and Solaicx, Oregon is now home to the largest solar manufacturing presence in the country. Inverter and fuel cell manufacturers also have a strong presence in the state. Workforce development efforts in clean energy will leverage and assist manufacturing workforce development efforts.

Oregon's Clean Energy Industry Status and Workforce Needs

This section provides information on the status, trends and workforce needs of clean energy companies in Oregon, the status of related workforce training programs and a sample of clean energy jobs and wages.

As explained in the methodology section of this report there were a number of challenges in securing this information. These are worth noting because they shape some of the recommendations in the following sections.

One of the biggest challenges facing clean energy workforce development is the tremendous diversity of the industry. The combined industry includes the renewable electricity and fuels producers, the conservation technology / energy efficiency product and service providers and several sectors of the construction industry. With the growth of green building, more and more sectors of the construction industry now overlap with the clean energy sector. These include the more obvious examples of solar hot water installers and HVAC experts to less intuitive positions such as framers with expertise in energy efficient advanced framing and manufacturers of efficient wall system products. The diversity challenge is compounded by the fact that many companies not typically considered clean tech, have some component of their services or products that do in fact fall into the clean tech category. Examples include appliance retailers whose product offerings include some high efficiency products or automakers with factories that run multiple manufacturing lines, only one of them being set up for hybrid vehicles, and so on.



Photo credit: Dennis Schwartz

Oregon’s Clean Energy Industry Status and Workforce Needs (cont’d)

Another significant challenge is that there currently is no adequate tool for tracking the number of companies, employees and wages in the clean energy industry in Oregon. This industry does not align well with federal Department of Labor codes for gathering labor market information. For example, there is not a special code for clean energy manufacturing. Therefore, the solar and fuel cell manufacturing companies are captured in general manufacturing but not in clean energy. Given this gap in assessment tools, it is a laborious task to gain employee and wages information and the results are less than ideally comprehensive. In fact, the first baseline assessment of clean energy companies in Oregon was conducted by BASE in 2003/4 and has not been systematically updated. This challenge is compounded by the fact that some clean energy companies are reluctant to directly share wage information.

Results from Multi-State Survey

One tool we used to gather the data presented in this report was to imbed workforce related questions into a survey conducted by Athena Institute on behalf of the Oregon Economic and Community Development Department and others.⁵ Preliminary results from this survey are shown below and in Appendix A.

The companies in this survey operate across Washington, Oregon, British Columbia, Idaho and Alberta. 43% of survey respondents are headquartered in Oregon, another 14% of the respondents have a presence in Oregon, although they are headquartered in another state. The on-line survey respondents can be categorized across the following subsectors:

Percentage of Total Respondents			
		Technology Provider	Service Provider
Clean Energy	Respondents include solar, tidal, geothermal, wind, hydro, wood fiber. Firms include project developers and project service firms, technology developers, system integrators and installers.	19.0%	12.4%
Emissions/ Environmental Management	Respondents include emissions technology developers and environmental engineering firms.	5.0%	6.7%
Green Buildings	Respondents include building material developers, architects, project developers, green realty firms and other green service firms.	8.0%	23.0%
Energy Efficiency	Respondents include energy efficient technology and equipment, and energy efficiency consultants	3.0%	2.6%
Recycled Materials	Respondents include firms recycling materials to develop new products, service firms managing company and residential recycling and waste	4.4%	1.0%
Business Service	Respondents include firms who provide sustainability consulting and technology solutions for increased business sustainability, and capital resources for firms in this sector	5.4%	9.5%

Oregon's Clean Energy Industry Status and Workforce Needs (cont'd)

Survey respondents reported the following:

Importance of Workforce

Employees are an important part of clean tech businesses – in supplemental survey interviews it was mentioned 60% in the top three of reasons people cited originally, and over 70% of the time it was in the top two of reasons people stayed in a location.

Education Levels in the Workforce

Respondents generally have a highly educated workforce. 62% of survey respondents have no employees with just a high school diploma, instead hiring employees with at least a trade degree or more. 30% of the respondents employ individuals with associates or trade degrees. 36% of respondents report that all of their employees have at least a four year degree or more. 72% of the firms have employees with graduate degrees, 33% employ workers with doctorates.

On the other end of the spectrum, a smaller subset of the respondents (18%) employ high school graduates at a much higher percentage than their peers, and 8% of respondents hire 50% of employees with just a high school degree.

Finding Skilled Workers

More than half of employers looking for employees are able to find them locally, both with new graduates and experienced workforce. When they do have to look outside their state for experienced graduates, they usually have to look into the United States more broadly than just the Pacific Northwest. For new graduates, an equal number of respondents look in the Pacific Northwest and the rest look nationwide. Preliminary analysis indicates that clean technology firms who are technology developers (rather than manufacturers, assemblers, or system integrators/installers) look outside the region more often than other organizations.

Difficult Positions to Fill

Companies reported difficulty filling specialty positions. Engineers, in particular, are in high demand within this sector. But there were a number of organizations who had challenges with marketing and general management and administration positions as well. There was not a pattern of these needs to size of company, although there was some correlation between the stage of company and needs. All of those but one who described their need for marketing professionals were in early commercialization or market growth stages. There was less correlation on the specialty positions and stage, age, or size of company.

“Companies reported difficulty filling specialty positions.

Engineers, in particular, are in high demand within this sector”

Results from Direct Outreach to Oregon Clean Energy Companies

As noted in the methodology section, in order to bring a more direct focus on Oregon clean energy workforce needs, we made direct contact with clean energy employers through face to face meetings, telephone interviews and the 2008 Business Alliance for Sustainable Energy (BASE) Summit. That information is presented below.

Oregon's clean energy industry is comprised of a remarkable diversity of job positions including meteorologists, chemists, solar panel and geothermal heat pump installers, electricians, fuel delivery truck drivers, machine operators, sales people, customer service representatives and consultants to give just a sample.

Each key clean energy sector has specific workforce challenges and needs – an overview of these are shown below. However, some overarching trends and challenges affect all the sectors.

- One, we are seeing a shift from service and installation to production in the solar, fuel cell and some supporting sectors such as inverters and conservation technologies. It is likely that wind turbine production will have a presence in Oregon in the near future.
- Two, all sectors reported having difficulty finding employees with basic workplace skills and work readiness including showing up on time, coming to work prepared to work, completing tasks on time, etc. In addition, several technical training programs reported that before trainees can engage in the program they first have to be provided with remedial math skills.

Sector specific information is provided below.

Solar

Oregon has recently seen an influx of solar manufacturers with plans for rapid expansion of capacities for photovoltaic cells and inverters. Solar World, Solacix, PV Powered, and Gro Solar have operations that span across the state.

While solar manufacturing is relatively new to Oregon, the state has a well-established solar photovoltaic and water heater installer sector. Driven in part by strong state tax credits and cash incentives from the Energy Trust of Oregon residential and commercial solar installations are growing strongly. Municipal governments are also showing increasing willingness to invest in solar energy systems. Approximately eight megawatts are projected to be installed in 2008, compared to the 1.2 megawatts installed in 2007.



Students in the Two-Year A.A.S. Renewable Energy Technician Program at Lane Community College participating in the design and fabrication of Photovoltaic and Solar Thermal systems. LCC/NEEI

Results from Direct Outreach to Oregon Clean Energy Companies (cont'd)

Workforce Needs -- Solar:

The solar industry is very diverse in the types of positions it includes (machine operators, installers, plumbers, sales) and also in the wages paid. Our findings include:

Manufacturing is a strong new source of jobs in Oregon. Solar World, Solaicx and PV Powered expect to need 630 workers combined by early 2009 (approximately half of those will be direct manufacturing and assembly positions). These companies report some trepidation in finding enough workers with machine operating skills.

- o Bob Beisner, Vice President, of Solar World in Hillsboro explains that the company prefers individuals to join them early (right out of community college and training programs) and grow their careers with them.
- o Jeff Jones, Vice President of Solaicx in Portland, reports that they have been filling the needs so far with people formerly in the semi-conductor field but experienced production workers are already difficult to find.
- o Roger Laubacher, CFO of PV Powered, reported challenges finding engineers, which required having to do some out of state recruiting. They have not yet had to go out of state for assembly workers, but have had challenges finding employees with experience in electronics assembly. They have drawn employees from the airplane and automobile manufacturing fields.

“Solar World, Solaicx and PV Powered expect to need 630 workers combined by early 2009”

Solar photovoltaic installer employers report a need for more trained installers. However, there is not yet full-time work doing installation. New graduates from solar installer training programs may make \$20 per hour but can't necessarily find full-time work. Without additional training and licensing, solar installers are not equipped to do other residential electrical work.

Demand for solar hot water growing, but solar industry is challenged to find plumbers to install the systems. Employers are resistant to paying journeyman plumber rates and there isn't yet full-time demand for solar hot water installers so limited license plumbers are unable to find full-time work.

