

# GREEN JOBS AND THEIR ROLE IN OUR ECONOMIC RECOVERY

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## HEARING

BEFORE THE

SUBCOMMITTEE ON WORKFORCE PROTECTIONS

COMMITTEE ON

EDUCATION AND LABOR

U.S. HOUSE OF REPRESENTATIVES

ONE HUNDRED ELEVENTH CONGRESS

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## **GREEN JOBS AND THEIR ROLE IN OUR ECONOMIC RECOVERY**

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**Tuesday, March 31, 2009**  
**U.S. House of Representatives**  
**Subcommittee on Workforce Protections**  
**Committee on Education and Labor**  
**Washington, DC**

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The Subcommittee met, pursuant to call, at 10:06 a.m., in Room 2175, Rayburn House Office Building, Hon. Lynn Woolsey [chairwoman of the Subcommittee] presiding.

Present: Representatives Woolsey, Shea-Porter, Payne, Hare, Sablan, Price, Wilson, and Kline.

Staff present: Aaron Albright, Press Secretary; Tylease Alli, Hearing Clerk; Jordan Barab, Senior Labor Policy Advisor; Jody Calemine, Labor Policy Deputy Director; Lynn Dondis, Labor Counsel, Subcommittee on Workforce Protections; Jessica Kahanek, Press Assistant; Joe Novotny, Chief Clerk; James Schroll, Junior Legislative Associate, Labor; Mark Zuckerman, Staff Director; Robert Borden, General Counsel; Cameron Coursen, Assistant Communications Director; Kirsten Duncan, Professional Staff Member; Ed Gilroy, Director of Workforce Policy; Rob Gregg, Senior Legislative Assistant; Alexa Marrero, Communications Director; Molly McLaughlin Salmi, Deputy Director of Workforce Policy; and Linda Stevens, Chief Clerk/Assistant to the General Counsel.

Chairwoman WOOLSEY [presiding]. A quorum is present. The hearing of the Subcommittee on the Workforce Protections will come to order. I will yield myself as much time as I may consume for an opening statement.

And I want to thank all of you—all of us, up here, also—for being here to attend this hearing on green jobs and the role they play in our economic recovery. Green industry, green technology will play a key role in our economic recovery, and that is no surprise to any of us. So today, the economy, which is in very bad shape, and millions of people are out of work—it is because of that we are going to have the discussion of what are green jobs and will they make a difference as our economy rebuilds itself?

In February, unemployment stood at over 8 percent, with workers in the construction sector taking the very hardest hit. But our president has taken bold action with the passage of the American Recovery and Reinvestment Act, an act that provides new resources and new momentum to create and maintain millions of new jobs.

Green jobs are a top priority of the Recovery Act, and at least \$500 million has been set aside for green job training. The exciting news is that greening our economy will require workers in existing and traditional jobs as well as in new industries and new job sites.

We now have substantial evidence, some of which you are going to hear about today in testimony, that green industries are revitalizing existing jobs that would have otherwise gone by the wayside. I am confident that if we stay on course and encourage American ingenuity and innovation we can emerge from this national recession stronger than we were before.

For this hearing today, we intend to roll up our sleeves; we intend to address some of the very practical questions that are in front of us. What is the broadest definition we can come up with for green jobs—a definition that truly captures the full potential of an emerging economy? What factors drive growth in the green jobs?

What are the skills that workers need, and how do we build on existing skills? And finally, what can we do to educate our future workforce for these jobs of the future?

I know that detractors of the green revolution argue that the lack of a standard definition for green jobs is a reason not to commit money to it. Well, that is exactly why we are here.

This is the Labor Committee. This is the Workforce Protection Committee. Our responsibility is putting job titles together under the Department of Labor, and we will be doing that and building on what our information is that we find out from you today.

We need a long-term viewpoint; we don't need a shortsighted viewpoint. And we may not have an exact consensus on a definition today, but most of us can agree on some very, very certain principles.

We know that green jobs are real. We know that green jobs enhance environmental quality while creating good jobs right here at home. And we know that a green economy will transform this country and the world.

So I look forward to hearing from all of you, and I defer now to our ranking member, Mr. Price, for his opening statement.

[The statement of Ms. Woolsey follows:]

**Prepared Statement of Hon. Lynn C. Woolsey, Chairwoman, Subcommittee on Workforce Protections**

I want to thank everyone for attending this hearing on "Green Jobs and Their Role in our Economic Recovery."

Green industry, green technology and green jobs are our future, and will play a key role in our economic recovery.

Today the economy is bad and millions of people are out of work.

In February, unemployment stood at over 8%, with workers in the construction sector taking the hardest hit.

But our President has taken bold action with the passage of the American Recovery and Reinvestment Act that provides new resources and new momentum to create and maintain millions of jobs.

Green jobs are a top priority of the Recovery Act and at least \$500 million has been set aside for green job training.

The exciting news is that greening our economy will require workers in existing and traditional jobs as well.

We now have substantial evidence—some of which you will hear in testimony today—that green industries are revitalizing existing jobs that would have otherwise gone by the wayside.

I am confident that if we stay on course and encourage American ingenuity and innovation, we can emerge from this national recession stronger than we were before.

For this hearing today we intend to roll up our sleeves and address some very practical questions. What is the broadest definition we can come up with for green jobs: a definition that truly captures the full potential of an emerging economy?

What factors drive growth in green jobs?

What are the skills that workers will need, and how do we build on existing skills?

And finally, what can we do to educate our future workforce for these jobs?

I know that detractors of the green revolution argue that the lack of a standard definition for green jobs is a reason not to commit money to it. But that is a short-sighted viewpoint. We may not have a precise consensus on a definition, but most of us can agree on certain principals. We know that green jobs are real. We know that green jobs enhance environmental quality, while creating good jobs right here at home. And we know that a green economy will transform this country and the world. I look forward to hearing from our witnesses and defer to ranking member price for his opening statement.

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Dr. PRICE. Thank you, Madam Chair. I want to thank you for holding this hearing.

I want to thank our distinguished panel for taking time and joining us today and sharing your expertise.

Today's hearing provides members of this subcommittee with the opportunity to learn more about the emerging workforce sector encompassed by the term "green jobs." As we have already seen, Congress has played an active role in shaping the direction of this workforce.

In December 2007, the Green Jobs Act was signed into law as part of the Democrats' energy package, creating a new program to provide training for workers in the energy efficiency and renewable energy fields. The cost was \$125 million.

And recently the Democrats' spending package included \$750 million for competitive grants to attract workers in high-growth and emerging industries. Nearly two-thirds of that has been set aside for green, energy efficient, or renewable energy industries.

It is clear that green jobs, whether through government mandates and spending or through legitimate market forces, are emerging as a significant part of the workforce sector. However, before devoting additional federal dollars, if any, to the emerging green jobs sector, to the emerging green jobs sector, we must be able to identify what exactly entails a green job and gauge the impact on the economy.

There must also be a broader discussion about which energy fields and technologies should be captured under the umbrella of green jobs. It would be shortsighted not to include a multitude of jobs in a broad range of industries, including energy technologies such as nuclear power and clean coal.

Looking at what Congress has already done, the Green Jobs Act defined green jobs as energy efficiency and renewable energy industries that include the energy efficient building, construction, and retrofit industries, the renewable electric power industry, and the energy efficient and advanced drivetrain vehicle industry. Also included in that definition were the biofuels industry, the deconstruction and materials use industries, and manufacturers that produce sustainable products using environmentally sustainable processes and materials.

However, some take a much broader definition of green jobs. To them, it may mean more than meeting workforce needs in a green-approved environmental field. They may also add the requirement of meeting ideologically-driven social goals.

