

John J. Heldrich Center for Workforce Development

## research brief

# Preparing the Workforce for a “Green Jobs” Economy

by Jennifer Cleary and Allison Kopicki

*As the United States embarks on its journey toward a clean energy economy, the buzz about the promise of “green jobs” has gained momentum among politicians, media, community organizers, educators, and workforce development stakeholders. This brief identifies the types of jobs and skills that will be in demand in this green future and the factors that are driving the new energy economy and the growth of its workforce. Finally, this brief considers strategies for building competitive, flexible workforce systems that can respond to emerging employer needs and highlights best practices occurring around the nation.*

## Introduction

Amidst the daily onslaught of dire news about the nation’s economy and record job losses, the green energy sector has held out a beacon of hope in the form of green jobs. While green jobs alone are unlikely to lift the U.S. economy out of the current recession, the next few years will be pivotal as the United States and many other nations around the globe undergo a massive shift in the way energy is produced and used in order to avert the effects of global warming. Green jobs will be a major part of this transformation to a clean energy economy, so it is essential to identify the occupations and skills that will be most in demand to support the energy revolution.

## What is a Green Job?

Green jobs can be broadly defined as jobs that involve protecting wildlife or ecosystems, reducing pollution or waste, or **reducing energy usage and lowering carbon emissions**. Green jobs in America’s energy economy are concentrated in the energy effi-

ciency (EE) sector, with growth also expected in the renewable energy (RE) sector.

The EE sector generally involves retrofitting homes and businesses to use less energy, as well as developing and manufacturing products that save energy. The renewable and clean energy sectors focus on creating, installing, and maintaining technologies that generate energy from resources that are naturally replenished and generally do not emit the greenhouse gasses that contribute to global warming. Renewable energies include wind, solar, geothermal, and hydropower. Part of the nation’s future energy supply is also likely to come from sustainable energy sources with low or no carbon emissions, including nuclear, coal with carbon sequestration (in which the harmful carbon emissions from burning coal are captured and stored), and natural gas cogeneration units, which are highly efficient.

The main distinction between the EE and RE sectors that is important for workforce and education professionals to understand has to do with the mix of occupations and employers in these sectors, and the green skills and certifications workers need to obtain these jobs. (See sidebar on page 2.)

## Preparing the Workforce for a “Green Jobs” Economy

---

Green jobs workers will include construction workers, cost estimators, financial analysts, computer technicians, accountants, manufacturing workers, truck drivers, salespersons, scientists, engineers, and many others — as long as their jobs have something to do with energy conservation or increasing the supply of renewable or clean energy sources.

Therefore, the majority of green jobs in the nation’s energy sector will not be new occupations in the immediate future, but rather traditional occupations that may require an additional layer of “green skills and knowledge.” For example, a sheet metal worker who does welding may need to learn new

techniques for manufacturing a wind turbine. Other opportunities in the green jobs economy will not require additional skills training. Thus, an experienced carpenter may not need new skills to install energy efficient windows and insulate a residence’s attic.

While green jobs occupations will be found across all industries and at all levels of education, the largest number of green jobs will be in occupations that require an apprenticeship, professional certificate, or one to two years of postsecondary education. Heating and air ventilation workers are needed to install more efficient heating, ventilation, and air conditioning (HVAC) systems, sheet metal

### Green Jobs in the Energy Efficiency & Renewable and Clean Energy Sectors

Energy efficiency is not just about putting on a sweater and turning off the lights. It’s about weatherizing homes, doing energy audits on businesses, and investing in more efficient equipment and lighting. It’s about creating systems to track energy usage and manufacturing efficient appliances.

Weatherization and building retrofits will provide the greatest number of green jobs. For residential weatherization, most jobs require low- to moderate-skills preparation, while in commercial and industrial retrofitting, there is a wider range of educational and training needs. Common occupations in these areas include the following:

#### Residential Weatherization

- Electricians
- Heating/Air Conditioning Installers
- Carpenters, Carpenter Helpers
- Construction Equipment Operators
- Roofers
- Insulation Workers
- Construction Managers
- Building Inspectors, Auditors

#### Commercial and Industrial Retrofits

- Building Weatherization Occupations
- Electrical Engineers
- Mechanical Engineers
- Cogeneration Construction and Operation
- Measurement and Verification Technicians
- Energy Management Analysts

For renewable and sustainable energy occupations, the distribution of required education and training preparation is more varied, and specific to the type of renewable energy. While the majority of renewable energy occupations are in manufacturing, there are also jobs associated with heavy construction and installation, and operations and maintenance. For example, in the wind energy sector, the occupations vary from entry-level construction laborers to advanced engineers.

