



## **STAFF REPORT**

### **Green Jobs: A Pathway to a Strong Middle Class**

#### **Introduction and Executive Summary**

The White House Task Force on the Middle Class has a simple mandate: to find, highlight, and implement solutions to the economic challenges facing the American middle class. With that mandate at our backs, it is no accident that we chose to focus on green jobs for our very first taskforce meeting in Philadelphia, PA on February 27.

There are many reasons for our interest in green jobs. The Obama/Biden Administration is deeply committed to reforming how we create and consume energy in America, and project of reform is the work of many different officials and agencies within the government. One part of that agenda is to promote the creation of green jobs.

Green jobs have the potential to be quality, family-sustaining jobs that also help to improve our environment. They are largely domestic jobs that can't be offshored. They tend to pay more than other jobs, even controlling for worker characteristics. Moreover, green jobs are an outgrowth of a larger movement to reform the way we create and use energy in both this country and the rest of the world. They represent a growth sector, and one that offers the dual promise of providing good jobs while meeting the environmental challenge to reduce our dependence on finite fossil fuels that generate harmful carbon emissions.

We devote more space to definitions below, but we define green jobs quite broadly as employment that is associated with some aspect of environmental improvement. A scientist working on advanced renewable energy alternatives to CO<sub>2</sub>-producing fossil fuels is engaged in

a green job, but so is a laborer weatherizing a home or a lineman--or linewoman--building out the smart electric grid.

This overview paper presents and discusses a few of the most important developments in green jobs over the past few years. Specifically, we examine the following questions and areas of interest regarding green jobs:

- What is a green job, and what are the characteristics of those jobs?
- Green jobs in the recovery package
- Green jobs in action: a review of ongoing activities in this area
- Policies to help promote the creation of green jobs
- Leveraging private capital investment in green jobs
- Making sure green jobs are good jobs, accessible to all.

## **Findings**

### Numbers and Characteristics

- Because definitions of green jobs are so broad at this point in time, it is impossible to generate a reliable count of how many green jobs there are in America today. We can, however, identify jobs in industries and occupations that are likely to be green jobs. Doing so yields these findings:
  - Green jobs are good jobs: they pay more, by 10 to 20 percent, depending on the definition, than other jobs.
  - Green jobs are more likely to be union jobs than other jobs.
  - Green jobs are more likely to be held by men, but less likely to be held by minorities or urban residents, and addressing this will be a significant challenge.
  - It will take considerable outreach to make the opportunity to work in a green job available widely available; we present various examples of programs in action intended to provide pathways to green jobs and out of poverty.

### Building the Movement

The American Recovery and Reinvestment Act (ARRA) includes various significant investments in green technology and jobs. These include:

- More than \$11 billion for investments in a new smart grid, investments that will create thousands of miles of new or modernized high-tech transmission lines, while training and employing highly-skilled and well-paid lineworkers.
- \$500 million for research and job training projects that prepare workers for careers in energy efficiency and renewable energy
- \$6 billion for a loan guarantee program that will enable green industries to continue their rapid growth.
- \$5 billion to the Weatherization Assistance Program that could save homeowners \$350 per year on their utility bills.

There are a set of initiatives—policies, programs, and the interaction of key intermediaries, including unions, educators, and public officials—that are strongly associated with building a green jobs movement in communities, states, and the nation. Those pieces, described in detail below and demonstrated in a number of case studies, are:

- a public mandate to achieve an energy conservation goal;
- elected officials invested in meeting the goal;
- private employers interested in creating green jobs to meet the new labor demands for environmentally-sound output;
- financing sources who want to invest in the new initiatives, often involving federal loan guarantees;
- extensive labor force intermediaries, including community colleges, union apprenticeship programs, and public/private training programs to serve as a linkage between employers and workers.

## **What Is A Green Job?**

There is no official or even widely-accepted definition of what constitutes a green job. This is not necessarily a disadvantage, as we seek to provide a broad, “lay-of-the-land” survey in this report. However, to have a coherent discussion about green jobs, we need to define some characteristics that broadly define them.

The most general trait of green jobs is that they must be jobs that somehow contribute to the improvement of environmental quality. We can add to this extremely general characterization by examining the far more specific definitions that have been offered by other institutions and groups. The United Nations Environmental Programme expands on our basic theme, that green jobs must work to preserve or improve the environment, with this much more detailed explanation:

“We define green jobs as positions in agriculture, manufacturing, construction, installation, and maintenance, as well as scientific and technical, administrative, and service-related activities, that contribute substantially to preserving or restoring environmental quality. 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. But green jobs, as we argue below, also need to be good jobs that meet longstanding demands and goals of the labor movement, i.e., adequate wages, safe working conditions, and worker rights, including the right to organize labor unions.” (United Nations Environment Programme, Labour and the Environment Unit, “Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World.”)

Phil Angelides, chair of the Apollo Alliance (see box), emphasizes this last point on the quality of a green job: “It has to pay decent wages and benefits that can support a family. It has to be part of a real career path, with upward mobility. And it needs to reduce waste and pollution and benefit the environment.”

Van Jones, founder and president of Green for All, adds yet another dimension, “blue-collar employment that has been upgraded to better respect the environment; family-supporting, career-track, vocational, or trade-level employment in environmentally-friendly fields, such as electricians who install solar panels; plumbers who install solar water heaters; farmers engaged in organic agriculture and some bio-fuel production; and construction workers who build energy-efficient green buildings, wind power farms, solar farms and wave energy farms.”

All of these definitions consistently point to at least three crucial characteristics of green jobs:

- Green jobs involve some task associated with improving the environment, including reducing carbon emissions and creating and/or using energy more efficiently;

- Green jobs should be good jobs that provide a sustainable family wage, health and retirement benefits, and decent working conditions;
- Green jobs should be available to diverse workers from across the spectrum of race, gender, and ethnicity.

We consider these three characteristics to be essential to green jobs, and throughout this paper we will emphasize programs with the potential to create jobs that have all three characteristics.

### **Characteristics of Green Jobs Today and the Workers Who Staff Them**

So what do green jobs in America look like? To develop an understanding of the characteristics of green jobs and the people who work in them, the Council of Economic Advisers (CEA) performed an analysis of workers in a variety of representative occupations and industries within the green sector. This is not an exhaustive analysis of green jobs, because there is no data set providing the precise information that would enable such an analysis. For example, our data sets enable us to identify persons working on the electric grid and doing home installations. But we cannot observe whether those workers are building the “smart grid” versus working on the current one, or whether an installation worker is “weatherizing” a home. However, with some reasonable assumptions, we can identify the prevalent occupations in highly green industries, which have a high likelihood of being true green jobs.

The CEA’s analysis shows that compared to the average American job, occupations likely to be green tend to be better paid, and are more likely to be union jobs. For example, industrial machinery mechanics who work in power generation, an emerging green sector, earn about \$28 per hour. Interestingly, mechanics with similar jobs, but who do not work in that power generating sector, earn about \$6 less per hour, suggesting a sizeable wage premium associated with some green jobs. In order to examine the extent of these differences across a set of occupations associated with green jobs, the table below shows wages for jobs in power generation and turbine manufacturing, two highly green industries, compared to wages for those same jobs in all other industries.