A green job, to some, may be one that is part of a unionized workforce, that guarantees tenure, or that imposes set costs on employers through mandated wages and benefits. Most Americans would not attach these added definitions to what they believe is a green job.

In the years to come, our nation will need a new generation of highly educated and skilled employees, and industries must be innovative and responsive to domestic and global competition. Efforts to increase energy conservation and foster job creation in the areas of green jobs are commendable and may better position the United States for the long term. But if the value of social goals is placed at a higher premium than economic prosperity and ingenuity, it is possible that none of this may be realized.

Republicans are committed to an emerging dynamic workforce focused on renewable energy and green jobs. Holding this hearing today brings us one step closer toward a careful vetting of the definition of a green job, which is important given that this category of jobs may be significantly impacted and shaped by future federal policies.

We all look forward to hearing from the witnesses today, and hope that you will provide us with a full and complete portrait of the green job sector. I look forward, as well, to working with my colleagues and the chairwoman on the this committee to explore this topic further.

I thank the chair.

[The statement of Mr. Price follows:]

**Prepared Statement of Hon. Tom Price, Ranking Republican Member,  
Subcommittee on Workforce Protections**

Good morning and thank you, Chairwoman Woolsey. I would like to begin by thanking our distinguished panel of witnesses for appearing today. We appreciate that they have taken time out of their busy schedules to share their expertise and experiences with us.

Today's hearing provides Members of this Subcommittee with the opportunity to learn more about the emerging workforce sector encompassed by the term "green jobs." As we have already seen, Congress has played an active role in shaping the direction of this workforce.

In December 2007, the "Green Jobs Act" was signed into law as part of the Democrats' energy package, creating a new program to provide training for workers in the energy efficiency and renewable energy fields. It came at a cost of \$125 million.

More recently, the Democrats' spending package included \$750 million for competitive grants to attract workers in high growth and emerging industries. Nearly two-thirds of that has been set aside for green, "energy efficient or renewable energy industries."

It is clear that "green jobs"—whether through government mandates and spending or legitimate market forces—are emerging as a significant part of the workforce sector. However, before devoting additional federal dollars, if any, to the emerging green jobs sector, we must be able to identify what exactly entails a green job and gauge the impact on the economy.

There must also be a broader discussion about which energy fields and technologies should be captured under the umbrella of green jobs. It would be shortsighted not to include a multitude of jobs in a broad range of industries, including energy technologies such as nuclear power and clean coal.

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efficient building, construction, and retrofit industries; the renewable electric power industry; and the energy efficient and advanced drive train vehicle industry.

Also included in that definition were the biofuels industry; the deconstruction and materials use industries; and manufacturers that produce sustainable products using environmentally sustainable processes and materials.

However, some take a much broader definition for “green jobs”. To them it may mean more than meeting workforce needs in a green-approved environmental field but the requirement of meeting ideologically-driven social goals. A green job to them may be one that is part of a unionized workforce, that guarantees tenure, or that imposes set costs on employers through mandated wages and benefits. Most Americans would not attach these added definitions to what they believe is a green job.

In the years to come, our nation will need a new generation of educated and highly-skilled employees. And industries must be innovative and responsive to domestic and global competition. Efforts to increase energy conservation and foster job creation in the areas of green jobs are commendable and may better position the United States for the long-term. But if the value of social goals is placed at a higher premium than economic prosperity and ingenuity, none of this may be realized.

Republicans are committed to an emerging, dynamic workforce focused on renewable energy and green jobs. Holding this hearing today brings us one step closer toward a careful vetting of the definition of a green job, which is important given that this category of jobs may be significantly impacted and shaped by future federal policy.

I look forward to hearing from our witnesses who may provide us with a full and complete portrait of the green job sector. And I look forward to working with my colleagues on the Committee to explore this topic further.

Thank you, Madame Chairwoman.

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Chairwoman WOOLSEY. Thank you, Mr. Price.

Without objection, all members will have 14 days to submit additional materials to the hearing record. Now I would like to introduce our very distinguished panel of witnesses who are here this morning, and after that I want to—I will tell you before then about the lighting system.

You have 5 minutes. When you start to speak the light will turn green in front of you, and then when it turns yellow you know you have 1 minute, and then when it is red, we hope that you are ready to just totally sum up. And then if you have more that you should say, help us when we ask questions. We only get 5 minutes too, between our question and your answer—so help us help you continue with your information to us, if you haven’t gotten it all out. We would be glad to do that.

So first I would like to start by introduction Dr. Robin Roy, and we are going to continue in the order that I am introducing you. Dr. Robin Roy is the Vice President of Projects and Policy at Serious Materials, a company that makes environmentally sustainable building materials.

Now, you may have seen Dr. Roy on television, and you may have followed what has been going on, and he will tell us a little bit about it. But a Chicago glass manufacturer was going to go out of business and Dr. Roy, seeing how, I believe, how dedicated the employees were at that company, took a look at could that company be useful and beneficial to his company, and they purchased it so that it could continue. Before I even met you, Dr. Roy, I was very impressed that you did that.

Before joining Serious, he cofounded Next Energy, which advises government industry and environmental organizations on energy policy and strategy. Dr. Roy was a project director and fellow at the United States Congress Office of Technology Assessment, where he advised Congress on energy efficiency initiatives in the federal gov-

ernment and housing sectors. Dr. Roy received his Ph.D. in civil engineering from Stanford University.

Jill Sherman is the Senior Development Manager at Gerding Edlen Development, and environmentally-conscious real estate development company in Portland, Oregon. Before joining that firm, Ms. Sherman developed affordable housing in the nonprofit sector.

She holds a B.S. in economics from the University of Pennsylvania and a master's in urban studies from Portland State University.

Thank you for being here, Ms. Sherman.

Dr. William Bogart is the Dean of Academic Affairs and Professor of Economics at York College in Pennsylvania. Before joining the faculty at York College, he was Chair of the Economics Department at Case Western Reserve University.

Dr. Bogart is a prolific writer and teacher of economics and finance. He received a Ph.D. from Princeton University.

Welcome, Dr. Bogart.

Jerome Ringo is the President of the Apollo Alliance. He was recently chairman of the National Wildlife Federation, which he represented at the United Nations conference on sustainable development in 1999.

Mr. Ringo was also a delegate to the 1998 global warming treaty negotiations in Kyoto, Japan. He has served as an associate research scholar at Yale University and is currently an official adviser to the Sundance Channel's, "The Green." Mr. Ringo attended Louisiana Technical University and McNeese State University.

Now Congressman Wilson is going to introduce Dr. Wolfe.

Mr. WILSON. Thank you, Chairwoman Woolsey and Ranking Member Price. I appreciate the opportunity to introduce our next witness.

Dr. Clint Wolfe's long scientific and management career includes service as a researcher with Westinghouse Electric Corporation, as lead investigator on nuclear steam generator corrosion issues for Westinghouse, and as manager of the strategic materials technology department at the Savannah River Nuclear Laboratory in my home state of South Carolina, where over 50 percent of electrical generation has been by nuclear, safely, for over 30 years.

Dr. Wolfe has served as the chairman of the technical advisory panel to the Department of Energy's plutonium-focused area. He was instrumental in the establishment of the South Carolina University's research and education foundation.

Dr. Wolfe is also the recipient of the distinguished service award from South Carolina State University, an HBCU, in Orangeburg, South Carolina. The award was in recognition of 17 years of service on the school's education foundation board of directors, including 3 years as chairman of the board.

Dr. Wolfe retired from SRNL in 2005 and became the executive director of Citizens for Nuclear Technology Awareness in Aiken, South Carolina, in January of 2008.

Dr. Wolfe, welcome.