#### Wind Energy Jobs

- Environmental, Energy Engineers
- Iron and Steel Workers
- Sheet Metal Workers
- Machinists, Millwrights
- Electrical Equipment Assemblers
- Construction Equipment Operators
- Industrial Truck Drivers
- Industrial Production Managers
- Operators, Maintenance Technicians

workers are in demand in the production of wind turbines, and construction workers will build cogeneration units and work on upgrading the nation's electric grid.

## What Drives Growth in Green Jobs?

Transformation to a new energy economy and increased green jobs in the United States depend on three major drivers.

**Technological Advances.** Many energy efficiency and renewable energy technologies are more expensive than traditional fossil fuel technologies. As these technologies become cheaper, the market will adopt them faster. It is impossible to predict which emerging technology — wind, solar, hydrogen — will dominate future energy markets. It is much more likely that the nation's energy future will be a patchwork of many different clean energy resources.

**Economic Conditions.** Because EE and RE technology is capital intensive, energy prices and the economy affect businesses' and consumers' willingness and ability to invest. Like many other industries, the current economic downturn has dried up credit for installers of renewable technologies, causing manufacturers to reduce their payrolls.<sup>1</sup> As traditional fuel prices rose over the past few years, energy efficiency and renewable technologies became more economically viable. The decline in fuel prices lowers demand for alternatives.

**Energy Policy.** Clean energy incentives (such as tax credits, rebates, or renewable energy certificate trading programs) and economic development initiatives can spur private-sector investment, particularly for risk-averse businesses. In general, policies designed with a long-term goal in mind give businesses the signal they need for wide-scale investment in green energy and technologies. Thus far, a comprehensive federal clean energy policy has not yet materialized. For example, federal

tax incentives for the production of wind energy have been extended several times, but this uncertainty contributes to a "boom-bust cycle of development" for the wind industry.<sup>2</sup>

Is the contemporary drive for energy efficiency and renewable energy very different than what occurred during the energy crisis of the 1970s? Indeed, that appears to be the case. In the 1970s, the nation experienced an isolated thunderstorm of sorts, when the oil embargoes and a burgeoning environmental awareness spiked a short-term interest in energy efficiency and alternative energies. Yet without strong, sustained federal policy direction and prices falling by the mid-1980s, no transformation of the energy economy developed, although gains in mass transit, alternative and efficiency technologies, and nuclear power occurred.

Today, multiple drivers are converging to create a potent national movement toward a clean energy transformation. Alternative energy technologies have become more competitive with traditional fossil fuel resources. While energy prices have recently declined, few doubt the return of volatility and higher prices. National security concerns have convinced many of the need for energy independence. The urgency of the global warming crisis has reached new heights and there is broad political consensus that action must be taken. Finally, the current economic downturn has galvanized federal policymakers to enact a \$787 billion stimulus package to spur the creation of jobs — estimated to generate a half-million green jobs in the next few years.

## Green Job Numbers: Myth or Real Math?

Green jobs are extremely difficult to quantify. There is no clearly defined federal government standard for counting green jobs, nor is there likely to be one, since there is no consensus on what constitutes a green job. Various industry associations and research

## Preparing the Workforce for a “Green Jobs” Economy

---

organizations, however, have attempted to provide estimates of green jobs, which offer a better understanding of the magnitude of jobs in the RE and EE areas.

As noted above, most green jobs are currently found within the energy efficiency sector. This is largely because energy efficiency is the cheapest “alternative” fuel — the kilowatt of electricity or gallon of gas not used

equates to money not spent and carbon not emitted. According to the American Solar Energy Society, and as shown in Figure 1 on page 5, in 2007 there were 218,000 direct industry jobs and industry revenues of \$42.6 billion in renewable energy, or about 5% of all green energy jobs. In energy efficiency, direct jobs totaled 3,745,000 and revenues reached slightly over \$1 trillion.<sup>3</sup>

### The American Recovery and Reinvestment Act: A Boost for Green Energy

The **American Recovery and Reinvestment Act** will deliver an influx of at least \$50 billion to the energy efficiency and renewable energy sectors. This federal aid, the biggest financial impetus to the clean energy industry in U.S. history, comes in the form of tax incentives, loan guarantees, and grants to reduce energy consumption in the public and private sectors, encourages development of alternative energy technologies like wind and solar, and makes the electric grid more efficient. Additionally, about \$1 billion will be directed toward green jobs training efforts, including \$500 million in funding for training in the RE and EE sectors as defined in the **Green Jobs Act of 2007**, which was passed by Congress within the Energy Security and Independence Act of 2007, but never funded.