<b>Average wages in 2007 in highly green occupations, all industries compared to highly green industries (turbine manufacturing and electric power generating)</b>			
<i>Green Occupations</i>	<i>Average wage in power generation (PG) or turbine/engine manufacturing (TM) sectors</i>	<i>Average wage for same occupation in all industries</i>	<i>Wage difference for highly green industry (percentage)</i>
Electrical power line installers and repairers (PG)	\$27.43	\$25.79	6.4%
Computer control programmers/operators (TM)	\$17.06	\$17.42	-2.1%
Control and valve installers and repairers (PG)	\$31.09	\$23.07	34.8%
Electrical and electronic engineers (PG)	\$40.55	\$41.78	-2.9%
Electrical/electronics repairers (PG)	\$29.80	\$24.97	19.3%
Electricians (PG)	\$27.90	\$23.99	16.3%
Engine and other machine assemblers (TM)	\$15.49	\$16.59	-6.6%
Engineering technicians (PG)	\$28.49	\$25.17	13.2%
First-line supervisors/managers of mechanics, installers, and repairers (PG)	\$34.68	\$28.64	21.1%
First-line supervisors/managers production and operating workers (TM)	\$28.32	\$25.82	9.7%
Industrial and refractory machinery mechanics (PG)	\$27.83	\$21.96	26.7%
Lathe and turning machine tool setters/operators (TM)	\$17.33	\$16.73	3.6%
Machinists (TM)	\$18.81	\$18.15	3.6%
Mechanical engineers (TM)	\$35.52	\$37.48	-5.2%
Miscellaneous assemblers and fabricators (TM)	\$15.00	\$13.89	8.0%
Multiple machine tool setters/operators (TM)	\$18.01	\$16.11	11.8%
Power plant operators/ distributors/ dispatchers (PG)	\$29.64	\$29.10	1.9%
Welding, soldering, and brazing workers (TM)	\$19.19	\$16.91	13.5%
<b>Every occupation in power generation or turbine/engine manufacturing</b>	<b>\$29.91</b>	NA	NA
<b>All U.S. Occupations</b>		<b>\$20.30</b>	

Note: CEA calculations from Occupational Employment Statistics data. Wages are reported in 2008 dollars.

Importantly, these wage differences remain even after controlling for factors that usually explain variation in wages. Further analysis by the CEA shows that after controlling for such differences, workers in green jobs typically earn better wages than workers in comparable non-

green occupations, with a premium ranging from about 10-20 percent. This advantage is more substantial for workers in renewable energy industries, but the wage advantage is present for green jobs of many kinds.

Furthermore, the CEA's analysis of the characteristics of these green jobs finds higher than average shares of union membership (see Appendix Table A1). In 2007, about 12% of the overall American workforce was unionized, while green occupations (defined as above, as likely occupations within highly-green industries) had much higher unionization rates. For example, electricians, who are prevalent in the highly-green power generation sector, had a union rate of 33%; the industrial mechanics noted above had union rates of about 20%.

These results are important because they show that green jobs are disproportionately good jobs. After decades in which the middle class has not gotten its fair share of the rewards from American growth and prosperity, the green sector of the economy represents a source of high-quality, well-paid jobs for the middle class. These green jobs also represent an opportunity for workers to organize into unions in high-growth industries in which labor and businesses can work together to build a green economy.

However, the CEA's analysis (see appendix table) also reveals important ways in which we can improve the green sector of the economy. Their analysis shows that green jobs are more likely to be held by whites, more likely to be held by men, and more likely to be located in suburban and rural areas. These results point to the need to make the opportunity to get a high-quality green job available to all kinds of Americans, including women, minorities, and inner-city residents. We will discuss strategies for broadening access to green jobs below, in the section on Green Jobs and Economic Mobility.

## **Green Jobs and Green Job Training in the American Recovery and Reinvestment Act of 2009**

The current recession is causing serious hardships for millions of Americans, but it also presents America with an opportunity. In charting our way out of this downturn, we have a chance to not only boost our economy, but to also address our pressing energy challenges by putting

Americans back to work in green industries. We can develop new opportunities for today's American workers and also for their children. The American Recovery and Reinvestment Act (H.R. 1), signed into law on February 17, represents a recognition of this opportunity, and is a down payment on the investments in green industry and infrastructure that are needed to take advantage of it. The American Recovery and Reinvestment Act (ARRA) establishes crucial infrastructure development programs and job training programs that will help green industries grow and thrive in America, and supports green investment that will spur demand for the green sector of the economy. By making investments now in our energy infrastructure, and ensuring that American workers have the skills they need to succeed in these new high-quality green jobs, the ARRA takes critical first steps in making America a fertile place for sustained green growth and job creation for years to come.

Key provisions of the ARRA that will help create green jobs and pave the way for future green investments include:

- **Building Thousands of Miles of High-Tech Transmission Lines:** We know that the existing electricity grid today is insufficient and outdated. For example, North Dakota – a state with significant wind energy potential – cannot carry the energy to the population centers that need the electricity most without a new transmission superhighway. In order to bring significant amounts of renewable energy online, we need to invest in tens of thousands of miles of new, high voltage national transmission lines. With more than \$11 billion for investments in a new smart grid, the ARRA will jumpstart the modernization of electric grid. These investments will create thousands of miles of new or modernized high-tech transmission lines. The bill will also deploy 40 million new “smart meters” and modernize the power grid itself, allowing smarter, more efficient delivery of power that will save energy, lower power bills, and enable future innovation in renewable energy and electric vehicles.

The ARRA does not only invest in the physical infrastructure needed to create a 21<sup>st</sup> century Smart Grid, it also invests in the workforce needed to build and maintain this system. The \$100 million workforce training program included in the ARRA can



overcome a key obstacle: a projected a shortage of lineworkers as the aging transmission workforce enters retirement. Workers who train today will be prepared to construct thousands of new miles in the future. These training programs will produce the highly-skilled and well-paid line workers that we need to build a 21<sup>st</sup> century Smart Grid.

- **Greening the Federal Government:** The federal government is the largest energy consumer in the world. Investing in energy efficiency upgrades to federal buildings around the country will create jobs while substantially reducing American energy use and slashing the government's energy bill by 25%. The ARRA provides \$4.5 billion to The General Services Administration to convert federal buildings into high-performance green buildings, which generally combine energy efficiency and renewable energy production to minimize the energy use of the buildings. In addition, the ARRA provides funding for acquiring greener vehicles as part of the federal vehicle fleet.
- **Investing in Green Retrofits:** Energy efficiency, by many measures, is our fastest, cheapest, and cleanest opportunity to address our energy challenges. Improving the energy efficiency of everything from our cars and homes to our factories and offices will not only help us meet our long-term energy challenges, but also deliver energy savings today. Simple improvements like upgrading a home's furnace, sealing leaky ducts, fixing windows and adding insulation can save families up to \$350 a year on their energy expenses. For many middle class families, these are significant savings. The ARRA will boost funding for programs that will enable energy efficiency retrofits for homes and businesses around the country, including \$5 billion to the Weatherization Assistance Program. The bill will provide energy efficiency grants to states, enabling them to continue state and local energy efficiency programs with a track record of proven success promoting green investments that save energy and create jobs.
- **Establishing a Clean Energy Finance Authority:** Encouraging investment and developing financing opportunities for new clean energy projects will drive the development of the green sector of our economy. In order to draw investment to these crucial areas, spurring growth, innovation and job creation, the ARRA creates a new

Clean Energy Finance Authority (CEFA) to help ensure the availability of financing for green investments. At the heart of the CEFA is a \$6 billion loan guarantee program that will encourage banks to finance green investments with confidence, enabling green industries to continue their rapid growth. By helping to remove the obstacles to expansion for clean energy companies, the CEFA will unleash the dynamism of the green sector of our economy and drive the creation of high-quality green jobs in vibrant, growing industries.