Chairwoman WOOLSEY. Thank you, Congressman.

Kathy Krepcio is the Executive Director of John J. Heldrich Center for Workforce Development at Rutgers University. She also serves as the Project Director of the National Technical Assistance

and Research Leadership Center to promote employment and economic independence for adults with disabilities.

Ms. Krepcio has served as chief of staff in the New Jersey State Office of Information Technology and director for policy and planning at the New Jersey Department of Human Services. She earned a B.A. from Syracuse University and an M.A. from Rutgers.

Welcome, all of you. We are very anxious to hear your testimony. And we will begin with you, Dr. Roy.

**STATEMENT OF ROBIN ROY, VICE PRESIDENT FOR PROJECTS  
AND POLICY, SERIOUS MATERIALS**

Mr. ROY. Chairwoman Woolsey, Ranking Member Price, members of the Committee, thank you for the opportunity to appear here today and share Serious Materials' experience in creating green jobs. Five months ago, the community around Vandergrift, Pennsylvania, woke up to devastating news: The Kensington Windows Plant has shut its doors, throwing about 150 folks out of work.

Some people had worked there for over 30 years. The average tenure was about 20 years. In a small community, it was an absolutely devastating blow.

Serious Materials had already been exploring east coast manufacturers, so we took a look. We looked at the plant, looked at the people; we really liked what we saw. They made high quality products, they had good facilities, good equipment, the workers were highly skilled. It was clear that we could introduce our technology, retool and revise production to make our highly economic, highly efficient products.

Two weeks ago, yesterday, we formally reopened, and now have hired back about 30 of those 150 workers. We were fortunate to have Governor Rendell out on the day 2 weeks ago, and what he said really speaks, I think, very vis-a-vis of this hearing today, so I am going to quote from him:

"This is a great example of the opportunities we have to create a green economy where workers manufacture products that reduce our energy dependence, encourage conservation, save consumers money, and strengthen our national security. We have a skilled workforce, idle factory space, and an infrastructure that can be used quickly to build, install and service products like these. And now we have new resources to invest in these industries and our people to make these projects a reality and rebuild our economy so that we can emerge from this national recession stronger than before."

I think all of those bits of what Governor Rendell said were really quite on target. By the way, we are, as you mentioned, Chairwoman Woolsey, we are also getting skilled workers back to work in Chicago, where another plant shut its doors in December, throwing about 300 people out of work. We have now acquired the assets of that plant, again through the bankruptcy process.

We have completed a great agreement with the union. We have just last week hired back the first several workers, and we plan to reopen in the next several weeks. We will keep you up to date on how all that progresses.

So what is it that we are doing? Serious Materials develops advanced green building products that save energy, save money, improve occupant comfort, and address climate change. That creates jobs in the process. I think it is fair to say that every Serious Materials job is a green job for that reason.

But beyond just the jobs that are created, our products contribute to economic health, saving more than it costs to produce and install them. I think that is very important. For example, replacing windows has generally not been regarded as cost effective—for example, in low-income weatherization—but our highly-insulating, low-cost windows technology actually changes that. Windows replacements are now cost effective for widespread installation in low-income weatherization, and in public and assisted housing, and in federal, state, and municipal buildings in many cities and many housing and building types.

These are all areas which are supported by the Recovery Act, you may notice, as well as private investment in various energy efficiency retrofits ordered by the tax credit—

It is certainly the case that the Recovery Act and the deliberations leading to it gave us great confidence in our efforts to acquire and restart both the Pennsylvania and Chicago plants.

More importantly though, looking forward, effective implementation of the Recovery Act and energy efficiency provisions is going to allow us to bring the staffing levels back up to where they were when those plants shut their doors and beyond, and bring production up there and beyond. It is enormously important that we get that effective implementation of the Recovery Act.

We are going to be able to hire up much more rapidly than we otherwise would have. We had always intended to expand to the East Coast and the Midwest, but now we will be able to do that very quickly—much, much more quickly than we would have otherwise.

There is an enormous amount of work to be done to deliver on the opportunities that are presented by the Recovery Act, both to create near-term jobs and also to deliver on the longer-term economic health, energy security, and environmental imperatives that we are facing. A lot of the work is administrative implementation of the Recovery Act; there is a lot that needs to be done. We are confident that it can all get done, but it needs to be moved on quite promptly and effectively.

A lot of the work just happens to be regular business activity as we hire up and retool and get our equipment going, get our suppliers and supply chains and our downstream going. There are also some legislative issues which seem like they are—they come up and have to be addressed over time. But we are confident that it all can go well, and we expect it to all go well. We are planning to have staffing at about 1,000 by the end of this year making high quality gear.

Now, I know there is interest in this Committee on job training issues. For us, as manufacturers of a product, job training is not the key focus in our facility. We are rehiring, mainly, of folks who have been put out of work that are already highly skilled. So it is not the critical issue for us.

That said, we know that downstream job training is vital in installation of our products, both our windows and our super-efficient drywall, things of that nature. Certainly in low-income weatherization we need a lot of auto skills—

And I can stop with that.

[The statement of Mr. Roy follows:]

**Prepared Statement of Robin Roy, Ph.D., Vice President,  
Serious Materials, Inc.**

Chairwoman Woolsey, Ranking Member Price, and members of the Committee, thank you for the opportunity to appear here today and share Serious Materials' experience.

*Serious Materials manufactures green products*

Founded in 2002, Serious Materials, Inc. develops and manufactures advanced green building materials that save energy, save money, improve occupant comfort, and address climate change. As a result, it would be fair to say that every Serious Materials job is a green job.

Our products include:

- **Serious Windows:** high-performance insulated windows that are up to four times more energy efficient than required for Energy Star listing. In fact, SeriousWindows already exceed the proposed Energy Star standards for the year 2013. With our acquisition of Alpen Windows in 2008, we now have more than 27 years of high-performance windows manufacturing experience, and have supplied windows and glass to 10,000 projects nationwide.

- **ThermaRock:** a unique aerogel-drywall product that provides high levels of insulation for space-constrained locations. For example, adding a  $\frac{5}{8}$  inch ThermaRock panel to an uninsulated brick wall can increase the thermal performance from about R-1 to about R-5.

- **QuietRock & QuietHome Windows:** soundproofing products which can reduce material use, enhance livability, and support denser, more sustainable urban development.

- **EcoRock:** an environmentally superior alternative to standard gypsum drywall, which uses 80% less energy to manufacture, and contains 80% postindustrial recycled material, including waste from steel and cement plants.

In addition to delivering unprecedentedly high performance, Serious Materials also uses advanced technology to drive down costs to unprecedented levels. The combination of high performance and lower costs makes our breakthrough products cost-effective in many applications where previously, savings didn't justify the costs.

For example, replacing windows has generally not been regarded as cost-effective for use in the low income weatherization assistance program. However, our highly insulating, low cost windows change that, and are cost-effective for wide-spread installation in low income weatherization in many cities and housing types. This is a major step forward delivered by the use of advanced technology. Similarly, insulating the walls of many older masonry buildings was often infeasible due to the indirect cost of consuming precious interior space. ThermaRock, with a thickness of  $\frac{5}{8}$  inch, provides an unprecedented insulation option which can be cost-effective in many applications. Notably, these advanced technologies do not require novel installation practices or labor skills.

*Serious Materials manufacturing facilities*

Serious Materials currently manufactures in four locations across the United States:

- Sunnyvale, California;
- Newark, California;
- Boulder, Colorado; and
- Vandergrift, Pennsylvania.

We will open our fifth plant, in Chicago, Illinois in the next several weeks.

The Vandergrift and Chicago plants provide excellent examples of putting skilled manufacturing workers back on the job.