Provisions of the Green Jobs Act directs funding to be used for training and support services, with priority going to veterans, displaced workers, and at-risk youth. Funding under the Act will include competitive grants that will be awarded to energy sector collaborative partnerships that connect industry employers with labor organizations, community organizations, educators, and representatives of the workforce system.<sup>4</sup> Beyond the \$500 million associated with the Green Jobs Act of 2007, an additional \$500 million in training will be made available through a number of programs focused on developing various aspects of the nation’s new energy workforce.

The stimulus bill dedicates about \$36.5 billion in energy efficiency and almost \$8 billion in renewable energy to promote job creation. Some important provisions include:

- \$5 billion to weatherize homes of one million low-income families,
- \$6.3 billion for energy-related grants to states,
- \$4.5 billion to retrofit federal buildings, and
- \$11 billion for modernization of the nation’s electric grid.

Further, the bill provides an extension of the production tax credit for renewable energy and direct grants worth up to 30% of the cost of building a renewable energy facility. Wind and solar energy developers have recently seen much of their financing disappear, as the mortgage market collapse dried up banks’ capacity to purchase tax credits that developers sold to banks. The alternative fuel vehicle industry gets a \$1.3 billion infusion in various grants and tax credits, and \$4.5 billion will be directed to research and development in basic energy science and EE and RE areas.<sup>5</sup>

No one can be sure if the stimulus package will create the promised 500,000 green jobs by the end of 2010, but it is certain that there will be enormous opportunities for workers with a wide range of education and skills. The ways in which the U.S. Department of Energy and states spend the stimulus money will affect the number of jobs that are created by the stimulus plan, as will the pace of the private sector’s uptake of key energy efficiency and renewable energy incentives. Workforce stakeholders should be preparing to work with industry to provide knowledge and skills training, both traditional and green, that will be necessary to meet the new demand.

The New York State Energy Research and Development Authority estimates that in New York alone, more than 500 new jobs were created each year due to its energy efficiency programs.<sup>6</sup> For every gigawatt hour saved, the agency's programs create or retain 1.5 jobs.<sup>7</sup> Overall, most estimates project roughly 8 to 11 jobs per \$1 million invested in energy efficiency retrofiting.<sup>8</sup>

Renewable energy jobs will be a smaller, but significant, fast-growing share of green jobs. In 2007, just 6.7% of the nation's energy supply came from renewable sources.<sup>9</sup> While campaigning for president, Barack Obama supported the goal of 25% of energy in the United States to come from renewable sources by 2025. That represents a significant transformation of the nation's energy supply.

Projections of green job growth in the future vary widely, owing to the ambiguity of green jobs and whether economists are calculating direct and/or indirect jobs (like administrative or information technology staff) created by the green energy industry. The Peter G. Peterson Institute for International Economics and

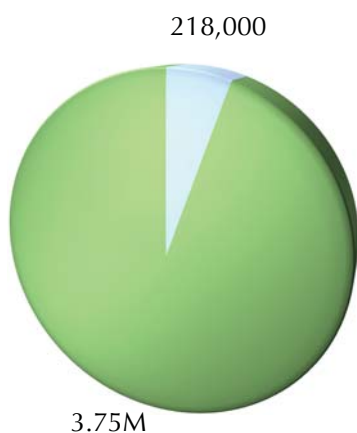
the World Resources Institute estimate that a billion dollar investment in clean energy economic recovery scenarios would create 30,100 jobs (while saving the economy \$450 million per year in energy costs).<sup>10</sup> The Center for American Progress estimates that \$100 billion in green economic investment translates into two million new jobs in two years.<sup>11</sup> More important than knowing exact job numbers is understanding the magnitude and makeup of these jobs, and where they will be.