- **Launching a Green Job Training Program:** Workers have always been the backbone of the American economy, and in order to make sure green industries continue to expand, we will need to teach our workers the skills they need for high-quality new green jobs. The ARRA addresses this need by funding workforce training initiatives, including \$500 million for an Energy Efficiency and Renewable Energy Worker Training Program that will be administered by the Department of Labor. A program was authorized by the Energy Independence and Security Act of 2007, but never funded. In addition, existing programs at the Department of Labor could better target their training to emerging green industries. Many groups involved in workforce training are already prepared to apply for funds and begin training programs. These workforce training programs will ensure a plentiful supply of the most important input to the green sector of the economy: Americans workers with the skills they need to excel in new green jobs.

The energy efficiency and renewable energy industries have been remarkably successful over the past several years, growing at impressive rates and generating high-quality green jobs across America. Without support, the current recession will force green industries to abandon their plans for expansion, halting job creation while setting back progress toward American energy independence by years. But with the help of the strategically targeted green programs in the American Recovery and Reinvestment Act, the green sector of our economy will be able, not only to weather this recession, but to continue expanding through the current downturn, becoming a source of high-quality green jobs when America needs them most.

## **Green Jobs in Action: Examples of Local Initiatives to Promote Green Jobs**

Throughout the country, people are working together to improve the environment and create green jobs. In many cases, these efforts engage a wide range of stakeholders, from public officials, to unions, to advocacy groups representing both environmental and social justice concerns. In this section, we highlight some of these initiatives, explaining their structure and how they're working.

Our goal here is not simply to describe best practices. We also intend to identify to the “pieces of the green jobs puzzle,” i.e., those factors that help to incubate quality green jobs in a given community. Those elements often involve a public mandate (a requirement that some share of energy production comes from renewables, for example), public and private actors working together to identify and tap relevant opportunities, financing mechanisms, workforce interventions to ensure workers have the skills they need, and the involvement of unions and community groups to make sure the interests of workers and community members are represented.

Numerous cities, including Los Angeles, Milwaukee, Philadelphia, New York, Portland (OR), and many others have green job programs up-and-running, and their investments are already generating significant returns.

The Los Angeles model represents a highly evolved example of the green jobs model, involving a diverse set of environmental initiatives and a very large group of stakeholders – from the office of Mayor Villaraigosa and the city council, to deep involvement by labor unions and businesses, to educators and advocacy groups representing potential green job holders. Most of the “pieces of the puzzle,” articulated below, play an active role in the LA case study. In particular, one sees in LA a deep commitment to providing less advantaged workers an opportunity to get green jobs.

### ***Case Study #1: Los Angeles: Extensive Labor Market Intermediaries Train Workers to Fill Newly Created Green Jobs***

The City of Los Angeles has undertaken or is in the midst of undertaking several initiatives that, together, begin to constitute a model for how cities can maximize the benefits of “going green” for working families. As is often the case, necessity was the mother of policy innovation. A few years ago, the city faced a number of stark challenges including: a state renewable energy mandate (a statewide “portfolio standard” requiring 20% renewable energy by 2017) and a state cap on greenhouse gas emissions; an impending shortage of skilled construction workers; entrenched poverty and joblessness in many low-income neighborhoods; and toxic levels of diesel pollution that were imposing huge health costs and blocking the growth of the nation’s largest port complex.

In the past year, Los Angeles has adopted a comprehensive approach to redevelopment which will ensure that city-subsidized development projects are built green and serve as vehicles for moving low-income residents into middle-class construction careers. The Port of Los Angeles has also begun to implement a comprehensive solution to freight-related air pollution that will increase efficiency, enhance security, and improve work conditions and living standards for port truck drivers. Most important is the fact that these initiatives are being undertaken on a large scale: the city’s construction policy is expected to impact 15,000 jobs over five years while the Clean Trucks Program (discussed below) could affect as many as 16,000 port truck drivers.

In 2008, the City of Los Angeles Community Redevelopment Agency (CRA) adopted a landmark policy designed to protect the environment, safeguard the interests of taxpayers, and ensure that city-supported projects create good construction jobs and career pathways for city residents. The Construction Careers and Project Stabilization Policy establishes minimum labor standards and a process for avoiding labor disruptions by means of a master agreement between the CRA and local building trades unions. The policy requires participating contractors and unions to make construction job opportunities available to local residents, including individuals who face barriers to employment such as a criminal record or a limited education.

The policy is being implemented alongside a requirement that large subsidized projects meet the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED) standards. In this way, city leaders have begun to lay the foundations for building a green-collar

construction workforce in Los Angeles. The UCLA Center for Labor Research and Education projects that the policy will make at least 5,000 apprentice-level construction jobs available to residents of neighborhoods with high levels of unemployment over the next five years. At least 1,500 jobs are expected to go to individuals who might otherwise remain homeless, unemployed, dependent on welfare programs, or caught up in the criminal justice system. But the most important result of the Construction Careers policy will be to leverage public investments in economic development to turn short-term jobs into long-term careers in the construction industry.

The Port of Los Angeles, meanwhile, has adopted a landmark “Clean Trucks Program,” which is expected to cut pollution from harbor trucks by 80% and pave the way to safe, clean, and sustainable growth for the port complex. The program requires motor carriers to replace old, polluting trucks with clean trucks, and to replace a workforce of poorly paid independent-contractors with a stable workforce of company drivers. In doing so, the program will not only raise labor standards for newly-minted green-collar workers but also allow port expansion to continue, creating new green trucking jobs.

Finally, a diverse group of stakeholders convened by the Apollo Alliance, a national interdisciplinary group dedicated to reduce global warming and create good, green jobs (see box), has begun to overhaul the city’s workforce development infrastructure to address the challenge posed by the clean technology revolution. This effort has focused on ensuring that disparate populations, including traditionally disadvantaged workers, received both the necessary training and access to these jobs.

This paragraph, from a case study of the LA case, provides a telling example of the extent to which intermediaries have been involved in these efforts:

“The Green Careers Training Initiative is being designed by the Los Angeles Infrastructure and Sustainable Jobs Collaborative, a public-private partnership of key stakeholders led by the Regional Economic Development Institute (REDI), an intermediary based at Los Angeles Trade-Technical College (LATTTC). The collaborative includes SCOPE/LA Apollo; the Mayor’s Office; the LADWP [LA Dept of Water and Power]; the Los Angeles Unified School District; California State University Los Angeles (CSULA) College of Engineering, Computer Science, and Technology; the IBEW Local 18-LADWP Joint Training Institute;

the Southern California Gas Company; Metropolitan Water District of Southern California; and the Southeast-Crenshaw Worksource (WIA one-stop) Center.”<sup>1</sup>

As of this writing, these collaborations are successfully training workers and placing them in green jobs. Interestingly, beneficiaries of the programs come from quite different walks of life, including young, entry-level workers with little experience in the relevant trades, such as building or electrical work, but also older, more experienced workers, already in these fields but needing skill upgrades.