*Back on the job, manufacturing in Vandergrift, PA*

The former Kensington Windows plant in Vandergrift, PA shut its doors in October 2008, putting over 150 people out of work after its parent company filed for bankruptcy. We looked at the plant and its people, and liked what we saw. Kensington Windows had manufactured high quality windows using the latest tech-

nology and high quality components. The average tenure of the work force was 18 years, with 9 percent having more than 30 years with the company. It was clear that we could revise the production to focus on highly insulating windows, and quickly introduce our cost and performance enhancing technology. The location was also excellent, allowing us to conveniently deliver products and service to the east, mid-Atlantic and central regions.

Serious Materials acquired the assets at the end of January 2009, through the bankruptcy process. We've rehired 30 of the former workers, and target getting back to a workforce of 150 by year's end.

On March 16, Governor Rendell keynoted the official ribbon cutting ceremony at the plant. As noted by the Governor:

"This is a great example of the opportunities we have to create a green economy where workers manufacture products that reduce our energy dependence, encourage conservation, save consumers money, and strengthen our national security. Similar opportunities exist across Pennsylvania. We have a skilled workforce, idle factory space and an infrastructure that can be used quickly to build, install and service products like these windows or energy efficient appliances. \* \* \* And, now, with the support of President Obama's American Recovery and Reinvestment Act, as well as our own state programs, we have new resources to invest in these industries and our people to make these projects a reality and rebuild our economy so that we can emerge from this national recession stronger than before."

There is a real, personal side to this, as best described by Robin Scott, one of first rehired workers and life-long area resident:

"When I was told Serious Materials was going to buy the place [Kensington] I was on cloud nine. I want my kids to recognize the bright future they can have in our country and what better example is there than giving our workforce a fighting chance during rough times. You can practically taste the excitement in the air—not only from Kensington employees but also from everyone in Vandergrift—it just feels like a huge relief for everyone."

#### *Getting back on the job, manufacturing in Chicago, IL*

Republic Windows garnered national attention in December 2008 when it suddenly closed its doors, declared bankruptcy, and left 300 people unemployed just before the holidays. As in Vandergrift, we looked at the plant and its people, and liked what we saw. We worked closely and productively with the union, United Electrical Workers, through the bankruptcy process. At the end of February 2009, Serious Materials acquired the assets of the former Republic Windows and Doors in Chicago, Illinois through the bankruptcy process.

I'm delighted to note that Serious Materials has completed an agreement with the union, and the Chicago plant will have union representation. We've just hired back the first few employees, and are planning to reopen in the next several weeks.

Vice President Biden commented on Serious Materials plans for the Chicago factory:

"The reopening of this factory and the rehiring of these workers provide an excellent example of how the money in the Recovery Act is targeted to spur job creation quickly," said Vice President Biden. "These workers will not only earn a paycheck again; they will go back to work creating products that will benefit America's long-term economic future."

We'll keep the committee informed on our progress in reopening.

#### *Effective implementation of ARRA is essential*

It will take some time, but Serious Materials intends to return to and exceed the former production and employment levels of the Chicago and Vandergrift plants. We are also expanding production and jobs at our other facilities in California and Colorado. These are all green jobs.

Effective implementation of American Recovery and Reinvestment Act energy efficiency measures is essential to our plans. It will allow us to expand operations and hire up far more rapidly than would be possible without it. This will bring more jobs not just at the factory, but also in installation, and for our upstream suppliers.

ARRA supports implementation of cost-effective energy efficiency measures in several areas:

- In private homes, with Sec 25C tax credits
- In low income weatherization
- In refurbishment of public and assisted housing
- In refurbishment of schools
- In improving other local, state and federal buildings

There is a great deal of work to be done to deliver on the opportunities presented by ARRA to both create near-term jobs and deliver on longer term economic health, energy security, and environmental imperatives.

We are working with our suppliers, customers, and other interested parties across a wide range of implementation issues.

There are also a number of important administrative issues to be addressed promptly and effectively. For example, the software models used to assess the cost and performance of measures in the Weatherization Assistance Program (e.g., the National Energy Audit Tool) urgently require updating and correction through the Department of Energy. Also regarding WAP, some administrative guidance will be needed from the Department of Labor. With respect to Energy Star, the Department of Energy has recently proposed strengthening the criteria for windows in a two-phase process. Phase I was urgently needed to catch up to code requirements already existing in many states, and to the market. Phase II is also urgently needed to restore Energy Star's leadership position. These are but three examples of many needed activities, none of which are unworkable, but all of which must be addressed.

On the legislative front, I note that a bill has been introduced to roll back the stringent energy saving requirements that ARRA established as a condition of receiving residential tax credits. In our view, rolling back those stringent criteria would be a significant misstep. The Recovery Act's higher performance standards require manufacturers to lift their game in order to benefit from taxpayer funds, but can be readily achieved using existing technology. Our products, and those of several of our competitors already meet the Recovery Act requirements for high performance. Shifting production to higher performance items will deliver near term benefits for jobs and the economy, and as importantly, deliver longer term benefits for energy security, the environment, and consumers. The higher standards also encourage American innovation, by clearly rewarding better-performing products. This hinges on continued support for raising the bar on energy saving windows. Unraveling the higher standards that were established in the Recovery Act would result in taxpayer dollars being wasted on unnecessarily inefficient products, and discourage innovation.

*The importance of job training*

Serious Materials manufacturers green building products for installation and use by others downstream. For the foreseeable future, we anticipate rehiring skilled workers, and job training is not a critical issue.

However, we recognize the urgent need for specialist installers downstream of our manufacturing work. Installation should provide good jobs both for skilled installers and for entry level helpers, who can then be on a track to become a skilled installer. Because window installation is a specialized activity and must be done in an effective, logistically efficient manner, we maintain on our team a certified trainer who regularly conducts courses suitable for all skill levels. We offer this training service to our customers and others, and anticipate that some may build such services into their training programs, both for entry level and higher skilled workers.

Thank you again for the opportunity to appear here today, and I look forward to your questions now and at any time.

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Chairwoman WOOLSEY. Thank you very much.  
Ms. Sherman?

**STATEMENT OF JILL SHERMAN, GERDING EDLEN  
DEVELOPMENT**

Ms. SHERMAN. Chairwoman Woolsey and members of the Committee, thank you very much for the opportunity—

Chairwoman WOOLSEY. Can you put your microphone a little closer to you?

Ms. SHERMAN. Sure. How is that?

Thank you for the opportunity to speak with you today about what we believe is a huge economic development opportunity. Although conditions are nothing short of brutal in today's real estate industry—and you typically don't hear real estate and opportunity

being talked about in the same sentence—at Gerding Edlen, we do see, along with the significant challenges, enormous opportunity.

Gerding Edlen Development has been working in the green building development business for over 15 years. We are an Oregon-based company with offices in Seattle and Los Angeles. For over a decade, our company has led the nation in developing highly sustainable, transit-oriented, mixed use urban high rise projects. We have more U.S. Green Building Council LEED certified buildings than any other firm, with 39 either certified or in the process of certification, including seven platinum and 24 gold rated buildings.

Along the way, with the help of our talented partners, we have pioneered numerous energy, water, and sewage innovations. For example, we recently completed a high rise office building where not only are we using 63 percent less energy than a typical building designed to meet code, but we also took the entire building off the municipal sewer system. So we are not connected—that building is not connected to the sewer because we process 100 percent of the storm, grey, and black water and actually recover more water than we can use in that building.