Results from Direct Outreach to Oregon Clean Energy Companies (cont'd)

“According to American Wind Energy Association, the wind industry in the U.S. currently employs 20,000, not including those manufacturing turbines or other equipment”

Wind

The United States installed more wind capacity in 2006 than any other country in the world, successfully bringing online 11,600 MW of renewable wind energy.⁶ As of December, 2007, 900 MW of wind energy had been installed in the state, with another 1,200 MW approved for construction and 1,400 MW in permitting stage. According to American Wind Energy Association, the wind industry in the U.S. currently employs 20,000, not including those manufacturing turbines or other equipment. Installation in Oregon is booming. However, there is no turbine manufacturing activity, although, Vestas Wind Systems national headquarters are located in Portland. However, installation is mushrooming.

Workforce Needs -- Wind:

The primary workforce need for the wind industry in Oregon is for turbine installation and maintenance technicians. Employers report a need for 600 wind technicians over the next four years.

Affordable housing is a big workforce issue. Most windfarms are based in rural areas and workers are having a difficult time finding housing at prices that enable them to purchase a home.

Need for meteorologists with wind resource expertise.

Geothermal

Geothermal is significant in its broad applications and ability to provide base-load power. In the Western United States and Hawaii 2,800 MW of geothermal energy supplies 4 million people with power.⁶ Applications of geothermal heating, cooling, and electricity generation have been used for over 50 years in Oregon.⁶ Electricity generation can be utilized regionally in two-thirds of the state and the remaining portions of the state are appropriate for heap pump applications.

Workforce Needs -- Geothermal:

Under the electricity generation side of the industry, geothermal developers mentioned need for geologists with specific geothermal resource expertise.

The heat pump and direct use element of the geothermal industry includes well drillers, plumbers, heat pump installers and maintenance and repair workers. The only gap we identified in this study was the lack of certified heat pump installers.

- o According to John Lund of the Oregon Geo Heat Center, in order to qualify for the state tax credits for geothermal systems, the system must be installed by an installer certified by the International Ground Source Heat Pump Association. There is no program on the west coast offering this certification training.
- o Lund estimates there are approximately six certified installers in Oregon and no certification programs.

Results from Direct Outreach to Oregon Clean Energy Companies (cont'd)

Fuel Cells

Oregon based fuel cell manufacturers are serving markets on five continents with backup, portable and stationary applications of fuel cell technology. As of January 2008, there were 52 commercial fuel cell companies in the United States.⁶

Workforce Needs – Fuel Cells:

Iris Sasaki, of Clear Edge Power, reports that her company is moving toward production of fuel cells. They anticipate needing 100 production workers by early 2009. These positions include manufacturing and assembly workers, test engineers and test technicians. They realize they cannot find people with fuel cell stack training so will need to develop these employees.

Amy Clem, of IdaTech, reports that the company currently has 80 U.S. based employees (72 in Bend Oregon). Fourteen of those employees work in production and manufacturing.

- o The company has opened a manufacturing facility in Mexico which now has 15 employees. They site lower production costs for the decision to operate from Mexico. In the next few years, IdaTech will be adding a few additional members to the Bend production team, but the majority of manufacturing will be transferred to Mexico.
- o IdaTech reports the company has not had trouble/challenges attracting manufacturing candidates to the company nor to Bend.

Small Hydro

There is an ongoing resurgence of interest in small hydro in Oregon, especially in irrigation districts, due to ease of adding power on to existing facilities. However, at this time, the activity in this sector is small and workforce needs have not yet surfaced.

Biomass

Woody biomass, including agriculture, urban and forest biomass, can be utilized for heat and energy applications across the state of Oregon in power plants and prepared fuels production (pellets, bricks, etc for stoves). Biomass has the potential for 150 MW of electricity generation and currently generates two trillion BTUs of thermal energy used in industrial facilities at 58 sites across the state.⁶

Development of this industry sector includes many challenges other than workforce training including the need for long term fuel supply agreements, large up-front capital outlays, and fluctuating federal incentive programs

“As of January 2008, there were 52 commercial fuel cell companies in the United States”

Results from Direct Outreach to Oregon Clean Energy Companies (cont'd)

Workforce Needs -- Biomass:

The biomass industry workforce falls into two primary categories: fuel collectors and haulers and plant operators. Given that the industry is in the early development phase, most of the work is not full-time at this point and much of it is difficult and poorly paid. Specific needs include:

Employers report difficulty finding certified turbine operators.

Some specialized equipment is needed to handle the small diameter forest waste products. Biomass employers are concerned about the capacity for loggers and clearers to acquire this equipment and get training in operating it effectively.

Some of the in-forest biomass jobs appear to be on a contract only basis and are often paying below family wage compensation levels. There is concern that some of these positions are filled by illegal immigrants.

Note, the biomass industry provides a good opportunity to create new opportunities in rural regions that have suffered from the downturn in the timber industry but there is risk that many of these jobs will not provide family wages.

Wave

Oregon is a prime location for the development of wave energy. The coast has strongly competitive wave resources in close proximity to readily available coastal substations. Old logging substations and facilities that have been closed can be renovated for wave production and are ready to handle the large capacity that will be generated. Additionally, Oregon has a highly capable metals manufacturing industry necessary for the production of emergent technologies. Wave energy technology today is being compared to wind energy technology 15-20 years ago. Due to the changing socioeconomic environment, it is believed that the industry will be able to come to scale, implementing technologies more quickly than was possible with wind.⁶

Workforce Needs -- Wave

Currently the wave industry in Oregon is in the very early development stage. According to employers, the challenges at this time effect actual installation of buoys and equipment. Marine operator capacity is a problem. Even though tugboats are available, tugboat operators often are not and have to be flown in from out of state, increasing time delays and costs.

Existing marine infrastructure is based on the fishery industry. Many of these workers have the necessary skills to meet some of the needs of the wave energy industry, but lack the legally required certifications.

Oregon also lacks a robust naval architecture and marine engineering industry. Employers reported having to draw on out of state services in these areas.



Finavera renewables buoy

Results from Direct Outreach to Oregon Clean Energy Companies (cont'd)

Conservation Technologies / Energy Efficiency

Market leaders are beginning to look at energy in a more strategic manner. They are no longer thinking about it as fixed cost, but rather as a strategic means of limiting their exposure to price volatility, reducing operating costs and increasing profitability and thus competitiveness in the marketplace. As energy efficiency increasingly becomes viewed as a low risk, high yield investment economists are expecting the sector of energy conservation technologies to be larger in job and revenue generation than all other renewable sectors.

The sheer diversity of the conservation technologies / energy efficiency sector makes for quite a challenge in determining current revenue and employment status, trends and projections. The study by the American Solar Energy Association, cited earlier in this report, explains:

The Renewable Energy industry is fairly well defined and consists of distinct sectors, but the Energy Efficiency “industry” is much more nebulous and difficult to define. There are specific elements that are clearly part of the EE industry, such as federal and state EE programs, utility EE spending, the insulation industry, the recycling industry, etc. However, most EE spending is included in partial segments of large industries, such as vehicles, buildings, lighting, appliances, etc.³

Two of the primary components of this sector are Energy Service Providers such as Johnson Controls, Honeywell and Siemens and building sciences and systems. Both of these have greatly varying job positions.

Despite the difficulty categorizing it, conservation technology / energy efficiency is one of the most mature of the clean energy sectors. Stan Price, of the Northwest Energy Efficiency Council (NEEC), estimates current day employment of 2,500 with an additional 2,500 trades jobs supported in Oregon as a result of project installation.⁶

Workforce Needs – Conservation Technologies

The Building Sciences workforce needs engineers (mechanical, controls, electrical) that understand the energy efficiency aspects of the systems. Traditional curriculum in engineering schools doesn't address the energy efficiency issues.

In addition to the high skill professional engineering level, building sciences has a large trades component. There is a need for training opportunities that provide trades workers with information on efficiency projects.

Another identified need is for people with project management skills who understand energy efficiency technologies.

“The sheer diversity of the conservation technologies / energy efficiency sector makes for quite a challenge in determining current revenue and employment status, trends and projections”

Results from Direct Outreach to Oregon Clean Energy Companies (cont'd)

This is a highly diverse sector that needs a targeted assessment to determine workforce opportunities and needs. The Sustainable Oregon Workforce has plans to conduct such an assessment in Phase 2. More on this in the recommendations section of this report.

Green Building

The global green building market is projected to double in size to \$4.7 billion over the next four years.⁷ Oregon is a nationally recognized leader in Green Building. This will continue to be an important economic cluster for the state in numerous areas including:

- Construction trades with green building expertise (including framers, roofers, plumbers, electricians, HVAC installers, concrete and asphalt workers, among many others)

- Architects and designers

- Businesses that provide green building products (including efficient wall systems, non-toxic paints, stains and interior products, certified sustainable lumber to name just a few)

- Building commissioners and auditors

- Facility operators

“The global green building market is projected to double in size to \$4.7 billion over the next four years”

Clearly, green building is a very diverse industry that has not yet been well-defined. To complicate matters there is strong overlap between the green building, solar installer, geothermal installer and conservation technologies sectors.

Workforce Needs – Green Building:

As evidenced in the section below on available workforce training programs, a number of programs are already training employees for certain aspects of the green building industry. Before we can adequately identify workforce needs specifically for the green building industry we need to develop a structure for categorizing and assessing this industry. This will be undertaken in Phase 2 of the Sustainable Oregon Workforce initiative. More on this in the recommendations section of this report.