## Where Will the Green Jobs Be?

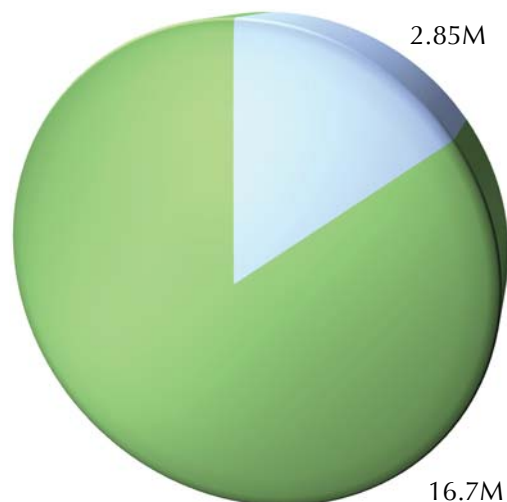
Across the nation, the demand for energy efficiency jobs and competencies is likely to be quite similar — the majority of EE jobs are in the retrofiting of buildings. Demand for renewable energy jobs and skills, however, will vary by state, as workforce strengths, natural resources and geography, infrastructure, and policy priorities play a large role in where renewable energy industry is located.

**Figure 1. Renewable Energy and Energy Efficiency Industries: Green Jobs Now — and Projected into the Future**

**U.S. Renewable Energy and Energy Efficiency Industries in 2007**



**U.S. Renewable Energy and Energy Efficiency Industries in 2030 (total jobs created in a moderate growth scenario)**



Source: American Solar Energy Society and Management Information Services, Inc., 2009.

■ RE Jobs ■ EE Jobs

**Workforce Strengths.** Since demand is fairly consistent for EE, all state or regional workforce agencies might consider preparing workers for retrofitting and weatherization occupations. Industry growth in the renewable energy sector will vary by state, with companies attracted to existing workforce capabilities, such as manufacturing skills, or states with a high number of skilled science and technology workers.

**Natural Resources and Geography.** Solar collection capacity is strongest in the southwest and in states like Florida and Texas. Wind strength and consistency needed for large turbine installations is found along the coasts and in the Great Plains states. Green jobs related to biofuels made from feedstock will dominate in the midwest and in other agricultural states. U.S. Department of Energy maps and data for all renewable resources across the nation are located at [www1.eere.energy.gov/maps\\_data/renewable\\_resources.html](http://www1.eere.energy.gov/maps_data/renewable_resources.html).

**Infrastructure.** In renewable energy manufacturing, a state’s industrial capacity influences the location of alternative energy component manufacturers, which are more likely to locate in states with industrial facilities and networks already in place. And size matters: wind turbine blades can be up to 200 feet long and weigh 40 tons, so manufacturers need to locate close to where wind turbines will be constructed, and near water or rail, since some of the components are too large to transport by road.<sup>12</sup>

**State, Regional, and Local Policy.** In the absence of centralized, national, long-term energy strategies, several states are leading in EE and RE development. By early 2009, 20 states had established various energy efficiency resource standards, which mandate efficiency levels through savings goals. At least 29 states have created renewable energy portfolio standards that charge utilities to supply consumers with a percentage of their energy from renewable sources.<sup>13</sup> The economic incentives attached to these energy

New Jersey, while not in the Sun Belt, has the second highest number of solar installations behind California (over 3,500 residential, commercial, and industrial installations) because of a strong rebate system put into place by policymakers to promote the growth of the solar industry in the state.<sup>14</sup> In addition, the large number of flat roofs on warehouses and big box retail stores provide the infrastructure for capturing the sun’s energy.

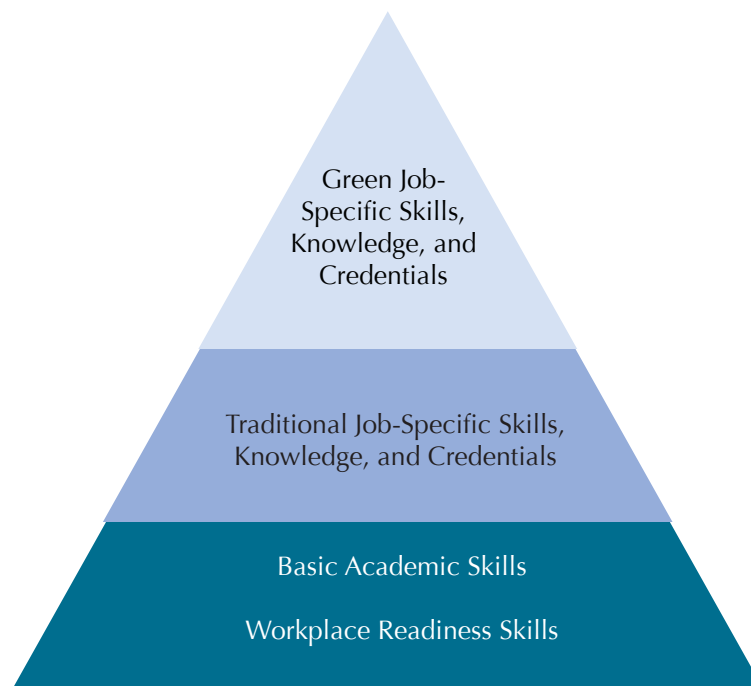
targets or goals will play a powerful role in creating demand for workers. In addition, numerous states or regional associations have designated economic development initiatives for clean energy sectors.