Today, the buildings that we develop consume 50 percent less energy than a code-compliant building and between 30 and 50 percent less water. We estimate that throughout our portfolio, we have reduced carbon emissions by over 7,500 metric tons annually and reduced energy consumption by 61 megawatts a year. Our current objective, though, is to develop buildings that actually produce more energy than they use and produce no waste—what we call net zero buildings.

In the aggregate, our projects to date represent almost \$5 billion worth of economic activity and literally tens of thousands of family wage jobs with skill sets ranging from finance, to engineering, to design, to highly-skilled union craftspeople in the field, to Americans working in factories producing doors, windows, conduit, steel, and the like.

However, new construction is only the tip of the iceberg. There are millions of commercial, education, medical, and other very large buildings across the country that are energy and water hogs—buildings that are needlessly wasting energy and desperately need retrofitting. And this is where we believe the current opportunity lies.

Rather than putting a new roof on a building, why not add solar panels and cogeneration facilities to generate energy? Why not install day lighting sensors, occupancy sensors, and new lighting systems to reduce lighting loads and therefore use less electricity?

Instead of replacing a broken sink or toilet, we can replace all of the plumbing fixtures and reduce water demand by 30 to 50 percent while also reducing the sewage outflow. Instead of fixing a broken window, why not replace all the outdated windows with—Mr. Roy’s—energy efficient glazing manufactured here in the United States?

We can do all of this very quickly—in fact, years faster than we can develop new buildings. Within a matter of weeks we can have architects and engineers hired who can survey the buildings, prepare drawings, pull required permits, and within 60 to 90 days we



could have tens of thousands of highly-skilled craftworkers in the field executing the work, and for the most part completing that work by the end of the summer of this year.

Am I doing something wrong? Okay.

This would create family wage jobs at multiple levels ranging, again, from engineers to designers to factory workers to skilled craftworkers on jobsites. The resulting job skills will have lasting demand as we move towards a new economy wherein we value resource efficiency and move away from unstable imported energy sources.

In closing, I just want to thank you again for having me here today and to the fact that we are having this discussion at this critical time, and emphasize that now is the time to take advantage of the opportunity and take a leap forward towards a more sustainable future where we can create tens of thousands of very high-skill jobs that can lift the economy, create a new foundation for the nation—a foundation that is good for both the economy, the environment, as well as people. And I look forward to answering any questions.

[The statement of Ms. Sherman follows:]

#### **Prepared Statement of Jill Sherman, Gerding Edlen Development**

Chairwomen Woosley and Members of the Subcommittee, thank you for the opportunity to speak with you today about what we believe is a huge economic development opportunity. Although conditions are nothing short of brutal in today's real estate industry, at Gerding Edlen, we see, along with the significant challenges, enormous opportunity. Gerding Edlen Development has been working in the Green Building Development business for over 15 years. We are an Oregonbased company with offices in Seattle and Los Angeles. For over a decade, our company has led the nation in developing highly sustainable, transit oriented, mixed use urban high rise projects. We have more US Green Building Council LEED certified buildings than any other firm, with 39 either certified or in the process of certification, including seven platinum and 24 gold rated buildings.

Along the way, with the help of our talented partners, we have pioneered numerous energy, water and sewage innovations. For example, we recently completed a high rise office building where not only are we using 63% less energy than a building designed to code, but we also took the entire building off the municipal sewer system. So, we are not connected to the sewer because we process 100% of our storm, grey and black water and actually recover more water than we can use in the building. Today the buildings we develop consume 50 percent less energy than a code compliant building and between 30% and 50% less water. We estimate that throughout our portfolio we have reduced carbon emissions by over 7,500 metric tons annually and reduced energy consumption by 61 mega watts per year. Our current objective is to develop buildings that actually produce more energy than they use and produces no waste, what we call net zero buildings.

In the aggregate, our projects to date represent almost \$5 billion worth of economic activity and literally tens of thousands of family wage jobs with skill sets ranging from finance, to engineering to design to highly skilled union craftspeople in the field, to Americans working in our factories producing doors, windows, conduit, steel and the like. However, new construction is only the tip of the iceberg. There are millions of commercial, educational, medical and other very large buildings across our country that are energy and water hogs. Buildings that are needlessly wasting energy and desperate need retrofitting; and this is where we believe the current opportunity lies. Rather than putting a new roof on a building, why not add solar panels and cogeneration facilities to generate energy? Why not install day lighting sensors, occupancy sensors, and new lighting systems to reduce lighting loads and therefore electrical demand? Instead of replacing a broken sink or toilet, why not replace all of the plumbing fixtures and reduce water demand by 30 to 50%, while also reducing the sewage outflow? Instead of fixing a broken window, why not replace all of the outdated windows with new energy efficient glazing that is manufactured here in the US?

We can do all of this very quickly, in fact years faster than we can develop new buildings. Within a matter of weeks we can have architects and engineers hired who can then survey buildings, prepare drawings and pull the required building permits within 60 to 90 days. Then we can have tens of thousands of highly skilled craft workers in the field executing the work and for the most part completing that work by the end of the summer of this year. This would create family wage jobs at multiple levels ranging from engineers and designers, to factory workers to skilled craft workers on jobsites. The resulting job skills will have lasting demand as we move towards a new economy wherein we value resource efficiency and move away from unstable imported energy sources.

In closing, I just want to commend your leadership on this issue and emphasize that now is the time to take advantage of this opportunity and take a leap forward toward a more sustainable tomorrow creating tens of thousands of high skill jobs that will not only lift this economy, but will create a new foundation for our nation, a foundation that is good for the economy, good for the environment and good for people. I look forward to answering any questions.

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Chairwoman WOOLSEY. Thank you very much.  
Dr. Bogart?

**STATEMENT OF DR. WILLIAM T. BOGART, DEAN OF ACADEMIC  
AFFAIRS AND PROFESSOR OF ECONOMICS, YORK COLLEGE**

Dr. BOGART. Madam Chairman, members of the Committee, I am honored to testify today. An aggressive push for a green economy is underway in the United States. Many people assert that green jobs can simultaneously improve environmental quality and reduce unemployment. These assertions are used to justify spending billions of dollars to subsidize preferred industries or technologies.

The recent revelations regarding the misuse of federal government subsidies by AIG provide a warning of how large-scale spending without sufficient due diligence can be misdirected. Today's testimony is organized around five questions that should be asked of those who would like to spend money subsidizing the creation of green jobs.

Question One: What is the net increase in jobs or energy produced? The most prominently cited estimates of jobs created do not estimate the number of jobs that would be destroyed as a result of a move from current energy technology to alternative energy production. Many green jobs are substitutes for existing jobs. An increase in electricity generation from wind or other sources will substitute for energy from, say, coal, which, in turn, will then reduce employment in coal mining and processing.

Question Two: What are the assumptions? The advocates for green jobs expenditures claim that their programs will have a large impact. This claim rests on economic multiplier analysis. Multipliers are based on the idea that an increase in activity by one firm will lead to an increase in activity by other firms. Multipliers are difficult to observe and must be estimated typically by a modeling technique known as input-output analysis.

Input-output analysis relies on two key assumptions, neither of which holds for green jobs. The first assumption is that the ratio of outputs to inputs is constant; in other words, no change in technology. The assumption that technological progress will operate favorably for wind, solar, and other preferred approaches while not operating for oil, gas, coal, and nuclear power is evidence that the jobs estimates are created using an inappropriate methodology.

The second crucial assumption for input-output analysis is that there are fixed prices over time. That is unlikely to be the case for green jobs since the key justification for public support for green technology is that oil and coal will become more expensive, either for technological reasons or because of a tax based on carbon dioxide emissions.