Results from Direct Outreach to Oregon Clean Energy Companies (cont'd)

Biofuels

Oregon is national leader in biofuels legislation. Biodiesel markets have doubled annually since 2002. Twenty five tanker truck companies are now hauling and distributing biodiesel across the state and more than 35 retail biodiesel outlets are in place statewide.⁶ Portland is home to 2 biodiesel blending terminals allowing tanker trucks to fill with biodiesel just as easily as diesel. New policies require a 10% ethanol blend across the state beginning in 2008.⁶

Workforce Needs – Biofuels:

Biofuels is another sector with extremely diverse workforce needs. The industry includes a myriad of agricultural jobs related to seedcrop production, positions associated with seed crushing and oil refining, trucking and distribution jobs, fuel station attendants and a variety of support positions. During our research, biofuel employers showed little concern about workforce issues. At this time issues such as feedstock procurement and development of a biofuels delivery infrastructure are taking precedent.

“Biodiesel markets have doubled annually since 2002”

Oregon's Clean Energy Workforce Training Programs

During the course of this study we collected information from six Oregon academic institutions, one non-profit organization and twelve apprenticeship programs (eleven provided by union training centers) that are providing a total of twenty eight clean energy workforce training programs. These are listed below.

Academic and Non-Profit Programs

Central Oregon Community College (COCC); Bend, OR

Program	Degree / Certificate	Training Application(s)
Sustainable Building Advisor Program	Sustainable Building Advisor Certificate	Green Building, Building Science, Construction

Description: Sustainable Building Advisor Program

This nine-month course is specifically designed for working professionals wishing to apply sustainable concepts to the buildings they design, develop, and construct. The course explores how to construct buildings that are energy and resource efficient, healthy working and living environments, environmentally responsible and cost effective.

Designed for architects, engineers, home designers, tenant and developer representatives, construction and capital project managers, building operators and other building industry professionals, information is presented in a highly interactive manner delivered by expert instructors and includes small group projects and field trips to see sustainable building concepts implemented.

Columbia Gorge Community College (CGCC); The Dalles, OR

Program	Degree / Certificate	Training Application(s)
Renewable Energy Technology (RET)	1-year certificate: Renewable Energy Technology	Hydro-generation, wind-generation, & automated manufacturing
Renewable Energy Technology (RET)	2-years AAS: Renewable Energy Technology	Hydro-generation, wind-generation, & automated manufacturing



Pilot Program Student and Wind Technician. Columbia Gorge Community College

Oregon’s Clean Energy Workforce Training Programs (cont’d)

“Students gain a working understanding of energy systems in today’s built environment and the tools to analyze and quantify energy efficiency efforts”

Description: Renewable Energy Technology Program

Columbia Gorge Community College’s Renewable Energy Technology program is a career ladder program offering a One-year Certificate and an Associate of Applied Science degree. This program was designed in collaboration with industry partners from the wind energy industry, power generation industry, Bonneville Power Administration, The Insitu Group, Intel, Cardinal IG, and Black and Veatch.

The Renewable Energy Technology Program prepares students for employment in a broad range of industries. These include hydro-generation, wind-generation, automated manufacturing, and engineering technicians.

The one-year certificate provides a basic level of knowledge and skills in the above areas in addition to computer applications, math, and writing skills. The two-year degree includes more in-depth skill levels to include PLCs (programmable logic controllers), industrial control systems, semiconductor devices/circuits, and higher levels of math and physics.

Entry level wages range from \$13 per hour to \$15 per hour. More experienced technicians or those who progress more quickly on the career ladder due to having graduated from the program can expect wages ranging from \$26 to \$36 per hour with electrical, electronics, and communication engineering technicians having the potential to earn far more.

Lane Community College (LCC); Eugene, OR

Program	Degree / Certificate	Training Application(s)
Energy management technician	2 year AAS	Facility Managers, Energy Auditors, Energy Program Coordinators
Renewable energy technician	2 year AAS	Designing and installing solar electric and domestic hot water systems

Description:

Students gain a working understanding of energy systems in today’s built environment and the tools to analyze and quantify energy efficiency efforts. The program began with an emphasis in residential energy efficiency / solar energy systems and has evolved to include commercial energy efficiency and renewable energy system installation technology

Oregon’s Clean Energy Workforce Training Programs (cont’d)

“Training is founded on installation of DHW and PV systems, however students have skills for a broader job market”

Energy Management Technician

Students learn to apply basic principles of physics and analysis techniques to the description and measurement of energy in today’s building systems with the goal of evaluating and recommending alternative energy solutions that will result in greater energy efficiency and energy cost savings. Graduates find employment in a wide variety of disciplines and may work as Facility Managers, Energy Auditors, Energy Program Coordinators or Control System Specialists, for such diverse employers as engineering firms, public and private utilities, energy equipment companies, and departments of energy.

Renewable Energy Technician

This professional technical program is offered as a second year option within the Energy Management Program. The coursework prepares students for employment designing and installing solar electric and domestic hot water systems. An advisory committee made up of renewable energy practitioners guides program development.

Renewable Energy students, along with Energy Management students, take a first-year curriculum in commercial energy efficiency giving them a solid background that includes residential energy efficiency, HVAC systems, lighting, and the usual requirement of physics and math.

In the second year, renewable students diverge from the Energy Management curriculum and take coursework that starts with two courses in electricity fundamentals and one course in energy economics. In the following terms students learn to design, install, and develop a thorough understanding of photovoltaic (PV) and domestic hot water (DHW) systems.

Training is founded on installation of DHW and PV systems, however students have skills for a broader job market. They will work for installation contractors, but they will have the background to seek employment in national and international marketing and sales, materials estimating, sizing and design.

Lane Community College (LCC): Northwest Energy Education Institute (NWEEL) Eugene, OR

Program	Degree / Certificate	Training Application(s)
NWEEL certification course	Energy Management Certification (EMC)	Advanced energy management principles and techniques
NWEEL certification course	BPA Residential Energy Auditor Certification	Residential energy audits
NWEEL certification course	BPA Residential Inspector Certification	Weatherization and residential energy conservation
NWEEL certification course	Building Operator Certification (BOC)	Energy and resource-efficient building operations

Oregon's Clean Energy Workforce Training Programs (cont'd)

Description: Energy Management Certification

This is an advanced certification program designed to provide a broad base of skills for energy managers and measurable return-on-investment for employers. This program is designed for engineers, technicians, architects, facility, maintenance and energy managers.

This program teaches a broad spectrum of energy management principles and techniques. Topics include building energy use, glazing, insulation, building envelope, heating/cooling, secondary HVAC, controls, central plant equipment, energy auditing, operation and maintenance.

Description: Building Operator Certification

This is a professional development program created by The Northwest Energy Efficiency Council (NEEC), and delivered in Oregon by NEEI. It is designed for operations and maintenance staff working in public or private commercial buildings. It certifies individuals in energy and resource-efficient operation of building systems at two levels:

- To become Level I certified, participants must attend seven Level-One classes (56 hours), and complete class exams and project assignments.
- To become Level II certified, participants must attend four core classes (35 hours) and two elective classes (14 hours), complete class exams, and assigned projects.

Description: Bonneville Power Administration Residential Certification.

Two BPA certification programs are offered for those interested in residential energy and inspector certification.

Residential Energy Auditor Certification

A five-day course that includes training in the principles of energy auditing, and interaction with utility customers in the field. This comprehensive program includes training in the principles of energy, energy and the building shell, energy auditing, air leakage, insulation, windows and doors, heating systems, indoor air quality, lighting and appliances, cooling and water heating. Attendees will be trained to conduct certified energy audits and deal with utility customers in the field. A certification examination will be administered on the last day of the session.

BPA Residential Energy Auditor Certification is ideal for employees who will be involved in a residential weatherization program and working with residential customers, helping them determine how energy is being used in their homes, what measures can be taken to save energy, how much those measure will cost and how quickly the measures will pay for themselves.



Conduit installation at wind turbine foundation.
Photo credit: John Demoss

Oregon's Clean Energy Workforce Training Programs (cont'd)

Residential Inspector Certification

A three-day workshop that teaches attendees how to conduct home inspections after residential weatherization work has been done. This workshop is a comprehensive review of installation specifications for residential weatherization work, as well as strategies for dealing with contractors and homeowners to ensure high-quality installation and a satisfied homeowner.

BPA Residential Inspector Certification is best suited for employees who are interested in weatherization specifications and/or will be inspecting residential energy conservation work and working with weatherization contractors.

Oregon Institute of Technology (OIT) Portland, OR & Klamath Falls, OR

Program	Degree / Certificate	Training Application(s)
Renewable Energy Systems	BS in Renewable Energy Systems	Management design and installation of renewable energy systems

Description: Renewable Energy Systems

The OIT Bachelor degree in Renewable Energy Systems is the first of its kind in the nation. The commencement of the first graduating class will take place in June 2008. The program reports significant demand for graduates and need for additional faculty and lab facilities at both the Portland and Klamath Falls campuses to meet that demand.