For example, the Electrical Training Institute of Southern California (ETI) a labor-management partnership jointly sponsored by a union—the International Brotherhood of Electrical Workers—and a business coalition of private contractors. The training follows an apprenticeship model, requiring over 1,000 hours and classroom work and 8,000 hours of on-the-job-training, making this a very rigorous program. Even graduates of this extensive training are eligible for constant upgrades, as the technology advances (e.g., a thirty hour course of photovoltaics was recently added). Importantly, the costs of training (which is free to participants) involve less than 10% public funding with the rest paid for by the unions and the contractors through a labor/management partnership agreement. Apprentices earn about \$20 per hour in wages and benefits, which can rise to \$50 once they graduate from the program. Over 600 candidates, both older and younger workers, have completed this training.<sup>2</sup>

In San Diego, the IBEW has been training electricians in renewable energy skills for the past decade, supplying workers to contractors installing solar panels on a range of buildings. As in the LA case, apprentices work for contractors and receive on-the-job training, while pursuing further classroom training at night through a local community college, where they can work towards an AA degree.

Bracken Hendricks, an expert in the green jobs movement, points out that apprentices can double their pay from about \$14 an hour to almost thirty “before graduating to journeyman inside wireman, journeyman sound technician or journeyman residential wireman. A journeyman inside

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<sup>1</sup>Greener Pathways...

wireman, for example, starts at \$35.40/hour.” Again, the fees for these programs are paid for by labor/management agreements.

But as always, there is still work to be done. Hendricks points out that the San Diego IBEW local is 40-45% Hispanic, but women and African-Americans are underrepresented, a consistent theme in this literature. It is here where the work of Van Jones, president and founder of Green for All, and his proposal for a Clean Energy Corps (see box) comes into play. These organizations have made significant inroads in linking the goals of poverty reduction, green production, and the creation of green jobs.

Green for All describes itself as a national organization dedicated to building an inclusive green economy strong enough to lift people out of poverty. The methods and tools of the operation are much like those described throughout this study, including public/private partnerships, connecting with labor market intermediaries for training, etc. But the organization also maintains a deep commitment to ensuring that persons of color and those from disadvantaged communities get an opportunity to get green jobs, thereby tapping into a growth sector and a potential foothold into the middle class. This goal of ensuring that high-quality green jobs are available to people of all backgrounds is discussed in more detail in the section on Green Jobs and Economic Mobility below.

### ***Case Study #2: Washington State: Building A Climate Change Framework with an Emphasis on Green Job Creation***

In 2007, the Washington State legislature adopted an ambitious set of goals, first set out in an executive order by Governor Chris Gregoire, for reducing Washington’s greenhouse gas emissions and dramatically increasing the number of green jobs in the state.

As in LA (and in every other case we encountered) public and private stakeholders quickly began to coalesce to meet the legislated goals. NGOs, such as The Washington State Apollo Alliance (see box), Climate Solutions, Solid Ground, and The Workforce Alliance, began

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<sup>2</sup> Op cit.

organizing and working with state and union actors, such as the Workforce Training and Education Coordinating Board, the Washington State Labor Council, the Washington Workforce Association, and the State Board for Community and Technical Colleges.

The participation of this broad set of organizations, many of which have already been involved in the creation and administration of other successful workforce development programs in Washington, was crucial both in designing the strongest possible program and in building political support for the proposal.

More recent legislation has helped to move the state closer to meeting its green goals for reducing carbon emissions while emphasizing the creation of good green jobs:

- The Employment Security Department (ESD) has been directed to analyze the labor market to identify high-demand green industries based on their importance to the development of a clean energy economy and their potential to create high-quality green jobs. There is to be a particular emphasis on green industries that create jobs in high-wage occupations and career ladders that allow workers to advance to these high-wage jobs.
- The State Workforce Training and Education Coordinating Board has been authorized to create Green Industry Skill Panels (GISPs), which would bring together business representatives from green industries, labor unions representing workers in those industries, educational institutions, and more local workforce development organizations. These panels would be funded on a competitive basis, and would seek to identify demand for high-wage occupations and careers within green industries and develop innovative strategies for recruiting and training the workers needed to meet this demand.
- The legislation would also create a Green-Collar Job Training Fund, which would train workers for high-wage occupations in growing green industries and occupations on the pathway to these high-quality green jobs. The Fund would be administered in accordance with the research conducted by the ESD and the GISPs on high-demand green industries



and good green jobs. The Fund would distribute competitive grants to organizations or group of organizations with proven success implementing workforce training programs. These grants would also seek training programs targeted towards adults and youth in families below twice the poverty line, dislocated workers, and entry-level workers in green industries.

#### BOX: Apollo Alliance

The Apollo Alliance is a coalition of business, environmental, religious, community, and labor leaders working toward a clean energy economy that hopes to put millions of Americans to work in 21<sup>st</sup>-century, high-quality, green-collar jobs. The name of the group invokes the President Kennedy's Apollo Program, suggesting that we can create a clean energy economy if we devote the same national will and resources to it that we did to putting a man on the moon. The alliance promotes investments in energy efficiency, clean power, mass transit, next-generation vehicles, and emerging technologies, as well as in education and training. The overall goal is reduce carbon emission and oil imports, while spurring domestic job growth. The Apollo Alliance has played a key organizing and coordination role in many of the examples we provide in the text.

#### BOX: Clean Energy Corps

The Clean Energy Corps (CEC) is a bold proposal by Green For All and its partners to bring together Americans across class, generations, background and experience to advance a national effort to stop global warming while increasing economic opportunity and promoting active citizenship. The CEC would bring together Americans who want to serve in the fight against global warming, yet lack organized opportunities to do so, with other Americans who seek pathways out of poverty or better employment in the clean energy economy, yet lack the necessary skills or connections to employers. Additionally it would connect even more American homeowners, businesses, local governments and schools, who want to reduce energy costs where they live, work and learn, but lack the financing to do so. The goal is to capture the imagination of America, unite constituencies, and motivate millions to act.

## **Financing Green Jobs**

The history of energy investment in any large, open economy has involved both public and private investment, with the public sector often playing an initial role, leading the way for venture private funding. Green energy, and thus green job creation, is no different. Many of the firms and industries creating green jobs today present real growth opportunities for private investors. According to a study by Roger Bezdek of Management Information Systems, Inc., the renewable energy industry (excluding hydropower) grew at over three times the rate of the American economy as a whole. Accelerating private investment in these fields has the potential to help boost the numbers of green jobs, while also offering clear environmental benefits and solid opportunities for profit in the private sector. As a result, one of the important challenges in developing a green jobs policy is to leverage the unique capabilities and resources of the private sector to maximize the creation of green jobs.