Question Three: What makes a job “green”? Being green differs depending on who is doing the classification. For example, a report from the U.S. Conference of Mayors counts current nuclear power generation jobs as green jobs, yet does not count future jobs in nuclear power as green jobs. The United Nations has a definition that includes steelworkers who produce parts for wind turbines regardless of the greenness of the steel production.

These definitional issues are not simply inconveniences that make it impossible to compare the claims of different reports. More importantly, they represent a fundamental confusion about the idea of a green job—a confusion that must be resolved before committing taxpayer dollars. The lack of transparency about the assumptions underlying various definitions provide incentives for special interest groups to have their jobs designated as green while excluding their rivals from the favored designation.

Question 4: What is the added value from the job? One problem with the green jobs literature is it consistently counts jobs as a benefit rather than as a cost to the consumer. The purposes of all businesses, green or not, is not to use resources but to produce goods and services desired by consumers that could be sold for more than the cost of production. Many jobs created in response to government mandates are not a benefit but rather a cost from the consumer’s viewpoint. Such costs may be worth incurring for the benefits from the program, but they should be counted correctly.

Promoting inefficient use of labor and thereby raising consumer prices will steer resources towards technologies, firms, and industries that will be unable to compete without ongoing subsidies. Dooming the environmentally-friendly sector to an unending regime of subsidies is fiscally irresponsible and harmful to any efforts to build a competitive and environmentally-friendly economy.

Question 5: How are technologies being chosen? The green jobs literature is selectively optimistic about favored approaches and pessimistic about disfavored ones. However, the premise that reorienting our economy in a greener direction by shifting to sustainable energy production is questionable because most jobs in renewable energy sectors appear to be subsidy-driven. Indeed, U.S. subsidies for renewable energy projects are so attractive that in 2008, BP announced that it dropped plans to build wind farms and other renewable projects in Britain; instead it is shifting its renewable programs to the United States, where government incentives for clean energy projects provide “a convenient tax shelter for oil and gas revenues,” as a BP spokesman noted.

Royal Dutch Shell also announced it was abandoning wind energy products in Britain in favor of the U.S. These developments lend support to the idea that renewable energy is viable only when spenders are bribed by taxpayer support or coerced by a mandate.

To attempt to transform modern society in the way proposed by the green jobs literature is an effort of staggering complexity and

scale. There will be significant opportunity to develop new energy sources, new industries, and new jobs. I am confident that a market-based discovery process will do a better job of developing those industry sources—energy sources, industries, and jobs than a series of mandates or subsidies based on imperfect information and hidden assumptions.

Thank you for giving me the opportunity to testify today, and I would be happy to answer any questions.

[The statement of Dr. Bogart follows:]

**Prepared Statement of William T. Bogart, Dean of Academic Affairs and  
Professor of Economics, York College of Pennsylvania**

Madam Chairman, members of the Committee, I am honored to testify before your Committee today on the question of green jobs and their role in our economic recovery.

An aggressive push for a green economy is well underway in the United States. Many people routinely assert that “green jobs” can simultaneously improve environmental quality and reduce unemployment. These assertions are used to justify spending billions of dollars to subsidize preferred industries or technologies. The recent revelations regarding the (mis)use of Federal government subsidies by AIG provides a warning of how large-scale spending without sufficient due diligence can be misdirected. Before we repeat that experience in another industry, we should perform sufficient due diligence. Today’s testimony is organized around five questions that should be asked of those who would like to spend money subsidizing the creation of “green jobs.”<sup>1</sup>

*Question 1: What is the net increase in jobs/energy produced?*

The most prominently cited estimates of jobs<sup>2</sup> created do not estimate the number of jobs that would be destroyed as the result of a move from current energy technology to alternative energy production. Many green jobs are substitutes for existing jobs. An increase in electricity generation from wind, solar, or other sources will substitute for energy from, say, coal-fired generation, which in turn will reduce employment in coal mining and processing. The net impact on employment will depend on the relative labor intensity of energy production in the respective sectors at the margin of added or subtracted production.

The labor intensity—the labor required per unit of energy produced—is much higher in the green jobs sector. Advocates point to this higher labor requirement as a benefit because it will tend to increase employment. However, this confuses an end (goods and services valued by consumers) with a means (labor). If the cost of energy increases as a result of inefficient production, then the net benefits available to the citizens of the United States decreases. Many goods become more costly and American producers become less competitive in world markets. The efficiency of energy use has increased dramatically over time, which is one reason for our high productivity and standard of living. It would be a mistake to discard this proven record of progress in favor of untested, costly alternatives.

Even in the favored green industries, increasing labor efficiency has been an important component in making the technologies more commercially viable. For example, corn-based ethanol cost reductions in the United States have been driven in part by economies of scale in farm operations and the advanced technology necessary to convert corn into ethanol. If instead we had thousands of workers diligently squeezing corn by hand we would not produce more biofuel but we would vastly inflate the number of green jobs and dramatically increase the cost of the fuel.

Many green jobs reports start with the assumption that spending public money is the source of the additional economic activity. However, that expenditure comes from higher taxes now or in the future. Because people engage in activities to avoid taxation, the cost of the tax exceeds the revenue yielded by the tax, a phenomenon known as deadweight loss. Such actions are wasteful but they are an unavoidable part of any tax policy. Including deadweight loss in the analysis of the supposed value of green jobs created by increased public spending will reduce the net benefit of the subsidy. The green jobs advocacy literature does not incorporate such estimates, which implies that their results overstate the benefits. The most glaring oversight is that these issues are not even mentioned in the literature.

*Question 2: What are the assumptions?*

The advocates for green jobs expenditures claim that their programs will have a large impact because of the added jobs and other benefits created as those hired into green jobs spend their paychecks. This claim rests on economic multiplier analysis. Multipliers are based on the idea that an increase in activity by one firm will lead to an increase in activity by other firms. For example, the contractor for a new football stadium buys concrete, the concrete subcontractor buys new tires for its trucks, all the firms' workers go out to dinner, and so forth. Multipliers are difficult to observe and must be estimated by indirect means, usually a modeling technique known as input-output analysis.

Input-output analysis relies on two key assumptions, neither of which can be made for green jobs. The first is constant coefficients production, which means that the ratio of outputs to inputs is constant regardless of the scale of production or the time period. This eliminates the possibility that inputs may be substituted for each other, either because of technical progress or because of changes in factor prices. For example, a typical assumption would be that if a dollar of energy was required to produce \$10 of steel at the time the input-output table was created, then this relation will continue to hold. In reality, if the price of energy increases, the relation is likely to change as higher energy prices induce steel producers to change production techniques to reduce the energy used per unit of steel. Since green jobs proponents concede that green energy will cost more per unit than conventional fuels,<sup>3</sup> the ratio of energy costs to production is not constant and this assumption is violated. The assumption that technological progress will operate favorably for wind, solar, and other preferred approaches while not operating for oil, gas, coal, and nuclear power is *prima facie* evidence that the jobs estimates are created using an inappropriate methodology.

The second crucial assumption for input-output analysis is that the relationship between production factor prices is constant. In most cases, the relation between inputs and outputs is calculated using dollar values rather than physical quantities. This approach is valid only if the physical quantities and the monetary values have a constant ratio, in other words if there are fixed prices over time. That is unlikely to be the case for green jobs since a key justification for public support for green technology is that oil and coal will become more expensive, either for technological reasons or because of a tax based on carbon dioxide emissions. Because of the pervasive role of energy, such changes would alter factor prices throughout the economy, again making the input-output analysis inappropriate.

*Question 3: What makes a job "green"?*

There is no standard definition of a green job. According to the studies most commonly quoted, green jobs pay well, are interesting to do, produce products that environmental groups prefer, and do so in a workplace that is unionized or expected to be unionized in the near future. Such criteria have little to do with the environmental impacts of the jobs.