The degree program begins by establishing a solid foundation of physics, chemistry and mathematics, which pave the way for coursework in electrical and mechanical engineering. Upper-division courses in renewable-energy specific courses include photovoltaics, energy management and auditing, wind power, biofuels, renewable-energy transportation systems, green building and fuel cells. The Renewable Energy curriculum prepares graduates for careers in the energy sector in general, and the renewable energy in particular.

Graduates of the program will be prepared for graduate study or for immediate employment as field engineers, energy auditors, renewable energy system integrators for homes and businesses, manufacturing engineers for component and subsystem manufacturers, designers for components and subsystems, local and state government renewable-energy inspectors, planners and other positions in the energy field.

"The Renewable Energy curriculum prepares graduates for careers in the energy sector in general, and the renewable energy in particular"

Oregon's Clean Energy Workforce Training Programs (cont'd)

Portland Community College (PCC): Trades and Industries Portland, OR

Program	Degree / Certificate	Training Application(s)
Facilities Maintenance	Facilities Maintenance Certificate	Facilities Maintenance

Description: Facilities Maintenance

The facilities maintenance technician installs, maintains and repairs HVAC/R (heating, venting, air conditioning and refrigeration) and other equipment and systems where environmental quality is essential to success of the company. They work in the semiconductor industry, large health care facilities and other heavy industry organizations.

This program offers the skills to enhance a career in facilities maintenance. Students learn the skills and concepts necessary to install, operate, maintain and repair control, piping and mechanical systems in large commercial, medical,

Portland Community College (PCC): Future Planned Programs

Program	Degree / Certificate	Training Application(s)
Renewable energy systems (RES) Solar or Fuel Cell	AAS in Engineering Technology	Solar installation and maintenance or fuel cell development
Renewable energy systems (RES) Wind or Hydro	AAS in Engineering Technology	Hydro-generation or wind-generation

Additional Non-Academic Non-Profit Program:

Energy Star Energy Trust Technical School Outreach

The Energy Star Energy Trust Technical School Outreach initiative is an innovative educational opportunity provided by the non-profit Energy Trust of Oregon's ENERGY STAR® New Homes program. It provides schools with an opportunity to incorporate cutting edge curriculum and project-based learning experiences into existing technical programs. Themes available for incorporation into existing high school and community college technical programs:

- Building Science / Construction
- Architectural Drafting
- Green Building
- Energy Conservation

“ENERGY STAR® New Homes program provides schools with an opportunity to incorporate cutting edge curriculum and project-based learning experiences into existing technical programs”

Oregon's Clean Energy Workforce Training Programs (cont'd)

Residential Inspector Certification

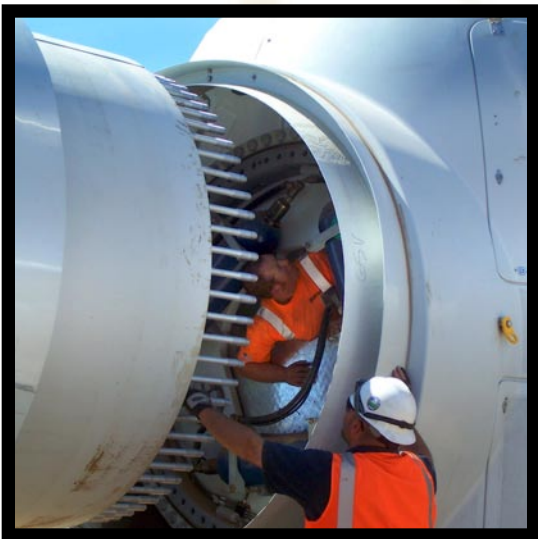
At its core, Technical School Outreach is a student and teacher development program, offering a combination of classroom and field learning experiences. The program is structured to introduce participants to the theories and best practices for energy efficient, climate-specific residential design and construction. The initiative provides schools with an opportunity to incorporate cutting edge curriculum and project-based learning experiences into existing technical programs.

Customized educational modules are administered onsite by industry professionals and technical experts. Modules target areas such as air sealing, insulation, mechanical ventilation, heating and cooling, solar technologies and building diagnostics, as well as emerging technologies such as tankless water heaters and radiant floor heating. Students receive hands-on training in areas such as effective air sealing techniques, framing alternatives, proper installation of mechanical systems, insulation material alternatives, blower door diagnostic testing and renewable energy applications.

Apprenticeship, Unions and the Clean Energy Industry

Union apprenticeship programs are well-established, privately-funded programs of long standing. These programs respond directly to the stated needs of employers, systematically and thoroughly training workers to match the number of job openings predicted by those employers. As registered apprenticeship programs overseen by the State of Oregon, they are monitored closely, their admissions and graduation records are available for public scrutiny, and they pay special attention to the recruitment and retention of women and minorities to their programs.

Registered apprenticeship is a system that allows workers to earn while they learn – apprentices work in the industry while taking classes at night, or for a specified number of weeks out of each year. Their wage rates are tied to journey-level wages, typically starting at 50% of a full-fledged journey level rate and increasing steadily as the apprentice accumulates work and classroom hours.



Wind Technicians aligning the bolt fit on wind turbine rotor assembly Photo credit: John Demoss

Oregon's Clean Energy Workforce Training Programs (cont'd)

Apprenticeship programs provide workers with credentials that are portable: “journeyman’s cards” are recognized throughout the industry and across state lines, providing workers who earn them the means to make a living not tied to the fortunes of a single employer. In addition, union apprenticeship training centers provide upgrade training to journey level workers. This means that older workers, trained in more traditional technologies, can easily return to their training centers for continuing education to upgrade their skills. Many of these centers have added new curricula in solar, wind, geothermal and other areas – this training is available to both apprentices and journey level workers. Thus, union workers can continue to learn and grow, and to develop new skills to match new industry demands.

Eleven union apprenticeship training centers and one non-union center responded to the survey, representing 15 occupations and operating in 29 sites around the state. Enrolling approximately 3,000 apprentices and serving several hundred journey level workers in continuing education classes, these programs graduate an average of 500 people per year.

National Electrical Contractors Association (NECA) / International Brotherhood of Electrical Workers (IBEW) Training Center

Occupation	Certification/ License	Length of Training Program	Starting Hourly Wage
Residential Electrician	Residential Electrical license	2 years	\$18
Inside Electrician	Electrical license	5 years	\$33

Central Electrical Training Center

Occupation	Certification/ License	Length of Training Program	Starting Hourly Wage
Limited Residential Electrician	Residential Electrical license	2 years	\$23
Inside Electrician	Electrical license	5 years	\$31

Northwest Line Construction Industry Joint Apprenticeship Training Committee (JATC)

Occupation	Certification/ License	Length of Training Program	Starting Hourly Wage
Lineman	Electrical license	3 years	\$34

“Many of these centers have added new curricula in solar, wind, geothermal and other areas”

Oregon's Clean Energy Workforce

Training Programs (cont'd)

Description NECA/ IBEW:

There are 16 electrical apprenticeship programs in Oregon which vary greatly in size and composition. They train residential and commercial electricians as well as outside linemen who work primarily for utilities.

Three of these program responded to the survey. These programs, which all happen to be union, have been operating 40-50 years as a cooperative endeavor of the IBEW and the NECA. In response to the growing solar industry, these programs, in cooperation with the national NECA/IBEW training organization, have developed a new, state of the art curriculum in solar photovoltaic technology. Covering wind and fuel cells as well as solar, this curriculum is currently being used to upgrade the skills of existing electricians as well as apprentices.

The major occupation for which these programs train is Inside Electrician. This apprenticeship leads to the General Journeyman Electrician license. Inside electricians perform electrical installations, including solar; construction, including “green building” work; and maintenance, repair and service of solar, wind, wave and other energy equipment.

The other major occupational category covered by electrical apprenticeship programs is Residential Electrician. Residential electricians work in all phases of the residential electrical construction and service industry. They do the electrical construction work on projects ranging from single-family residences to apartment complexes of no more than 3 stories, including solar installation. They also perform repair and maintenance on existing installations.

The Lineman’s program (which is registered with Washington state, but not Oregon) trains apprentices to construct and maintain high-voltage electrical transmission facilities from the generation site (including renewable energy sites) to the utility customer. This is a 3-year program which graduates about 75 workers each year; the occupation has a \$34 starting wage.



Technicians prepping wind turbine transmission cables for splice.
Photo credit: John Demoss

Plumbers & Steamfitters Local 290 Training Center

Occupation	Certification/ License	Length of Training Program	Starting Hourly Wage
Steamfitter	Boiler license	5 years	\$35
Plumbing	Plumbing license	5 years	\$35

- Steamfitter: Works with steam & hydronic heating systems.
- Plumber: Solar water heating; gray water reclamation; related geothermal applications

Oregon's Clean Energy Workforce Training Programs (cont'd)

Willamette Carpenters Training Center

Occupation	Certification/ License	Length of Training Program	Starting Hourly Wage
Carpenter	N/A	4 years	\$29
Industrial Maintenance Millwright	N/A	4 years	\$25

- Carpenter: Green building training, including insulated concrete forms, siding and thermal barriers for buildings.
- Industrial Maintenance Millwright: Turbine work, including mounting gear units, installing blades, rigging towers, maintenance.