One powerful mechanism by which the government can encourage the private sector to invest in areas that will create green jobs is by providing access to financing. Government assistance in securing financing, through programs like the Clean Energy Finance Authority described below, is critical to growing industries like renewable energy, which must borrow to fund their rapid expansion. And in today's credit markets, where even creditworthy borrowers face real difficulty raising capital, such reliable financing is even more important. This shortage of credit could stifle investment in green industries, and as investment declines, so does job creation.

Using government resources to ensure the availability of financing to companies like these will unleash the dynamism of the green sector of the economy and spur expansion that will give a boost to the economy while putting more Americans to work. A number of useful strategies have been put forward for working with the private sector to create green jobs; some have already been put into practice, other merely proposed. Three of the most successful and promising strategies are explored below.

*The Clean Energy Finance Authority*

The American Recovery and Reinvestment Act, signed into law on February 17, establishes a Clean Energy Finance Authority (CEFA), which will coordinate the Federal government's efforts to enhance America's investment in renewable energy. At the heart of the program is \$6 billion of funding for loan guarantees that are expected to leverage over \$75 billion in new private capital for renewable energy investments that will create jobs. This program will build on existing loan guarantees administered by the Department of Energy and the Department of Agriculture that encourage investment in renewable energy, energy efficiency, and biofuels.

Major renewable energy investments, like building a new wind farm or constructing a new solar plant, cost hundreds of millions of dollars. Government assistance in securing financing helps renewable energy firms overcome one of the major obstacles to their continued growth.

Although financing is an important hurdle in the best of times, this problem is exacerbated by the conditions in credit markets today. The unavailability of loans has already caused many clean energy companies to scale back their plans for expansion; after a record-setting year in 2008, the wind industry may cancel half of its projects in 2009.

Of course, when major projects like these are scaled back or canceled---when the factories that make wind turbines and solar panels to supply major renewable energy projects cut production or even shut down---green jobs are lost. This process has already begun, with some of the biggest renewable energy companies temporarily closing American factories.

The CEFA's loan guarantee program is designed to address this problem. The Federal government guarantees that banks will recoup their investment if they lend to clean energy projects. Because banks can be confident their loans will be repaid, they can confidently expand their lending, which gives clean energy companies reliable access to financing for their investments in new projects. New wind farms and solar power projects, in turn, provide business for wind turbine and solar cell manufacturers. By removing obstacles to getting financing for clean energy firms, this loan guarantee program leverages the private sector to drive green job creation.

Existing loan guarantee programs have been very successful, and the Clean Energy Finance Authority will continue that success. But no program is perfect, and there are small improvements that could be made to these loan guarantee programs to significantly improve their uptake and success. Perhaps the most important is simply to reduce the complexity and increase the flexibility of the application wherever possible. Uncertainty about criteria for participation and details of the application processes can deter potential participants, limiting the effectiveness of the program. Existing programs may also deter investment by offering guarantees only to certain types of investors, usually banks, or by guaranteeing only part of the loan. Continued refinements to loan guarantee programs will help to ensure that every dollar of public money committed to the program will leverage the maximum amount of private investment.

### *Production Tax Credit (PTC) for Renewable Energy*

The Energy Policy Act of 1992 created a Production Tax Credit (PTC) for the generation of renewable energy. The measure allowed an income tax credit of 1.5 cents per kilowatt-hour, which has since risen to 2.1 cents per kilowatt-hour due to inflation-indexing. The tax credit is available to wind, geothermal, and certain other renewable energy generation projects, of which wind power is the largest.<sup>3</sup>

The PTC helps make renewable energy price-competitive with fossil-fuel energy generation, which helps create jobs because investment in and generation of wind power and other renewable energy creates many more jobs than comparable investments in fossil fuels. According to estimates by economist Robert Pollin, green investments generate 2.7 times as many jobs as fossil fuel spending. Furthermore, the PTC has been an extremely important driver of development in the wind power industry. By making wind power competitive with fossil fuels, the PTC encourages further investment in wind power, which in turn improves technology and leads to further gains in competitiveness from wind power.

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<sup>3</sup>The PTC is not available for solar power, but a solar energy investment tax credit is available to businesses and individuals who install solar energy systems in their homes and businesses.

However, since its creation, the PTC has usually been extended for no more than a few years at a time, and has three times been allowed to expire (in 1999, 2001, and 2003) before it was eventually renewed. This erratic treatment has caused the wind power industry to expand in fits and starts rather than experience steady expansion that would reliably create high-quality green jobs year after year. In each of the three PTC expirations, the following year saw a sharp dropoff in new wind projects. And in addition to the direct effects of these expirations, repeatedly allowing the PTC to lapse has the additional downside of creating uncertainty about the mid- to long-term future of wind power, which further discourages investment.

The Recovery Act is very helpful in this regard, as it extends the PTC for three years (through December 31, 2012) for firms that produce electricity from wind, biomass, geothermal energy, gas from the biodegradation or burning of municipal solid waste, and qualified hydroelectric production. Perhaps just as importantly, the Recovery Act included important steps to make the PTC more effective at encouraging renewable energy production in the midst of a deep recession. Firms that owe the government no taxes, because they are not currently turning a profit, are not helped by the production tax credit. This is a problem right now, given the present downturn. The American Recovery and Reinvestment Act addressed this problem through a number of mechanisms, including allowing businesses to take more of the credit upfront and temporarily converting the credit to a grant. These temporary changes will help to ensure that the Production Tax Credit continues to provide an incentive for renewable energy development despite the current recession.

### *Milwaukee Energy Efficiency (Me2)*

Thus far, this section has focused on the ways in which government can ensure the availability of financing for renewable energy investments. However, the green sector of the economy also contains many jobs in energy efficiency. Financing investments in energy efficiency presents a different set of challenges. Investments in energy efficiency are much less centralized than investments in renewable energy; much of the work in energy efficiency involves retrofitting and weatherizing homes and businesses, whereas renewable energy projects are more likely to involve the creation of large generation facilities.

The small-scale, decentralized nature of energy efficiency projects makes it all the more important to develop creative strategies for using government resources to support investment. This is particularly true in the case of investments in energy efficiency for residential buildings. Residents, particularly renters, may be reluctant to invest in energy efficiency measures that would create substantial cost savings over several years because the residents are not sure that they will occupy the building long enough for the savings to recover the initial cost of the investment.

Yet solutions to these problems, which have the potential to facilitate significant investments in energy efficiency, have been put forward. One promising proposal for financing energy efficiency investments is the Milwaukee Energy Efficiency project (Me2), which is being developed by the City of Milwaukee and the Center on Wisconsin Strategy (COWS) in conjunction with local business, labor, and community leaders.