Newton, Iowa is an example where geography, infrastructure, and economic development targets created green jobs. In November 2008, TPI Composites opened a 316,000 square foot wind turbine facility in this manufacturing town that was reeling from the loss of Maytag, which at one time employed one out of every five residents.<sup>15</sup> As a result of TPI Composites’ new facility, 500 green jobs were created.

## What Skills are Green Jobs Employers Seeking?

As noted earlier, green jobs are often traditional jobs — construction workers, manufacturing production workers, accountants, scientists — many of which require a new, green layer of skills and knowledge. Employers in the energy efficiency and renewable energy sectors interviewed for this study stressed that that workers applying for green jobs **first need the basic skills and traditional competencies, degrees, and other recognized credentials associated with a particular job.** “Green” competencies, where they are necessary, must be learned either in tandem with or after learning the core skills associated with a given occupation. (See Figure 2.)

**Figure 2. Skills Sought by Green Jobs Employers**



Source: John J. Heldrich Center for Workforce Development, 2009.

In the short term, not every green job will require particular green skills or certification. Manufacturing workers in a solar panel facility, for example, may not require anything more than the basic skills required of others working in advanced manufacturing environments. In the world of weatherization and installation and maintenance of RE and EE technologies, standards for certification and training are highly variable, especially at the entry level. In some home weatherization programs run by local utilities, for example, entry-level workers may need little more than basic construction laborer or installation skills, such as an air sealer who caulks gaps in windows.

Standards embraced by employers or mandated by funding programs, however, often have implications for the training and certification needs of workers. Workers who obtain **nationally recognized credentials** associated with common standards for jobs in the RE and EE sectors may have a better chance at obtaining a job even if the job does not require it. For example, a solar panel installer may prefer, but not require, that installers

obtain a nationally recognized certification, such as a Photovoltaic Installer Certificate from the North American Board of Certified Energy Practitioners. Employers are the best and most up-to-date source of information on which certifications and levels of education are required for a particular green job.

In addition to certifications, employers stress that broad sets of green knowledge, which cross many industries and occupations, are becoming increasingly important for job advancement, and may be considered basic knowledge in the future clean energy economy. These green concepts include:

- **Sustainability.** How ecological systems work and the conditions under which they can function well now and into the future, including a basic understanding of the interconnectedness of human activity and the natural world, the effects of energy consumption, waste disposal, and the effects chemicals and other manmade substances have on natural systems — from waterways to air quality and climate.

- **Green Technologies, Standards, and Processes.** Awareness of the policies, nationally recognized standards, equipment, and work practices that mitigate the environmental impacts of human activity, including energy use. From solar panels, to tax incentives, to weatherization and green manufacturing standards, many aspects of business and government are changing to enable the transition to a clean energy economy.
- **Life Cycle Analysis.** The environmental and economic effects of a product at every stage of its existence, from extraction of materials through production to disposal and beyond. According to employers, life cycle analysis is of great usefulness in showing the benefits of using green technologies to consumers.

### What Can Workforce and Education Systems Do to Prepare Workers for Green Jobs in the Emerging Energy Economy?

The energy efficiency and renewable energy sectors are positioned to have a long-term transformative effect on the nation’s economy. If the promise of the green energy economy holds true, the nation will experience benefits in both combating climate change and helping to restore economic strength and employ a large number of workers in the United States. In order to respond to the complex and evolving energy industry needs, stakeholders must **develop a coordinated, flexible workforce development infrastructure.** Such systems, which formalize communication networks, articulation agreements, and other linkages among key stakeholders, will also position states and programs to be competitive for federal and foundation grants. To be effective, state agencies and other key stakeholders should explore the following strategies:

#### Common Certifications in the RE and EE Industries

Certifications in the RE and EE sectors are associated with standards established by nationally recognized credentialing bodies. Organizations that provide certifications commonly preferred or required by employers include:

- **The Association of Energy Engineers** provides energy efficiency-related certifications for facilities managers, HVAC installers, and other positions, including geothermal.
- **The North American Board of Energy Practitioners** attributes certifications for photovoltaic (PV) and solar thermal installers, as well as a more general, entry-level certificate in PV technology that can enhance a wide range of existing curricula from construction and trades to engineering.
- **The Building Performance Institute (BPI)** offers certifications for building analysts, heating and air conditioning professionals, and others that incorporate significant knowledge about whole-systems design, energy efficiency, and renewable energy. BPI certification is required for Energy Star contractors and is a preferred certification among employers in the building trades.
- **Energy Star** provides online training to contractors on energy efficient building design.
- **Solar Energy International** is a private training provider in Colorado that offers online and in-person courses in renewable energy sectors that are highly regarded by some employers.
- **The Green Building Certification Institute** runs the Leadership in Environmental and Energy Design (LEED) Accredited Professionals program, a leading certification in the green building and facilities management fields.



## Use Federal and State Public Policy as a Roadmap

Develop “green jobs policy experts” who can create partnerships with state environmental, energy, and economic development leaders to understand policy developments and to discern their likely effects on job growth in key areas of the energy economy and to identify potential employers. The Database of State Incentives for Renewable Energy ([www.dsireusa.org](http://www.dsireusa.org)) provides detailed information on state renewable energy initiatives and provides a good starting point.

## Build Partnerships with Employers and Labor Unions

Establish a green energy advisory council with the leaders of companies, utilities, and labor unions to create a strategic venue for interaction and an ongoing feedback mechanism that ensures training programs and curricula are driven by industry’s priority workforce needs. Employers can identify demand for certifications, hiring and recruitment policies, and specific occupations, as well as which jobs will draw from labor unions. Since labor unions and employers often provide significant amounts of training themselves, they can also provide needed guidance on key gaps that exist within the education and training system that need to be filled. This will assist states to build training systems that build upon and support employer and union-led efforts rather than coming into competition with them.

## Develop a Green Jobs Workforce Collaborative, a “Green Jobs Talent Network”

Encourage green job growth in states and effectively meet employer demand as it evolves, through forming a voluntary collaboration network around the green energy industry. This sector approach creates a coalition of educational institutions (from high

school to university), workforce and economic development system stakeholders, labor and community-based organizations, green energy companies, and industry associations in order to provide and support a trained and job-ready workforce for green jobs. The **Los Angeles Infrastructure and Sustainable Jobs Collaborative** offers an example of a talent network approach, bringing together public and private partners to provide a seamless training and education infrastructure for low-income residents to be trained for livable wage occupations within the utility industry. Partners include utilities, labor unions, high schools and vocational-technical schools, community colleges, and universities.

Through research and the development of the **New Jersey TLD Talent Network**, a collaborative workforce model for the transportation, logistics, and distribution industry, the John J. Heldrich Center for Workforce Development has identified key elements of effective talent networks. These include:

- **Identification of Assets.** Create an inventory of the public and private assets in states or regions to identify gaps and eliminate overlap. Map out existing training opportunities, including programs managed by employers, unions, community-based organizations, and educational institutions. Chart the funding streams available through various private and public entities to support green job growth and training efforts and look beyond traditional funding sources. For example, **Massachusetts** takes part in a 10-state auction of carbon dioxide emissions allowances by the Regional Greenhouse Gas Initiative. Out of these funds, Governor Deval Patrick recently allocated \$5 million for an Energy Efficiency Skills and Innovation Initiative to fund job training for energy auditors and installers of insulation, and establish “seed grants for innovative delivery models that will allow the energy efficiency industry to reach a new level of capacity and employment.”<sup>16</sup>