HVAC & Metals Institute/SMW Local 16

Occupation	Certification/ License	Length of Training Program	Starting Hourly Wage
Sheet Metal Worker	N/A	5 years	\$18

- Sheet Metal Worker: Efficient design and installation of energy-efficient heating, ventilation and air conditioning systems. Combines sheet metal and electrical work involving installation, wiring, service and repair of environmental control systems and the fabrication and installation of ductwork.

Pacific NW Ironworkers & Employers Apprenticeship Training Center

Occupation	Certification/ License	Length of Training Program	Starting Hourly Wage
Ironworker	N/A	4 years	\$30

- Ironworker: Wind turbine erection and maintenance.

Glaziers Local 740 JATC

Occupation	Certification/ License	Length of Training Program	Starting Hourly Wage
Glazier	N/A	4 years	\$31

- Glazier: Glazing techniques for energy efficiency; glass panel system installation; work on solar panels.

Oregon's Clean Energy Workforce Training Programs (cont'd)

Heat & Frost Insulators & Allied Trades Local 36

Occupation	Certification/ License	Length of Training Program	Starting Hourly Wage
Heat/Frost Insulator	N/A	4 years	\$30

- Heat/Frost Insulator: Heat loss prevention, process and domestic systems; cryogenics and energy conservation techniques; firestop techniques.

Painters JATC

Occupation	Certification/ License	Length of Training Program	Starting Hourly Wage
Painter	N/A	4 years	\$16

- Painter: Use of low solvent materials for green buildings.

Roofers JATC

Occupation	Certification/ License	Length of Training Program	Starting Hourly Wage
Roofer	N/A	3 years	\$26

- Roofer: Installation of eco-roofs.

Renewable Energy Joint Apprenticeship Training Committee/OSEIA

Occupation	Certification/ License	Length of Training Program	Starting Hourly Wage
Solar Installer	N/A	1 years	\$20
Renewable Energy Technician	Renewable Energy Technician license	2 years	\$20

- Note: this is the one non-union apprenticeship program to respond to our survey.
- Solar installer & Renewable Energy Technician: Installation of renewable energy systems, including photovoltaic; limited to 25 KVA or less, off-grid.

Oregon's Clean Energy Workforce Training Programs (cont'd)

Challenges Faced by Training Providers

As evidenced by the relatively large number and diversity of training programs that participated in this study, Oregon has a solid resource base of organizations committed to training workers for the clean energy industry. However, these programs face a number of challenges.

Once again, the diversity of the clean energy industry is challenging. Oregon community colleges and universities are interested in developing programs and curriculum for clean energy related training, but are uncertain about the needs of the various clean energy sectors, the types of jobs needed, pay rates and demand level for the positions. They are justifiably concerned that any resources invested in program development are going to result in a program that is in high demand and producing strong career opportunities.

Another challenge is the need to coordinate public and private sector training programs so as to reduce inefficiencies in the expenditure of public workforce dollars. This is particularly true in training for the wind and solar industries, where registered apprenticeship programs include renewable energy industry skills within larger occupational categories (electrician, ironworker, steamfitter, etc.).



Both public and private training programs face the challenge of being underutilized by employers. In our experience clean energy companies usually have little knowledge of the workforce resources available to them. For example, a study of members of the Association of Oregon Industries reported that 57.7% of respondents never used the workforce development enterprise.⁸ Though construction employers are well aware of Oregon's system of registered apprenticeship, the same is not true of manufacturing employers, and the number of manufacturing apprenticeship programs has fallen dramatically over the past 15-20 years. Nevertheless, manufacturing apprenticeship may offer one valuable approach to training in the clean energy industry.

Finally, program funding is often a challenge. Community college and university programs are reliant upon public funding that is often inadequate to support rapid development of new targeted training programs. These programs need to develop sustainable funding plans which will include significant support from the private industries that they support. More on these challenges is found in the gaps and recommendations sections below.

Sample of Clean Energy Jobs and Wages

Note, the following table is a sample of clean energy jobs. There are literally dozens of positions that are not reflected here. The wage rates shown do not take into account benefits such as health insurance and retirement packages.

Renewable Field	Occupation	Certification/ License/Degree	Starting Hourly Wage
Geothermal	Geothermal heat pump installer	IGSHPA (International Ground Source Heat Pump Association) accredited GSHP installer	\$18-29/hr
	Geothermal heat pump designer	Mechanical engineer energy geo designer	3-5% of project cost
	Facilities manager	Mechanical engineering background	\$20-24/hr
	Geothermal geologist	BS or MA geology	\$50 - 120/hr
Solar	Solar installer kw < 25	Solar LRT license	\$20/hr
	Solar installer kw > 25	Journeyman electrician	\$33/hr
	Manufacturing Production	None	\$10 – 30/hr
Conservation Technologies	Energy analyst	Professional engineer (PE) with optional certified energy manager (CEM)	\$60-80k per year
	Energy engineer	Professional engineer (PE) with optional certified energy manager CEM	\$60-80k per year
Biomass	Biomass plant operator	Boiler operator certification	\$18-20/hr
	Biomass plant operator	Turbine operator	\$18-20/hr
Wind	Wind energy technician	One year certificate wind energy technician	\$20-24/hr
	Wind energy technician	AAS degree wind energy technician	\$20-24/hr
Fuel Cell	Manufacturing/ assembly technician	BS mechanical engineering	\$23-25/hr
	Fuel cell test technician	BS in chemical or mechanical engineering	\$35-55k per year

Oregon's Clean Energy Workforce Gaps and Challenges

Based on the information compiled from both clean energy companies and training providers we have identified several gaps in Oregon's clean energy workforce. These fall under two categories, broad gaps in the workforce system that effect all industries and industry-specific short term needs. These are described below.

Overarching Gaps in the Workforce System

Clearly, there is growing interest in the clean energy sector by both academic institutions and workforce agencies. However, a number of gaps are hindering development of the industry.

Workforce System Gap	Description
A The clean energy industry is not yet fully mature and contains a large percentage of small and start-up companies. Many clean energy companies are challenged to pay family wage jobs.	As the state of Oregon explores ways in which to strengthen the workforce for the clean energy industry it is important to allocate resources that benefit the industry while simultaneously providing family wage jobs. This is a challenge because currently many of the existing clean energy sectors depend upon relatively low wages and contract labor to be profitable. In the clean energy industry as in others, there is certainly a place for lower wage positions for entry level workers. However, programs supported by state resources should result in the opportunity for such entry level workers to advance to living wage, career positions.
B Communication gaps between key stakeholders are preventing training program development and utilization of workforce resources by clean energy companies.	There is inadequate communication between clean energy employers and community colleges and universities, between community colleges and union training programs, and between workforce agencies and clean energy employers. Most clean energy companies reported having little knowledge of existing training programs and even less of agency workforce resources. One of the needs identified by clean energy companies in the course of our research was the need for the education system to act with speed in developing these high need training programs. It will be difficult to quickly develop effective programs given the communication gaps identified above.
C A lack of renewable energy and energy efficiency competencies in traditional and core curriculum is leaving most high school and college graduates unprepared for employment in the clean energy industry.	The lack of renewable energy competencies (knowledge, skills, abilities) in traditional and core curriculum is acute. Engineering, plumbing, electrician, geology, meteorology, building sciences are all academic and trade fields in which incorporation of renewable energy and energy efficiency training would provide graduates with a stronger basis to enter the clean energy workforce.
D All sectors report difficulty in finding employees that are "work ready".	Virtually all sectors reported having difficulty finding employees with basic workplace skills and work readiness including showing up on time, coming to work prepared to work, completing tasks on time, etc. In addition, several technical training programs reported that before trainees can engage in the program they first have to be provided with remedial math skills.

Oregon's Clean Energy Workforce Gaps and Challenges (cont'd)

Workforce System Gap	Description
E No avenues exist to glean the knowledge base of clean energy experts nearing retirement.	In essence, our first wave of clean energy pioneers are baby boomers and will begin retiring in mass in 2011. Currently, there is no mentoring or knowledge transfer mechanism to capture the value of their knowledge and experience.
F Oregon Employment Department does not have mechanisms in place to track clean energy jobs and wages information.	The codes used by the Oregon Employment Department do not adequately track jobs and wage information on clean energy companies. For example, the solar manufacturing firms in Oregon will be tracked as manufacturing jobs but not as clean energy jobs. It is difficult to evaluate whether or not the clean energy industry is progressing if we are unable to establish a baseline.

In addition to the industry wide gaps addressed above, many key clean energy sectors report specific workforce gaps.