The model for Me2 is straightforward. The financing challenge, a typical one in the energy sector, is that up-front costs of, for example, weatherization, lead to larger savings down the road. To address this challenge, the Me2 program uses a public/private mix of investment capital to pay for weatherization in properties where such work would produce large savings. The savings to the consumer are then paid back by only gradually reducing their monthly bill. That is, on-bill savings initially represent less than their actual amount, so that owners and occupants of buildings can repay the cost of energy efficiency investments through a charge on their monthly energy bill.<sup>4</sup>

The program also includes an important provision that attaches the repayments to the property, not the individual. If a building is weatherized in the Me2 program, and the occupant moves out before the cost of the weatherization is fully repaid, the next occupant would take over the repayment obligation. This way, occupants no longer face an incentive not to invest because they might not recoup the benefits. They start saving money as soon as the investment is made,

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<sup>4</sup>That is, suppose the pre-weatherization bill was \$200/month and the post-weatherization bill is \$150. During the repayment period, the consumer pays, say, \$180 a month, reaping some benefits from the weatherization and

and if they leave before repayment is complete, the subsequent occupant receives the benefits of the retrofit and takes over payment.

The Me2 program provides a mechanism for individuals to easily repay the loans that are needed to fund investments in energy efficiency, coordinates with banks and contractors to arrange loans, energy auditors, and contractors, and provides part of the upfront cost of improvements. By coordinating all the parties involved in energy efficiency projects, ensuring easy repayment, and providing part of the up-front cost, the program would be able to leverage the resources of private individuals to greatly increase investments in energy efficiency. A similar approach is moving forward in various states and cities, including Michigan under the leadership of Governor Jennifer Granholm, Philadelphia under Mayor Michael Nutter, and in Oregon through the efforts of state legislators.

The green sector of the economy is growing rapidly, and continues to present enormous opportunities for future growth. Private sector investors are often seeking opportunities to invest in precisely the industries that will create high-quality green jobs for working families. As a result, one of the most important roles of the government in encouraging the creation of these jobs is to remove impediments to private investment in green industries. The public sector and the private sector each have strengths and weaknesses, and it is important for the government to recognize its own weaknesses and actively seek ways to exploit the strengths of the private sector to advance a green jobs program. By structuring public policy in ways that encourage financing of green investments and working to ease the bottlenecks in green investment, the government can leverage the unique capabilities of the private sector to spur green job creation.

## **Green Jobs and Economic Mobility**

Green jobs can also provide a pathway into the middle class for those who are struggling economically. As President Obama noted at the announcement of the Middle Class Task Force on January 30, the task force's work will include developing policy solutions for "people who aspire to be in the middle class. We're not forgetting the poor. They are going to be front and

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returning some to original investors. Once the work is paid off, the full savings redound to the consumer.

center, because they, too, share our American Dream. And we're going to make sure that they can get a piece of that American Dream if they're willing to work for it."

Green jobs are a natural place to begin this effort. The green sector of our economy is still developing, and will generate many jobs and career pathways that did not previously exist. At this early stage, we have an opportunity to ensure that this sector is open to workers seeking that first rung on the ladder to the middle class, particularly younger workers who are just starting out and trying to overcome the disadvantages of their childhood.

The skills young people learn today can help propel them through a lifelong career in the growing green sector of the economy. Our country's future, and the economic security of our aging population, depends on younger workers becoming successful and productive citizens. At the same time, pathways into good green jobs should also be made available to older workers who are struggling to support their families and looking for opportunities to join the middle class.

One way to open doors for these workers is to provide access to training programs where they can learn the skills they will need to succeed in a green job. To maximize their effectiveness, these programs should be targeted on training for jobs in particular sectors of the green economy where there is known to be unmet demand for skilled workers. Green job training programs should also provide support services to help disadvantaged workers address various barriers to employment.

Already, some innovative work is underway in this area. Here are just three examples of local initiatives that are providing green job training and opportunities for disadvantaged workers.

- **Bronx Environmental Stewardship Training (BEST) Program:** Run by Sustainable South Bronx, an environmental justice nonprofit, the BEST Program trains local low-income residents for skilled labor in green industries. Participants, nearly all of whom have been on some form of public assistance, go through a 10-week training program in jobs involved in green building, urban forestry, and other green industries. The program



awards certificates for the various competencies in which it provides training, and also helps trainees to develop basic job skills. Finally, BEST helps place graduates in local green businesses and follows those placed for up to three years. BEST graduates continue to be in high demand, in large part because of Sustainable South Bronx's commitment to partnering with business and closely tracking the evolving needs of the green labor market. Over 80% of BEST graduates are still employed, and 15% have gone to college. After 5 years of success, BEST is now a model for other cities looking to give their low income residents a pathway into the new green economy.

- **Solar Richmond:** Based in California, Solar Richmond combines the aims of weatherizing low income homes and providing pathways out of poverty for its low-income residents, particularly minority youth. The program connects residents with the city's nonprofit low-income assistance and construction training entity to get trained in construction techniques. Solar Richmond trainees then get an extra 2-week solar skills module. Finally, Solar Richmond partners with local construction and solar installation businesses, as well as the nonprofit that does most of Richmond's low income solar installations, to place their participants. While the program is fairly new, 85 percent of graduates have been placed with employers.
- **Mile High Youth Corps (MHYC):** MHYC connects urban youth aged 16-24 with green service activities to teach job and life skills. Crews of 8-10 work together on environmental projects around the city of Denver, including energy conservation in low-income housing, public land and water conservation, and, as part of the federally-supported YouthBuild program, green construction of new affordable housing. The work is paid and provides on-the-job training, which is accompanied by Corps-to-Career classes that teach job search and job preparedness skills. Corps members also receive basic education to make sure that they are ready to succeed post-program. In just one year, MHYC members contributed 41,000 hours of community service to Denver's neighborhoods, earned 21 GEDs, and won 50 AmeriCorps educational awards for a total of \$100,776 towards further education.

Having a full-time job that pays above the minimum wage represents economic progress in and of itself for many program participants. Some previously had no income at all, or very meager incomes from public assistance; others were working at minimum wage jobs. But an additional goal of green job training initiatives should be to ensure that disadvantaged workers can get on a career pathway that leads to greater opportunity and the family-sustaining wages that middle-skill green jobs can provide.

Green job training programs can also be an important tool in breaking down barriers that have prevented communities of color from realizing their full economic potential. For example, pre-apprenticeship programs at community colleges, like the Seattle Vocational Institute's Construction Training Program, can help open up new pathways into green labor apprenticeship programs for low-skilled minorities and women. Another strategy, which has been employed successfully in Newark, New Jersey, is to require green economic development projects to train local low-income residents for the construction jobs that they create. Initiatives like these can help ensure that the green building boom creates new opportunities for those seeking pathways out of poverty.

The Administration can jump-start more of these efforts with the funding provided in the American Recovery and Reinvestment Act (ARRA) for green job training. The Recovery Act provides \$750 million for a program of competitive grants for worker training and placement in high growth and emerging industry sectors. Of these funds, \$500 million is specifically set aside for research, labor exchange, and job training projects that prepare workers for careers in energy efficiency and renewable energy.

Secretary of Labor Designee Solis brings particular expertise in this area, as a principal author of the Green Jobs Act of 2007. The Labor Department can provide leadership in targeting disadvantaged populations and fostering partnerships among employers, state and local government, labor unions, and community-based organizations, to ensure that green job training programs bring new people into the labor market in the most promising sectors of a local economy. Coordinating efforts among federal agencies will also be important, for example, to

connect the efforts of the Departments of Labor, Energy, and Housing and Urban Development with the Corporation for National and Community Service.