Being green differs depending on who is doing the classification. In an odd twist, the Conference of Mayors report (p. 12) counts current nuclear power generation jobs as green jobs, yet does not count future jobs in nuclear power as green jobs. The United Nations report excludes all nuclear power related jobs and many recycling jobs, while at the same time expanding their definition in other areas by including all jobs asserted to "contribute substantially to preserving or restoring environmental quality." (p. 3) The UN version of green jobs is extended to include jobs in the supply chain. For example, wind turbine towers involve large amounts of steel and so employment in the steel industry counts so long as the steel ends up in a turbine. The steel jobs themselves are not required to have a low environmental impact, it is sufficient that the steel produced goes to a favored product. As a result, important value judgments are embedded in the definitions and not explained.

These definitional issues are not simply inconveniences that make it impossible to compare the claims of different reports. More importantly, they represent a fundamental confusion about the idea of a green job, a confusion that must be resolved before committing taxpayer dollars. The lack of transparency about the assumptions underlying various definitions provide incentives for special interest groups to have their jobs designated as green while excluding their rivals from the favored designation.

*Question 4: What is the added value from the job?*

One problem with the green jobs literature is that it consistently counts jobs as a benefit rather than a cost. The purpose of a business, green or not, is not to use resources but to produce a good or service desired by consumers that could be sold for more than the cost of production. For a given level of output, businesses that

use more resources are less efficient—have higher costs—than those using fewer resources. Many jobs created in response to government mandates are not a benefit of the program but rather a cost. Such costs may be worth incurring for the benefits a program produces, but they must be counted as costs not benefits.

The Conference of Mayors report includes lawyers and administrators of regulations as benefits of green jobs spending. This is analogous to claiming an increase in prison guards as a benefit of the war on drugs. By making labor the end, rather than treating labor as the means to production of environmentally friendly goods and services, the literature makes a foundational error. Promoting inefficient use of labor will steer resources towards technologies, firms, and industries that will be unable to compete in the marketplace without ongoing subsidies. Dooming the environmentally friendly sector to an unending regime of subsidies is fiscally irresponsible and harmful to any efforts to build a competitive and environmentally friendly economy.

Many of the benefits of producing products accrue to the owners of the intellectual property underlying the products. In the case of wind power, most of the patents and other key intellectual property are held by European firms. We import the high value parts of the process, and Americans perform the relatively low value operations of assembly and installation. This is analogous to the situation in much U.S. manufacturing in which Chinese firms perform assembly work but U.S. firms capture most of the value.

*Question 5: How are technologies being chosen?*

The green jobs literature calls for massive shifts in power generation technologies. The literature is selectively optimistic about favored approaches (wind, solar, biomass) and pessimistic about disfavored ones (coal, nuclear). However, the premise that reorienting our economy in a greener direction by shifting to “sustainable” energy production is questionable because most jobs in renewable energy sectors appear to be subsidy driven. For example, a study done for the American Wind Energy Association and the Solar Energy Research and Education Foundation estimated that if the investment tax credit for solar/photovoltaic projects and the production tax credit for wind energy were not renewed at the end of 2008, then those industries could lose 77 percent of their jobs.<sup>4</sup>

Indeed, U.S. subsidies for renewable energy projects are so attractive that in 2008, BP announced that it dropped plans to build wind farms and other renewable projects in Britain; instead it is shifting its renewable programs to the United States, where government incentives for clean energy projects provide “a convenient tax shelter for oil and gas revenues,” as a BP spokesman noted.<sup>5</sup> Royal Dutch Shell also announced it was abandoning wind energy projects in Britain in favor of the U.S.<sup>6</sup> In Germany, environmental advocates are arguing that wind power is an inefficient and ineffective method of reducing CO2 emissions.<sup>7</sup> These developments lend support to the idea that renewable energy is viable only where there is taxpayer support or mandates.

To attempt to transform modern society in the way proposed by the green jobs literature is an effort of staggering complexity and scale. To do so based on wishful thinking and bad economics would be the height of irresponsibility. There will be significant opportunities to develop new energy sources, new industries, and new jobs in the future. I am confident that a market-based discovery process will do a far better job of developing those energy sources, industries, and jobs than a series of mandates or subsidies based on imperfect information and hidden assumptions.

Thank you for giving me the opportunity to testify today. I would be happy to answer any questions.

ENDNOTES

<sup>1</sup>This testimony is based on research conducted jointly with Andrew Morriss, Andrew Dorchak, and Roger Meiners, “7 Myths About Green Jobs” available at <http://papers.ssrn.com/sol3/papers.cfm?abstract=id=1357440> and “Green Jobs Myths” available at <http://papers.ssrn.com/sol3/papers.cfm?abstract=id=1358423>.

<sup>2</sup>United States Conference of Mayors, U.S. METRO ECONOMIES: CURRENT AND POTENTIAL GREEN JOBS IN THE U.S. ECONOMY, 2008; American Solar Energy Society, RENEWABLE ENERGY AND ENERGY EFFICIENCY: ECONOMIC DRIVERS FOR THE 21ST CENTURY, 2007; Center for American Progress, GREEN RECOVERY: A PROGRAM TO CREATE GOOD JOBS AND START BUILDING A LOW-CARBON ECONOMY, 2008; United Nations Environment Program, GREEN JOBS: TOWARDS DECENT WORK IN A SUSTAINABLE, LOW-CARBON WORLD, 2008.

<sup>3</sup>For example, the study from the Center for American Progress (p. 6) notes that \$1 million spent on solar energy will currently produce considerably less energy than \$1 million spent on oil.

<sup>4</sup>Navigant Consulting, Economic Impacts of the Tax Credit Expiration. Prepared for the American Wind Energy Association and the Solar Energy Research and Education Foundation, 13 February 2008, Navigant Consulting, Bedford, MA.

<sup>5</sup>Terry Macalister, Blow to Brown as BP scraps British renewable plan to focus on US, THE GUARDIAN (7 November 2008).

<sup>6</sup>Danny Fortson, Shell to quit wind projects, THE SUNDAY TIMES (7 December 2008).

<sup>7</sup>Anselm Waldermann, Wind Turbines in Europe Do Nothing for Emissions-Reduction Goals, SPIEGEL ONLINE INTERNATIONAL (10 February 2009), <http://www.spiegel.de/international/business/0,1518,606763,00.html>.

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Chairwoman WOOLSEY. Thank you very much.  
Mr. Ringo?

**STATEMENT OF JEROME RINGO, PRESIDENT,  
THE APOLLO ALLIANCE**

Mr. RINGO. Thank you very much, Madam Chair and members of the Committee, for inviting me to testify.

We face many challenges today, some of which are foreign oil dependency, puts our national security and economy future at risk. We face the collapse of a financial sector and growing threats of global warming and all its economic, environmental, and human costs.

Since 2003, the Apollo Alliance has been talking about economic stimulation through green jobs, and under the umbrella addresses climate change and energy independence. We believe our nation can and must achieve a triple bottom line: energy security, climate stability, and broadly-shared economic prosperity. The message of the Apollo Alliance has been working for 6 years—the message of clean energy, good jobs, and now the economic message of our time.

Green collar jobs are well-paid career-track jobs that contribute directly to preserving or enhancing environmental quality. They run the gamut from low-skill, entry-level positions to high-skill, higher-paid jobs, and include opportunities for advancement in both skill and wages.

Green collar jobs tend to be local. Building retrofits, solar panel repairs, transit line construction—these jobs can not be outsourced. Many manufacturing jobs can be green collar jobs if we start making the input of the clean energy economy here. There are 750,000 green collar workers in America today, according to Leo Gerard, the president of the United Steelworkers of America, and Michael Peck, the CEO of Gamesa, which is a wind turbine manufacturing facility in Pennsylvania.