Industry-Specific Workforce Gaps

Industry-Sector Specific Gaps	Description
G Wind Technicians	Wind development presents a tremendous opportunity to create family wage jobs in Oregon. Wind industry employers in Oregon and Southwest Washington report a need for 600 wind technicians over the next four years. They are concerned about being able to find enough trained technicians and being able to encourage them to live in the rural regions necessary to do the work, especially given the shortage of affordable housing in many of these regions. The Columbia Gorge Community College currently has the capacity to produce only 34 technicians per year. Moreover, the program coordinator reports that a number of graduates are being lured away by out-of-state employers. Some union apprenticeship programs are turning out journey level workers with the skills to do this work. For example, the Pacific Northwest Ironworkers and Employers Apprenticeship Training Center offers a four-year program that trains most of the workers who erect wind towers, and is increasing the size of its program to graduate approximately 100 journey level workers per year starting in 2008. Electrical apprenticeship programs also offer classes for apprentices and licensed electricians on the maintenance of wind turbines and other electrically-powered equipment used in the wind, solar and wave industries. Many of these journey-level electricians and ironworkers, however, will be able to choose among a variety of employment options, of which wind turbine maintenance is only one. Though it may seem beyond the scope of a workforce study, we feel it important to highlight that addressing affordable housing in high wind resource regions will become increasingly important to developing this industry in Oregon. with remedial math skills.

Oregon's Clean Energy Workforce Gaps and Challenges (cont'd)

Industry-Sector Specific Gaps	Description
H Manufacturing and Production Workers	Oregon now has a large solar and fuel cell manufacturing presence. These companies project a need of nearly 1,000 new workers over the next four years. All but one of these companies reported trepidation finding enough suitable manufacturing workers to meet their needs. The one reporting no concern is planning to move most of their manufacturing activities to Mexico.
I Electricians, Limited Renewable Technicians, Plumbers and Limited Solar Thermal Installers	At least two of these companies are working closely with the community college system, particularly Portland Community College to establish a manufacturing training center. They are also working to establish internship programs. This strong collaboration between industry and academic institutions is a positive development. Most solar installation companies reported challenges meeting demand and many customers and would-be customers (residential and commercial) reported frustration getting solar installers to provide bids, installation and maintenance in a timely manner. Limited Renewable Technicians (LRTs) are trained to install renewable energy systems (solar, wind, biomass, etc.) under 25 kilowatts up to the point of connecting to the electricity grid; a licensed electrician must do the actual connection. Currently the Oregon Solar Energy Industries Association (OSEIA) and Lane Community College are producing approximately 4-5 LRTs per year. Jon Miller, recently director of OSEIA, suggests demand is sufficient to employ 15-20 LRTs per year. Some OSEIA member contractors do send their employees to electrical apprenticeship programs, but at this time none participate in training with plumbing apprenticeship programs, which have been less amenable to cross-over training.
J Energy Engineers	This is a difficult issue. LRTs provide a lower wage alternative to employing full-time licensed electrician, but LRTs cannot complete an installation, and contractors report difficulty finding licensed electricians to do so on a part time basis. We expect solar installers will push for greater concessions from the state on the licensing front and that this will be opposed by larger electrical contractors and organized labor. Engineers are in high demand within all of the clean energy sectors. Companies are reporting challenges finding energy engineers, and anticipated needs are growing. Energy engineers serve as building energy modelers, energy auditors, energy systems managers, energy systems designers, etc. Employers are looking for engineers who understand the broad field of energy engineering; traditional engineering curricula like electrical and mechanical engineering do not address energy engineering issues in whole. Organizations such as the Engineering and Technology Industry Council have stated that a significant expansion of engineering graduates from Oregon universities is paramount to the maintenance of high tech industries. Many of these new graduates will need to be versed in the topics of energy engineering if a strong and diverse clean energy sector is to develop in Oregon. The Oregon Institute of Technology's new Bachelors degree in Renewable Energy Systems has begun to address the need for energy engineers. The program has the potential to be a leader in renewable energy engineering education, provided funding needs are met. Industry representatives are enthusiastic about the program; they have helped shape the curriculum and provide internships for students. Currently, enrollment is at its maximum and students from across the nation have moved to Portland to participate. With sufficient support, the program could provide over fifty renewable energy engineering graduates annually.

Recommendations

Based on our research and the current status of clean energy workforce development in Oregon we recommend the following actions. Each recommendation lists the letter/s corresponding to the specific gap/s it addresses shown in the tables above.

- l) Strengthen the workforce system’s ability to address short-term needs of clean energy industry by building capacity of the key university, community college and union training programs. Specific recommendations to meet immediate workforce needs include:
 - a. Support Portland Community College efforts to address immediate needs of solar and fuel cell manufacturing. Ensure that this program includes career pathways for high school students (i.e. “Intro into Clean Energy Industry & Careers) and displaced workers into manufacturing jobs. (D,H)
 - b. Add capacity to the Columbia Gorge Wind Technician program. (D,G)
 - c. Add capacity to the Oregon Institute of Technology Bachelors degree in Renewable Energy Systems in Portland and Klamath Falls. (C,D,J)
 - d. Encourage increased enrollment in union apprenticeship programs. Recognize the value and increase the visibility of these programs where possible, especially for representatives of emerging manufacturing concerns and for staff of regional workforce boards. Integrate information about registered apprenticeship programs into any high school to work pipeline activities. (G,I)
 - e. Develop pre-college clean energy “bridge” courses for low-skilled adults to be offered in community colleges (similar to the Healthcare and Manufacturing industry “bridge” courses that have been recently developed) and in key non-profit programs (e.g. Oregon Tradeswomen, Portland Youth Builders) and union apprenticeship training centers.
 - f. Strengthen, expand and integrate existing programs before creating new. There are already at least 28 clean energy training programs in Oregon. Resources will be most efficiently invested by strengthening these programs and improving collaboration among them. (B,G,H,I)



Pilot Program Student and Wind Technician. Columbia Gorge Community College

Recommendations (cont'd)

“Tuition and industry support must become primary. This will likely mean moving these programs into the academic core program offerings”

- 2) Implement measures to build efficiency, resiliency and sustainability in the clean energy workforce training system:
 - a. Clean energy related community college programs need to establish a plan for long term sustainable funding. Although the state may choose to provide capital to assist in the start up of these programs, the institutions must move quickly to reduce dependence upon additional state funding. Tuition and industry support must become primary. This will likely mean moving these programs into the academic core program offerings. The state should assist in analyzing funding options, including private investment and state policies, to identify sustainable funding plans for key clean energy training programs. (B,C,D)
 - b. Support ongoing development of union apprenticeship and training programs. This may include assistance with outreach and marketing efforts and assistance in effectively integrating into the workforce system. (B,D,G,H,I)
 - c. Establish industry internship and mentoring systems to strengthen existing programs and as key elements of any necessary new programs. It is important to create mechanisms for knowledge transfer so that retiring clean energy experts can share their knowledge base with incoming workers. We support the concept of a “Retired Skilled Workers Corps” forwarded by the Oregon Future Workforce Needs Analysis report.⁹ (A,B,C,D,E)
- 4) Implement mechanisms for the Oregon Employment Department to be able to track employment and wage information for the clean energy industry. (B,F)
- 5) Increase collaboration between key stakeholders:
 - a. Improve communication between trade associations, union training programs, community colleges and universities and employers. (B,G,H,I)
 - b. Increase collaboration between Oregon universities and community colleges to effectively utilize existing regionally-specific programs and resources. This may include developing statewide certificates and degrees for clean energy occupations including competencies and skills that cut across multiple occupations (cross-cutting skills) in the clean energy industry. (B,G,H,I)
 - c. Investigate opportunities for improved collaboration between electrical and plumbing apprenticeship programs and the OSEIA and Lane Community College Limited Renewable and Limited Solar Thermal Technicians program. (B,I)

Recommendations (cont'd)

- 6) In addition to developing targeted clean energy specific training programs, sustainable energy elements should be added into the core curriculum for conventional academic and technical programs such as engineering, electrician, plumbing, buildings sciences, meteorology and geology. (C)
- 7) Perform a detailed analysis of the conservation technologies sector including its components, projections and workforce needs. (B,E,F)
- 8) Perform a detailed analysis of the green building sector including its components, projections and workforce needs. (B,E,F)
- 9) Expand the Sustainable Oregon Workforce initiative and Oregon climate change legislation to include additional sustainable industries and lay the foundation for an Oregon Green Jobs initiative. (A,B,D,E). See section below.