With these partnerships and by employing these new resources, the Administration can fund and develop model programs that will train thousands of Americans for the new green jobs of the future, while helping to provide them with a pathway into the middle class.

## **Conclusion**

### **Policies to Help Promote the Creation of Green Jobs: The Pieces of the Puzzle Come Together in Philadelphia**

A key goal of our overview is to identify the “pieces of the green jobs puzzle”—the policies, institutions, stakeholders, and partnerships that are part of a successful green jobs movement in a community, be it a city, town, or rural area.

After reviewing successful models, either up-and-running or more nascent, the architecture for a successful green jobs initiative appears to include these components:

- a public mandate to achieve an energy conservation goal;
- elected officials invested in meeting the goal;
- private employers interested in creating green jobs to meet the new labor demands for environmentally-sound output;
- financing sources who want to invest in the new initiatives, often involving federal loan guarantees;
- extensive labor force intermediaries, including community colleges, union apprenticeship programs, and public/private training programs to serve as a linkage between employers and workers and ensure that green jobs are good jobs;
- partnerships and coordinating mechanisms for all of the above.

We briefly describe each of these, while some, like financing, have been explained more thoroughly above. Following each brief description is an example of this puzzle piece in practice

in the city of Philadelphia, where Mayor Michael Nutter has been aggressively pressing to implement these pieces to build a green jobs movement.

***A public mandate:*** A majority of states have implemented Renewable Portfolio Standards (RPS), which mandate a minimum reliance on renewable sources in the generation of energy used in the state. Similarly, many cities and towns have set demanding targets for greenhouse gas reduction emitted from their communities and have committed to enhancing green building codes, the tree canopy, and regional transit systems to foster sustainable neighborhoods. These mandates have multiple motivations:

- to reduce carbon emissions and mitigate climate change;
- to reduce the state or locality's exposure to high and volatile energy prices;
- to create new jobs for their citizens in the green economy.

***In action:*** In Philadelphia, an ambitious sustainability framework (“Green Works for Philadelphia”) outlines fifteen targets the City is committed to meeting by 2015. The City’s plan is integrated with state-level mandates such as Governor Ed Rendell’s Alternative Energy Portfolio Standard (requiring utilities to source 18% of their power from renewables by 2020) and with the state’s new Act 129 (which mandates a 1% by 2011 and 3% by 2013 reduction in base load electricity consumption.) These public mandates create incentives and generate resources for green jobs investment. For example, Act 129 is expected to generate \$85 million of energy savings per year in metropolitan Philadelphia service territory to pay for programs to reduce electricity consumption, much of which will be devoted to the installation of weatherization in residential, commercial, and institutional buildings.

***Elected Officials:*** Having engaged public officials who are dedicated to improving the environment and creating good jobs is of course an integral piece of the puzzle. Virtually every step in this chain, including the one just noted—a mandate to replace fossil fuel consumption with renewables—involves support from the public sector. Note, importantly, that especially at the local level, such support does not necessarily involve public spending. More often, it involves coordination among key players, setting up the right incentives, and identifying and

overcoming existing barriers. In many cases we observed, one of those barriers was access to green jobs by women and persons of color, groups that might otherwise be less likely to get some of these jobs.

***In action:*** In Philadelphia, Mayor Nutter has challenged Philadelphia to become “the greenest city in America.” The challenge is not to become the greenest city government, and the Mayor’s challenge is predicated on partnerships beyond government and, indeed, beyond the city limits. The Mayor’s Sustainability Advisory Board consists of leaders drawn from three sectors: non-profit leaders who educate and advocate for green issues, public-sector leaders from suburban counties and state agencies, and private-sector leaders from both business and labor. The Mayor’s commitment, including the nation’s first big-city cabinet-level Director of Sustainability, ensures that the public mandates described above become an organizing principle of policy development and operational practice across every aspect of government.

***Private employers:*** The vast majority of green jobs in America will be created by private employers, not by the government. Yes, government at all levels can and should work with businesses to create the structure—the monetary and regulatory incentives, the siting issues, some of the high fixed costs that cannot be externalized—within which green jobs can flourish. But at the beginning and the end of the day, private employers must be the ones who create green jobs in this country.

***In action:*** In Philadelphia, this emerging green-economy consists of a vast regional array of existing and expanding private-sector firms that range from architecture and landscape design and building, to urban agriculture and food distribution through farmer’s markets and co-ops, to small and growing weatherization and solar installation companies, to global-scale manufacturing facilities for both wind, solar, and bio-fuel technology, and finally to research institutions conducting path-breaking R&D. The Building Owners Management Association, the American Society of Heating, Refrigeration, and Air-conditioning Engineers, the Regional Labor Council of the AFL-CIO, the Delaware Valley Green Building Council, and many other private-sector employer and labor

associations are actively engaged with the City and Counties on implementing a green jobs strategy. Other associations such as the Sustainable Business Network are pooling the networking and purchasing power of small businesses throughout the region. The Greater Philadelphia Green Business Commitment creates building owner and tenant checklists that help foster further demand for green jobs.

**Financing Sources:** Much like private employers must be at the heart of green job creation, private investors must play a key role in financing the investments in green technological advances that will themselves promote the green jobs movement. As we discuss above, there is a relatively new capital marketplace for these investments to flow through, but there is a clear role for the federal government here. The history of major regime shifts of energy in this country has always involved a combination of public and private investment, and renewable energy, battery technology, retrofits, and weatherization will be no different. In the absence of public lending incentives, like loan guarantees, it is likely that a sub-optimal level of investment will occur in these areas. The American Recovery and Reinvestment Act recognizes this reality, devoting \$X to such lending initiatives.

**In action:** In Philadelphia, the Mayor's office has proposed the creation of a new public authority that can attract and pool a variety of capital sources to support large-scale investment, especially in weatherization, building retrofits, and green infrastructure in the water and street systems. A public authority can borrow directly from capital markets and participate in federal programs including Qualified Energy Conservation Bonds (zero interest bonds that provide tax credit to those who hold them<sup>5</sup>). The city's funding authority would also provide the mechanism by which these funds could be revolved, using part of the energy savings from businesses and households as the repayment stream, until the city and region's entire building stock was brought to optimal energy efficiency.

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<sup>5</sup> More precisely, the Federal government pays the interest on the bond, though this is done through a tax credit to the bond holder.

***Extensive labor market intermediaries:*** For a variety of important reasons, green job initiatives throughout the nation have depended on a broad set of intermediaries to help ensure:

- workers receive the training they need to do these jobs;
- green jobs are good jobs, with fair pay and benefits;
- green jobs are available to all who desire and are able to do them, regardless of gender, race, age, or ethnicity.

These intermediaries have included community organizations, unions, NGOs representing workers' interests, community and four-year colleges, employers, and advocacy organizations, including those working for environmental and social justice.

***In Action:*** The commitment in Philadelphia is to reorient our Workforce Investment System around the emerging opportunities on the green economy. One key focus is on the community college system. Several of the region's community colleges are starting "Green Jobs Academies," special programs designed to impart skills related to this type of work. The region's primary low-income weatherization provider, the Energy Coordinating Agency, has launched a new training facility that trains building auditors in to identify the interventions needed to improve a building's energy efficiency, while forthcoming training classes will prepare the workers needed to complete the audits.