- **Cultivate Career Pathways.** Support low-skilled, low-income workers to move into higher-skilled jobs that pay better wages through education and green jobs training. Ensure that training results in a **nationally recognized credential**. In addition, states should focus on accreditation of training programs and on creating “stackable” credentials through articulation agreements. For example, the **NJ PLACE Program**, an initiative of the New Jersey Council of Community Colleges and the New Jersey Department of Labor and Workforce Development, allowed community colleges to work with labor unions to obtain national accreditation of union apprenticeship programs so that these programs could count toward an Associate’s degree. Similarly, **Los Angeles** developed the Green Careers Training Initiative (GCTI) in association with the Apollo Alliance and the city’s Green Retrofits program. Among GCTI’s goals are to create “green career ladders” in order to link low-income residents with union apprenticeship and community college training programs, as well as provide incumbent worker training. Such programs can provide means for worker advancement as well as lifelong learning opportunities.
- **Align Green Jobs Workforce Training Efforts with Economic Development Initiatives.** Establish a connection between attracting green energy businesses and customized training and hiring and recruitment systems. In Georgia, Suniva, Inc. built a new manufacturing facility for silicon solar cells. Through a partnership with Gwinnett Technical College and **Georgia Quick Start**, the state’s free, customized workforce training program, Suniva is ramping up to its projected workforce of 100 jobs.
- **Do Not Duplicate Training or Curricula.** Ensure that workers in multiple locations have access to training that is relevant to employers by developing mechanisms to share curricula that result in credentials

that are in high demand by employers and are not otherwise available. Consider developing centralized training centers that provide students with the opportunity to get hands-on training using state-of-the-art equipment, thus potentially conserving costs. For example, **Florida’s Solar Energy Center** receives \$3 million in operating funds from the University of Central Florida and provides continuing education programs in alternative energy technologies through a partnership of universities, community colleges, technical institutes, workforce agencies, and industries. Besides solar energy training, hands-on classes in home energy rater training, fuel cell technology, and disaster relief are taught at the center.

## Conclusion

The RE and EE industries will create new business and job opportunities for millions of American workers. The American Recovery and Reinvestment Act, the steady movement toward a clean energy economy, and the rising price of traditional fossil fuels will determine how many jobs are ultimately produced in the green economy. States and communities with innovative energy policies and coordinated workforce development systems will emerge as leaders in this new green economy. Stakeholders who wish to partake in the federal stimulus training funds for green jobs will need to be committed to preparing their workforce by building strategic partnerships among industry, labor unions, and educators.

Green jobs employment and training efforts will be better poised to succeed by:

- Focusing education and training efforts on providing industry-recognized credentials, developing career pathways for workers, and complementing — not duplicating or circumventing — employer and labor union-led training efforts.

- Tracking the effects of key drivers of energy sector job growth — technology, economic conditions, and public policy — on the real-time hiring needs of employers.
- Creating a green jobs talent network to coordinate education and training with economic development efforts and the emerging workforce needs of employers.

Taking these steps will enable state, regional, and/or local green jobs initiatives to build a sustainable, flexible, and coordinated workforce education infrastructure. An effective green jobs workforce strategy will produce multiple benefits, including ensuring that training leads workers to real job opportunities, helping businesses to be more competitive, and garnering federal green jobs training grants.