Green Jobs Initiative Overview

There is evidence that we may be in the early phases of an economic transformation in industrialized economies. Similar to the transition from manufacturing and production to service and knowledge industries, we are now seeing a strong emergence of environmentally oriented and socially conscious consumers and companies. As noted earlier in this report demand for clean energy products is mushrooming and is just one aspect of the growing green economy. One of the fastest growing consumer demographics is known as Lifestyles of Health and Sustainability (LOHAS). This demographic sector has grown to nearly 50 million people in the United States, who annually spend \$200 billion on products such as organic cotton clothing, renewable energy products and ecotourism.⁷

In response to the vast opportunity for job creation in this emerging green economy, cities, states and even the United Nations are beginning to develop green jobs initiatives. Some of these initiatives address jobs at all levels of the economic spectrum, while others focus more closely on manual labor positions. For example, Dr. Raquel Pinderhughes, in a report on green jobs opportunities in the Bay Area of California suggests:

Green collar jobs are blue collar jobs in green businesses – that is, manual labor jobs in businesses whose products and services directly improve environmental quality. Green collar jobs are located in large and small for-profit businesses, non-profit organizations, social enterprises, and public sector institutions. What unites these jobs is that all of them are associated with manual labor work that directly improves environmental quality. Green collar jobs represent an important new category of work force opportunities because they are relatively high quality jobs, with relatively low barriers to entry, in sectors that are poised for dramatic growth.¹⁰

“we are now seeing a strong emergence of environmentally oriented and socially conscious consumers and companies”

Recommendations (cont'd)

A report by the Apollo Alliance Green for All program reads:

Green-collar jobs, as we define them, are well-paid, career track jobs that contribute directly to preserving or enhancing environmental quality. Like traditional blue-collar jobs, green-collar jobs range from low-skill, entry-level positions to high-skill, higher-paid jobs, and include opportunities for advancement in both skill and wages....Because the phrase “green-collar job” has been bandied about so much lately, it is important to emphasize once again what we mean - or rather, what we do not mean - when we use this term. Put simply, if a job improves the environment, but doesn’t provide a family-supporting wage or a career ladder to move low-income workers into higher-skilled occupations, it is not a green-collar job.¹¹

And, a report issued by Worldwatch Institute states:

In this report, we define green jobs as positions in agricultural, manufacturing, R&D, administrative, and service activities aimed at alleviating the myriad environmental threats faced by humanity. Specifically, but not exclusively, this includes jobs that help to protect and restore ecosystems and biodiversity, reduce energy, materials, and water consumption through high efficiency and avoidance strategies, de-carbonize the economy, and minimize or altogether avoid generation of all forms of waste and pollution.¹²

Thusfar, very few of these initiatives have included any concrete actions. Oakland California and the State of Washington are two exceptions.

- Oakland Green Job Corps: The Green Jobs Corps is a collaboration of community-based organizations, unions, the City of Oakland, and private companies. It will provide local Oakland residents with job training, support, and work experience so that they can independently pursue careers in the new energy economy. The Oakland City Council provided \$250,000 of seed funding to the corps. A portion of these funds will create paid internships for Green Jobs Corps graduates in renewable energy and energy efficiency sectors. The Green Jobs Corps intends to:
 - Recruit participants and provide them with ongoing support;
 - Teach participants “soft” skills: general life skills necessary to be successful in any work environment;
 - Teach participants “hard” skills: specific required to work on new energy projects as a member of the Oakland Green Corps;
 - Provide participants with employment experience for a limited time on City-funded renewable energy and efficiency projects;
 - Support participants in transitioning from the Oakland Green Jobs Corps into independent employment.

Recommendations (cont'd)

- The Green Washington State Climate Change and Green Jobs Initiative: Washington lawmakers recently passed a bill setting goals for reducing emissions over the next four decades, and increasing clean-energy jobs to 25,000 by 2020. A Green Collar Jobs Training Account will administer grants to training providers like colleges and apprenticeship programs.

We strongly recommend that Oregon strengthen its position as a leader in the green economy by developing concrete implementation plans for a substantive green jobs initiative. We recommend an initiative that addresses the full spectrum of green job opportunities but that provides special emphasis and resources to programs that lift people out of poverty into the green economy.

Since the formation of green job initiatives is still very new territory, we believe the first step the state of Oregon should take is to invest a modest amount of funds to support a green jobs team in evaluating the best concrete mechanisms for Oregon to create substantive, lean and effective mechanisms for developing green collar career pathways.

“We strongly recommend that Oregon strengthen its position as a leader in the green economy by developing concrete implementation plans for a substantive green jobs initiative.”

Conclusions and Next Steps

The Sustainable Oregon Workforce Phase I established a baseline of clean energy workforce training programs and short term industry needs. The initiative found that the clean energy industry in Oregon is growing at a significant rate and its complexion is evolving to include production as well as retail and installation. The industry is extremely diverse and in some sectors, such as green building and conservation technologies, not yet well defined. Wages paid in the field vary greatly, but many opportunities exist to establish a strong base of family wage opportunities.

Identified short term industry needs include workers with manufacturing and assembly skills, energy engineers, wind technicians, solar installers, geologists with geothermal resource evaluation skills and meteorologists with wind resource evaluation skills.

Surprisingly at least twenty eight clean energy workforce training programs already exist in the state. These programs range from multi-day certification programs, to union apprenticeship programs to a full four year Bachelors degree in Renewable Energy Systems.

Through the development of this report, *An Analysis of Clean Energy Workforce Needs and Programs in Oregon*, the Sustainable Oregon Workforce initiative answered a number of key questions regarding the workforce needs of clean energy companies. However, a number of big questions remain unanswered. These include:

- What is the current comprehensive status of the clean energy industry in Oregon? How many companies are here? What is the current level of clean energy employment and wage ranges?
- How do we ensure that training programs lead to family wage jobs with advancement opportunity?
- How can we ensure that money invested by Oregonians result in jobs that benefit the Oregon economy?

In order to answer these questions and rapidly develop a strong clean energy workforce, Oregon academic institutions, trade associations, labor unions, the Oregon Employment Department and the state Workforce Development system will need to make system level changes to many of their programs. The Oregon Employment Department will need to develop means to track the clean energy industry. The workforce development system will need to find ways to better inform the industry about their services. Academic institutions and labor unions will need to improve collaboration to avoid duplication and achieve maximum efficiency with resource allocations.



Photo Credit: Dennis Schwartz

Conclusions and Next Steps (cont'd)

The state of Oregon has committed \$75,000 to 3Estrategies' Business Alliance for Sustainable Energy to build on the progress made in the Sustainable Oregon Workforce initiative to date. In phase 2 of SOW, we intend to begin addressing the gaps identified in this report and to aid the many clean energy workforce stakeholders in addressing the big questions outlined above. Specific objectives of SOW Phase 2 include are shown in Appendix D.

The Sustainable Oregon Workforce initiative is highly collaborative. We welcome your feedback, comments and suggestions. Please contact us at 541.617.9013 or Cylvia@3estrategies.org.

Conventional energy sources are becoming more and more costly, both in economic and environmental terms. Oregon possesses a tremendous diversity of renewable energy resources and a solid base of clean energy companies and workforce training programs. These combine to present Oregonians with an exciting opportunity to become a leader in the clean energy industry, generating innovative family wage jobs and providing solutions to the pressing energy and environmental issues of our age. Though some questions and much work remain, we hope this analysis of clean energy workforce needs and programs and the ongoing efforts of the Sustainable Oregon Workforce will be valuable in positioning Oregon to capitalize on this monumental opportunity.

“Oregon possesses a tremendous diversity of renewable energy resources and a solid base of clean energy companies and workforce raining programs.”

Appendix A

Preliminary Results from Athena Institute Clean Tech Study

Description of the Study

This regional study involved three components: company analysis, interviews, and on-line survey:

- **Company analysis:** the research team looked at third party sources to generate lists of regional firms and identify preliminary information on revenues and employee counts, including on-line databases, directories, company public filings and more.
- **Interviews:** in each state, 6 – 10 interviews with cleantech and sustainability firms were conducted.
- **On-line survey:** two separate on-line surveys were conducted, one during the summer of 07 and one in the fall of 07. There were 201 respondents in all for the survey across British Columbia, Washington and Oregon. For this particular analysis, we removed those respondents who were not clearly clean technology or sustainability firms, including government groups, large utilities, associations, advocacy groups and individuals. We also consolidated multiple responses from the same firm and cleansed the data set of responses that were too incomplete to provide valid information. These adjustments led to a final count of 162 respondents for the survey that we've analyzed here.

The companies in this study operate across Washington, Oregon, British Columbia, Idaho and Alberta. 43% of our survey respondents are headquartered in Oregon, another 14% of the respondents have a presence in Oregon, although they are headquartered in another state.

New Graduates

New graduates (less than three years experience)

- 45% yes we find employees in the cities of our primary locations
- 25% not hiring
- 15% no, we have to look in the rest of the Pacific Northwest
- 15% no we have to look in the rest of US
- 5% no, we have to look outside of North America

So within those who are hiring new graduates

- 56% yes we find employees in the cities of our primary locations
- 19% no, we have to look in the rest of the Pacific Northwest
- 19% no we have to look in the rest of US
- 6% no, we have to look outside of North America

Appendix A

Preliminary Results from Athena Institute Clean Tech Study

Experienced Graduates

Experienced graduates (more than three years experience)

- 44% yes we find employees in the cities of our primary locations
- 22% no we have to look in the rest of US
- 22% not hiring
- 6% no, we have to look in the rest of the Pacific Northwest
- 6% no we have to look in rest of Canada
- 0% no, we have to look outside of North America

So within those who are hiring new graduates

- 56% yes we find employees in the cities of our primary locations
- 28% no we have to look in the rest of US
- 8% no, we have to look in the rest of the Pacific Northwest
- 8% no we have to look in rest of Canada
- 0% no, we have to look outside of North America

Why are they hiring out of the Pacific Northwest?