Whether we're talking about homeowners replacing their windows or going solar, workers moving from old manufacturing to green manufacturing, venture investors looking to do well by doing good, unions looking to tap the blue/green nexus, elected officials putting the pieces of the puzzle together, it all amounts to the same thing: building a better, cleaner economy with good jobs for all. The Obama/Biden Administration and the Middle-Class Taskforce will continue to track these developments, and to look for ever new ways to expand and promote green jobs as a pathway into a strong, environmentally sound middle class.

**Appendix: Further CEA analysis of jobs in green occupations in likely green industries.**

**Table A1: Characteristics of likely green occupations (percentages except for wages)**

	<i>Wage (2008 \$)</i>	<i>BA</i>	<i>Union Member</i>	<i>Public Sector</i>	<i>Male</i>	<i>White</i>	<i>Black</i>	<i>Hispanic</i>
Electrical power line installers and repairers	\$21.23	14.0%	26.6%	12.1%	98.1%	84.6%	7.3%	12.7%
Computer control programmers/operators	\$17.83	2.4%	19.2%	2.8%	96.3%	96.8%	2.2%	9.6%
Control and valve installers and repairers	\$22.76	12.2%	46.8%	18.0%	95.8%	88.2%	10.0%	13.4%
Electrical and electronic engineers	\$29.00	76.7%	5.5%	10.6%	89.9%	78.7%	5.1%	5.2%
Electrical/electronics repairers *	\$21.46	9.0%	9.2%	24.6%	100.0%	100.0%	0.0%	10.5%
Electricians	\$21.07	6.3%	33.0%	5.7%	98.5%	90.5%	5.8%	14.6%
Engine and other machine assemblers	\$16.70	2.7%	49.5%	0.0%	83.8%	88.1%	5.1%	14.8%
Engineering technicians	\$21.14	15.0%	15.4%	18.0%	80.8%	82.6%	11.2%	10.6%
First-line supervisors/managers production and operating workers (TM)	\$17.53	15.2%	9.2%	5.7%	80.6%	83.5%	10.8%	12.7%
First-line supervisors/managers of mechanics, installers, and repairers (PG)	\$20.02	16.0%	11.7%	15.2%	92.7%	87.6%	7.8%	9.2%
Industrial and refractory machinery mechanics	\$19.13	5.5%	19.5%	3.9%	97.2%	87.8%	8.0%	11.4%
Lathe and turning machine tool setters/operators	\$14.26	0.0%	23.2%	0.0%	89.8%	87.7%	9.1%	18.4%
Machinists	\$16.94	4.8%	16.8%	2.2%	95.1%	86.6%	8.1%	13.2%
Maintenance and repair workers, general	\$16.83	7.9%	13.6%	14.8%	96.7%	85.5%	8.4%	15.3%
Mechanical engineers	\$27.22	76.5%	5.9%	5.4%	91.4%	83.5%	3.8%	2.7%
Miscellaneous assemblers and fabricators	\$13.79	6.2%	14.2%	1.9%	63.3%	75.8%	17.3%	18.9%
Multiple machine tool setters/operators*	\$19.22	28.5%	31.7%	0.0%	79.2%	79.2%	20.8%	7.4%
Power plant operators/distributors/ dispatchers	\$24.84	19.2%	34.0%	17.8%	81.9%	88.9%	4.5%	6.5%
Welding, soldering, and brazing workers	\$16.33	2.8%	18.3%	1.3%	95.2%	87.4%	8.5%	20.5%
<b>U.S. overall average (including all occupations)</b>	<b>\$14.69</b>	<b>30.4%</b>	<b>12.1%</b>	<b>14.1%</b>	<b>53.1%</b>	<b>81.6%</b>	<b>11.8%</b>	<b>13.9%</b>



**Table A1 (cont.) – Characteristics of likely green occupations (percentages except for wages)**

	<i>Primary earner</i>	<i>North-east</i>	<i>South</i>	<i>Mid-west</i>	<i>West</i>	<i>Central city</i>	<i>Balance of MSA</i>	<i>Non-MSA</i>
Electrical power line installers and repairers	92.7%	6.3%	50.7%	17.0%	26.0%	27.9%	57.3%	14.8%
Computer control programmers/operators	92.0%	20.1%	32.7%	42.6%	4.6%	10.8%	53.9%	35.3%
Control and valve installers and repairers	94.3%	13.1%	42.3%	32.7%	12.0%	19.3%	64.8%	15.9%
Electrical and electronic engineers	93.6%	20.8%	29.2%	20.0%	30.0%	26.1%	65.8%	8.2%
Electrical/electronics repairers *	61.1%	6.8%	73.5%	2.3%	17.5%	23.0%	58.9%	18.1%
Electricians	92.6%	16.5%	38.0%	22.2%	23.3%	26.3%	51.9%	21.8%
Engine and other machine assemblers	99.0%	17.0%	26.0%	45.2%	11.9%	0.0%	62.9%	37.1%
Engineering technicians	90.2%	13.6%	34.9%	27.2%	24.2%	28.6%	53.4%	18.0%
First-line supervisors/managers production and operating workers (TM)	90.1%	16.1%	36.3%	28.8%	18.8%	23.0%	50.2%	26.8%
First-line supervisors/managers of mechanics, installers, and repairers (PG)	91.5%	16.8%	36.0%	22.1%	25.1%	20.1%	57.0%	22.9%
Industrial and refractory machinery mechanics	94.6%	13.2%	42.8%	29.8%	14.3%	21.4%	47.8%	30.8%
Lathe and turning machine tool setters/operators	91.8%	5.0%	29.3%	49.1%	16.6%	11.4%	51.7%	36.9%
Machinists	90.2%	18.4%	29.6%	32.2%	19.9%	25.0%	49.2%	25.7%
Maintenance and repair workers, general	90.9%	19.3%	39.6%	22.3%	18.8%	23.2%	53.3%	23.5%
Mechanical engineers	93.9%	21.0%	21.1%	42.3%	15.7%	26.2%	62.9%	10.9%
Miscellaneous assemblers and fabricators	83.5%	11.3%	32.9%	40.4%	15.4%	29.8%	41.1%	29.2%
Multiple machine tool setters/operators*	100.0%	0.0%	39.4%	53.2%	7.4%	20.8%	28.5%	50.6%
Power plant operators/distributors/ dispatchers	96.5%	14.3%	40.4%	21.2%	24.2%	15.6%	47.1%	37.3%
Welding, soldering, and brazing workers	92.9%	10.1%	40.5%	29.5%	19.9%	22.2%	43.6%	34.1%
<b>U.S. overall average (including all occupations)</b>	<b>84.3%</b>	<b>18.3%</b>	<b>35.8%</b>	<b>22.8%</b>	<b>23.2%</b>	<b>31.5%</b>	<b>51.2%</b>	<b>17.4%</b>

Note: Calculations from the Jan. 2007- Oct. 2008 CPS ORGs using ORG sampling weights. **Data for all U.S. workers are included.** Occupations with \* have sample sizes that are less than 20 and should be interpreted with caution.