## Endnotes

1. Kate Galbraith, "Dark Days for Green Energy," *The New York Times*, February 3, 2009.
2. Union of Concerned Scientists, *Production Tax Credit for Renewable Energy*, [www.ucsusa.org/clean\\_energy/solutions/big\\_picture\\_solutions/production-tax-credit-for.html](http://www.ucsusa.org/clean_energy/solutions/big_picture_solutions/production-tax-credit-for.html) (accessed on February 3, 2008).
3. Management Information Services, Inc. and American Solar Energy Society, as referenced in Roger H. Bezdek, *Green Collar Jobs in the U.S. and Colorado: Economic Drivers for the 21st Century* (Boulder, CO: American Solar Energy Society, Inc., 2009) (accessed February 19, 2009 at [www.ases.org/images/stories/ASES/pdfs/CO\\_Jobs\\_Final\\_Report\\_December2008.pdf](http://www.ases.org/images/stories/ASES/pdfs/CO_Jobs_Final_Report_December2008.pdf)).
4. Independence and Security Act of 2007 (accessed at <http://thomas.loc.gov/cgi-bin/query/F?c110:5:./temp/~mdbsyaB9rP:e866520>; and [http://solis.house.gov/list/press/ca32\\_solis/wida6/greenjobscomm.shtml](http://solis.house.gov/list/press/ca32_solis/wida6/greenjobscomm.shtml)).
5. Elena Foshay and Keith Schneider, *Congress Approves Clean Energy Provisions of Stimulus; Consistent with Apollo Economic Recovery Act*, February 13, 2009 (accessed February 17, 2009 at <http://apolloalliance.org/rebuild-america/energy-efficiency-rebuild-america/data-points-energy-efficiency/clean-energy-provisions-of-stimulus-are-consistent-with-apollo-economic-recovery-act/>).
6. New York State Energy Research and Development Authority, *New York Energy Smart Program Evaluation and Status Report, Year Ending December 31, 2007* (report to the System Benefits Charge Advisory Group) (Albany, NY: New York Energy Research and Development Authority) (accessed August 21, 2008 at [www.nyserda.org/pdfs/Combined%20Report.pdf](http://www.nyserda.org/pdfs/Combined%20Report.pdf)).
7. Jason Walsh and Sarah White, *Greener Pathways: Jobs and Workforce Development in the Clean Energy Economy* (Madison, WI: Center on Wisconsin Strategy, 2008).
8. Ibid.
9. Energy Information Administration, *U.S. Energy Consumption by Energy Source 2003-2007* (accessed on February 25, 2008 at [www.eia.doe.gov/cneaf/alternate/page/renew\\_energy\\_consump/table1.html](http://www.eia.doe.gov/cneaf/alternate/page/renew_energy_consump/table1.html)).
10. Trevor Houser, Shashank Mohan, and Robert Heilmayr, *A Green Global Recovery? Assessing U.S. Economic Stimulus and the Prospects for International Coordination*, February 2009 (accessed at [www.petersoninstitute.org/publications/pb/pb09-3.pdf](http://www.petersoninstitute.org/publications/pb/pb09-3.pdf)).
11. Robert Pollin, Heidi Garrett-Peltier, James Heintz, and Helen Scharber, *Green Recovery: A Program to Create Good Jobs and Start Building a Low-Carbon Economy* (Washington, D.C.: Center for American Progress, 2008) (accessed on February 25, 2009 at [www.americanprogress.org/issues/2008/09/pdf/green\\_recovery.pdf](http://www.americanprogress.org/issues/2008/09/pdf/green_recovery.pdf)).

12. Jason Walsh and Sarah White, *Greener Pathways: Jobs and Workforce Development in the Clean Energy Economy*.

13. Ibid.

14. James O’Neill, “New Jersey’s Largest Solar Field Planned,” NorthJersey.com, September 25, 2008 (accessed at: [www.northjersey.com/environment/environmentnews/NJs\\_largest\\_solar\\_energy\\_field\\_planned.html](http://www.northjersey.com/environment/environmentnews/NJs_largest_solar_energy_field_planned.html)).

15. Dean Reynolds, “Town Reinvents Self with Wind Power,” CBS News, November 2008 (accessed at [www.cbsnews.com/stories/2008/11/21/eveningnews/main4626116.shtml](http://www.cbsnews.com/stories/2008/11/21/eveningnews/main4626116.shtml)).

16. Press release, Office of the Governor, Commonwealth of Massachusetts, December 19, 2008 (accessed at [www.mass.gov/?pageID=gov3pressrelease&L=1&L0=Home&sid=Agov3&b=pressrelease&f=081219\\_rggi&csid=Agov3](http://www.mass.gov/?pageID=gov3pressrelease&L=1&L0=Home&sid=Agov3&b=pressrelease&f=081219_rggi&csid=Agov3)).

## About the Authors

**Jennifer Cleary** is a Senior Project Manager at the John J. Heldrich Center for Workforce Development at Rutgers, The State University of New Jersey. Her current work is focused on developing industry-based intelligence and assisting policymakers to develop and implement workforce and employer engagement strategies that promote economic growth.

**Allison Kopicki** is a Project Manager at the Heldrich Center and is currently working on a number of sector-focused workforce development initiatives, including green jobs and jobs in the transportation, logistics, and distribution sector.

## About the Heldrich Center

The John J. Heldrich Center for Workforce Development, based at the Edward J. Bloustein School of Planning and Public Policy at Rutgers, The State University of New Jersey, is a dynamic research and policy center devoted to strengthening the nation’s workforce. It is one of the nation’s leading university-based centers devoted to helping America’s workers and employers respond to a rapidly changing 21st Century economy.

The Center’s motto —“Solutions at Work”— reflects its commitment to offering practical solutions, based on independent research, that benefit employers, workers, and job seekers. The Center’s policy recommendations and programs serve a wide range of Americans at all skill levels.

Learn more about the Heldrich Center at [www.heldrich.rutgers.edu](http://www.heldrich.rutgers.edu).

**RUTGERS**

Edward J. Bloustein School  
of Planning and Public Policy