- 50% not applicable
- 29% lack of qualified personnel locally
- 12% need personnel to work in locations outside the region
- 8% need trained/certified individuals only available from programs or companies located outside of the region

So within those who are hiring outside of Pacific Northwest, they do it because

- 58% lack of qualified personnel locally
- 25% need personnel to work in locations outside the region
- 17% need trained/certified individuals only available from programs or companies located outside of the region

Appendix A

Preliminary Results from Athena Institute Clean Tech Study

Positions where there is difficulty finding qualified people locally:

Specialty technology Areas

- Engineers (numerous responses, some specific examples below)
 - Junior through senior level engineers
 - Engineering with fuel cell system expertise
 - Energy efficiency engineers who are also able to effectively communicate with and motivate businesses to implement EE programs
 - Career electrical engineers
 - Safety and engineering
- Commissioning and design simulation
- Power line technicians
- Licensed architects with sustainable design experience (i.e. LEED Accredited professionals in the Salem Oregon area)
- Sustainability consultants
- Water/wastewater treatment plant operators
- Tree fallers to clear dead and dying alder from out planting areas
- We have difficulty finding people with sufficient analytical and statistical training for the type of social science research we pursue

General business positions

- Manager
- Marketing
- Graphic design
- communications
- secretary
- upper management

Other responses

- Most activity is contract based—generally find resources on the west coast
- No real problem – we tend to have over-qualified, under paid employees
- We have recruited nationally, but hired locally
- We seek the most qualified regardless of their current area of residence
- Our difficulty is not in finding qualified people but paying them since we are not funded outside of grants yet
- Too soon, we have to secure more funding before hiring

Appendix A

Preliminary Results from Athena Institute Clean Tech Study

Why is it difficult to hire those positions?

- Lack of experience (numerous responses)
- Unqualified SEC experience
- New field of engineering
- Lack of cleantech/sustainability backgrounds in candidates
- Little local experience in area
- Smaller selection pool in the Pacific Northwest
- Strong market in Portland and the overall shortage of candidates in the Salem area
- Hard to find all skills in same person
- Hard to get people to our location
- High demand in the industries, 80's and 90's cutbacks are having long term consequences
- Qualified candidates don't tend to live near the city
- Size of organization
- Specialty trade with limited salary for position
- Salary scale we are able to pay
- Lack of interest in craft
- Qualified graphic designers are in higher demand
- Rapid growth hard to attract workers to "expensive" region
- Booming economy, shrinking labor force
- Meth problem in Portland as well as the difficulty of getting a talented person to work with their hands and get dirty anymore
- Communications professionals – those with excellent written skills and deeper understanding of environmental issues—are hard to come by

Do they Engage in Internship or Co-Operative Training Programs with Trade Schools, Colleges or Universities to employ students as part of their program requirements?

- 60% Yes I do participate
- 22% No, lack of time & resources
- 10% No, lack of information on specific programs and contacts
- 4% No, local trade schools, colleges or universities not available
- 4% No, I do not think it would be useful

Appendix A

Preliminary Results from Athena Institute Clean Tech Study

Training programs they use (note: didn't ask in the first survey, and only limited number responded to this question in the second survey, even though 77% of the second survey respondents participate in programs)

- Internships with UW, Seattle U, Macalester College, Oregon State University
- Marketing
- Software
- Biobased
- Horticulture
- Driving Schools

Specific Training programs, workforce programs or other policies they would like to see to meet their human resource requirements

- More courses in renewable energy
 - Solar installer programs
 - Basic high school math refresher classes would be helpful
 - Byproducts management associates degree would make waste reduction for manufacturers more effective
 - More intensive specialized training with commissioning and design simulation
 - We are lucky to have LCC in our neck of the woods which has very forward thinking training and licensing programs, which serve our needs
 - If the university chemist also had training in manufacturing of hwo to make the chemical compounds they are coming up with would have really helped get this technology out of the lab and into the market
 - Huge job force training in biofuels operations planning inspections
 - Very much a lack of interest or response from WSU and community colleges. Seems we are too small to be of interest
- (continued on next page)

Appendix A

Preliminary Results from Athena Institute Clean Tech Study

(continued from previous page)

- Environmental planning
- Sustainability planning
- LEED technical and project management
- ArchiCAD software training
- SketchUP software training
- Sustainable Design Advisor program
- More internship programs
- More financial assistance for job creation
- Apprenticeships
- Blue collar, mechanical
- driving trades
- distributed generation assembly, test, installation and service personnel
- vocational agriculture

Internships

Number of Interns in a year (only 2/3 of the companies responded to this question, so numbers are likely inflated in favor of hires)

45% hire 0

55% hire 1 – 4

% Interns onto permanent positions

64% said 0% of the interns go on to permanent positions

18% said that 1 – 25 % do

18% said that 51 – 75% do

Staff retiring

10% within the next two years (2008 – 2010)

40% in 3-5 years

32% in 10+ years

18% in 6-9 years

Appendix B

Oregon Clean Energy Workforce Resources

Business Alliance for Sustainable Energy (BASE):

541.617.9013. www.3estrategies.org

Oregon Workforce Partnership:

503.636.1404. www.oregonwfpartnership.org

Local Workforce Investment Boards:

- Lin-Benton Workforce Investment Board
Corvallis. 541.752.1010
- Enterprise for Employment and Education
Salem. 503.399.2398
- Lane Workforce Partnership
Eugene. www.laneworkforce.org
- The Oregon Consortium
Albany. 866.888.4862
- Rogue Valley Workforce Development Board
Medford. 541.776.5100
- Workforce Investment Council of Clackamas County
Oregon City. 503.657.6958 ext. 5271
- Worksystems, Inc.
Portland. 503.478.7300

Worksource Oregon.

www.worksourceoregon.org

- Regional centers in Portland Metro, Willamette, North Coast, South Coast, Southern Oregon, Central Oregon, Columbia Gorge, Eastern Oregon

Oregon Employment Department.

www.employment.oregon.gov. 503-947-1470

Appendix C

Sustainable Oregon Workforce Clean Energy Employer Consortium

Kevin Bannister, Finnavera Renewables

Bob Bass, Oregon Institute of Technology

Bob Beisner, Vice President, Solar World, Oregon

Barbara Byrd, AFL-CIO

John Demoss, CEO, PTW Inc.

Roger Laughbacher, PV Powered

Cal Mukomoto, Warm Springs Forest Products

Bill Sproul, Clear Edge Power

Al Waibel, Davenport Power

Appendix D

Objectives of the Sustainable Oregon Workforce Phase 2

- Determine means to address the top gaps in Oregon's clean energy workforce to include:
 - Assisting Oregon higher education institutions in implementing programs to address challenges identified in the SOW Phase I findings
 - Assist in securing resources to strengthen existing key programs
 - Working with the Community College system to meet immediate clean energy workforce needs
 - Assisting in establishing key industry internship programs
- Spearhead collaborative projects between industry, training providers, trade associations and labor unions.
- Assess the potential and challenges associated with creating a statewide, collaborative clean energy educational track.
- Compile a statewide inventory of sustainable energy development efforts to better inform communities across the state of efforts underway and opportunities to leverage those efforts.
- Assist collaborative efforts between regional workforce development and economic development agencies regarding clean energy.
- Perform an evaluation of job positions and workforce needs in the conservation technologies industry.
- Perform an evaluation of job positions and workforce needs in the green building industry.
- Work with industry partners to develop career pathways roadmaps identifying skills and competencies for entry level occupations and job advancement in key clean energy industry sectors.
- Coordinate an Oregon Green Collar Jobs Initiative including guiding the establishment of policies and incentive programs.
 - Identify other key green collar sectors (construction, organic agriculture, water, forestry, others)
 - Determine the job opportunities/ needs of clean tech aspects of construction and the green building industry.
- Build key partnerships including the BEST center, the Oregon Business Plan and others to be determined.

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Toni Boyd, Geo Heat Center, Oregon Institute of Technology
Dan Campbell, Central Oregon Electrical Training Center
Diana L. Catt, Idatech
John DeMoss, PTW
Roger Ebbage, Lane Community College
Matt Fikejs, NEEC Northwest Energy Efficiency Council
Ken Fry, NECA/IBEW Training Center
John Guyer, Certified IGSHPA Instructor
Bob Kimes, Plumbers & Steamfitters Local 290 Training Center
Patrick King, Marubeni Sustainable Energy
Rodger Laubacher, PV Powered
Michael Light, Oregon / Southwest Washington Heat, Frost Insulators/Asbestos Workers JATC
Stephanie Manzo, Sunlight Solar
Margo Maddux, Idatech
Clint Mapes, Greater Portland Roofers and Waterproofers JATC
Jon Miller, Oregon Solar Energy Industries Association
Sarah Morton, PV Powered
Cal Mukomoto, Warm Springs Forest Products Biomass facility
Ric Olander, HVAC and Metals Institute
Stan Price, Northwest Energy Efficiency Council
Cynthia Putnam, Northwest Energy Efficiency Council
Bill Regan, Western Oregon / Southwest Washington Painters JATC
Iris Sasaki, Clear Edge
Alex Sifford, Sifford Energy Services
Erik Simpkins, Idatech
Bill Sproul, Clear Edge Power
John Steffans, Willamette Carpenters Training Center
Al Waibel, geothermal consultant
Erik Westerholm, Lane Community College
Sanda Williams, Portland Community College
Susan Wolf, Columbia Gorge Community College
Lee Worley, Pacific NW Ironworkers & Employers JATC
Kim Zimmerman, Energy Trust Tech School Outreach