Every new American bill creating demand for renewable energy and energy efficiency services creates new jobs overseas even though we have a robust manufacturing infrastructure and a skilled workforce here. Fully half of America's existing wind turbines are manufactured overseas, and we rank fifth among countries that manufacture solar components, even though the solar cells were born in America.

Congress can take advantage of this incredible opportunity to strengthen and expand America's middle class by boosting our energy manufacturing sector. Congress can do this, for example, by helping the clean energy manufacturing supply chain retool and retrain to create a clean energy manufacturing supply and ensuring labor and domestic content standards are included.

I have included as part of the written testimony a letter signed by the Apollo Alliance and business supporters and will be sent to congressional leadership. The letter makes the case for why we must invest in domestic manufacturing and ensure that clean energy products are made in America. Apollo will be rolling out our manufacturing proposal in late April and sending a delegation to our state and local coalition members to meet with our congressmen over the break—over the Spring Break.

We are more likely to build a new energy future with good jobs for working Americans if we ensure any new energy policy is an investment strategy as well as a regulatory strategy. Thank you for this opportunity to testify.

[The statement of Mr. Ringo follows:]

**Prepared Statement of Jerome Ringo, President, the Apollo Alliance**

Chairwoman Woolsey and members of the subcommittee, thank you for inviting me here today to talk about an issue of crucial importance to our nation's future.

For Americans this is a time of daunting challenges and boundless opportunities. We have become more and more dependent on foreign oil, putting our national security and economic future at risk. We have seen a collapse of the financial sector that has had rippling effects on the rest of the American economy. And we have seen the growing threat of climate instability and all its economic, environmental and human costs.

Nevertheless our energy, climate, and economic crises also present tremendous opportunities. The Apollo Alliance offers a unique perspective on the issue before this committee, "Green Jobs and their Role in Our Economic Recovery." As a coalition of labor, business, environmental, and social justice leaders and organizations, we believe our nation can and must achieve a triple bottom line: energy security, climate stability, and broadly shared economic prosperity. My goal today is to illustrate how clean energy and good jobs go hand in hand.

In 2003, the Iraq War impressed upon the country the need for energy security, and the climate change debate was in full force. The founders of the Apollo Alliance believed they could capture the interest of the Bush administration by talking about economic stimulation through green jobs, and under that umbrella, address climate change and energy independence. They catalyzed the conversation about green-collar jobs and tried to impress upon the powers that be that the polemical discussion that pitted jobs against the environment was false and old. The past administration didn't want to listen. But change has come and President Barack Obama understands that investment in a clean energy economy means jobs and economic prosperity.

Last time I was in Washington, D.C. something happened that made me so excited. It was when President Obama signed the executive order on middle class communities. He walked up to me and grabbed my hand. I said, "Mr. President, I'm Jerome Ringo." He said, "I know who you are. You're the president of Apollo Alliance. You guys are doing great work. Keep up the good work."

The reason why I was so excited is that the message the Apollo Alliance has been working on for six years—the message of clean energy, good jobs—is now the economic message of our times.

The Apollo Alliance's comprehensive economic development strategy, The New Apollo Program, recognizes that great challenges bring with them great opportunity. We say no to business as usual and yes to a new path that will build a clean energy economy that creates millions of jobs—high-quality jobs that pay decent wages and support families. We say yes to a climate stability agenda that also strengthens national security. The Apollo Alliance estimates that an ambitious \$500 billion in federal spending over 10 years would create over 5 million jobs. This includes a broad range of activities such as building efficiency, renewable energy investments, smart growth, advanced grid technology, research and development initiatives and a "cap and invest" program to reduce climate change pollution.

What are green-collar jobs? Green-collar jobs are well-paid, career track jobs that contribute directly to preserving or enhancing environmental quality. They run the gamut from low-skill, entry-level positions to high-skill, higher-paid jobs, and include opportunities for advancement in both skills and wages.

Green-collar jobs tend to be local. Building retrofits, solar panel repairs, transit line construction—these jobs can't be outsourced. Most of these jobs are in indus-



tries that already exist, but that are just now getting involved in the green economy because of policy changes and public commitments to energy efficiency, renewable energy, and transportation.

Green-collar jobs are here and growing and exist in many of the states of this committee's members.

A new report by the Political Economy Research Institute at the University of Massachusetts, Amherst says that investment in energy efficiency retrofits, a smart electrical transmission grid, rapid transit and renewable energy will yield over 37,000 jobs in Congressman Grijalva's state of Arizona and in Congressman Kline's state of Minnesota.

Environment California predicts that by meeting California's Renewable Portfolio Standard goal of 20 percent by 2010—119,000 person-years of employment will be created at an average salary of \$40,000. And there are two measures on November's ballot that would raise the portfolio standard.

The clean energy economy is present in Pennsylvania, Michigan, New Jersey, Oregon, South Carolina and nearly every other state in the union. There is no doubt that investment in the clean energy economy creates and retains jobs—jobs like the ones held by workers at Republic Windows and Doors in Chicago. The company's fortune is evidence of the success of the American Recovery and Reinvestment Act (ARRA) and its considerable investment in weatherization and energy efficiency.

In early December 2008, 260 members of United Electrical, Radio and Machine Workers of America Local 1110 lost their jobs at the window company. Last month, Kevin Surace, the chief executive officer of Serious Materials, a Sunnyvale, California-based manufacturer of ultra energy efficient windows, reached agreement with the plant's former owner and with United Electrical Workers and purchased the Chicago factory. He also committed to honoring the union contract and to eventually rehiring all of the plant's union workers. In late March 2009, President Obama commended Mr. Surace for his work to reopen another window plant in Vandergrift, Pennsylvania where 150 people once worked.

The potential of the clean energy economy is evident. What's not evident is whether we have the human capital or the political will to ensure the jobs are American. In 2005, a National Association of Manufacturers study found that 90 percent of survey respondents expect a moderate to severe shortage of qualified, skilled employees like machinists and technicians. And the National Renewable Energy Lab concurs that a shortage of skilled labor is a large obstacle to an economy with strong renewable energy and energy efficiency industries.

We've had the political will to pass policies that create the demand for the clean energy economy—the Production Tax Credit, Investment Tax Credit, and the ARRA which appropriated more than \$100 billion dollars for clean energy and green-collar jobs.

The missing element is the supply side. We don't make most of the systems involved in producing clean energy. Fully half of America's existing wind turbines were manufactured overseas. And we rank fifth among countries that manufacture solar components, even though the solar cell was born in America. The fact that other countries are prepared to deliver these products—and we are not—means that every new American bill creating demand for renewable energy systems and energy efficiency services actually creates new jobs overseas, even though we have a robust manufacturing infrastructure and a skilled workforce. We have an incredible opportunity to strengthen and expand America's middle class by boosting our clean energy manufacturing sector.

Congress can take advantage of this opportunity by implementing the following:

1. Provide direct federal funding for clean energy manufacturers to retool their facilities and retrain their workers to develop, produce, and commercialize clean energy technologies.

2. Attach standards to funding: condition federal support to manufacturers on their ability to meet labor and domestic content standards.

3. Increase funding for the Manufacturing Extension Partnership, both to expand its role in strengthening the clean energy supply chain and to establish partnerships with regional/local development and manufacturing support organizations.

4. Increase funding for the Green Jobs Act and direct funds administered under the Act toward workforce and skill standards development for the clean energy manufacturing industries.

5. Create a "Presidential Task Force on Clean Energy Manufacturing" to bring together a range of federal agencies to make the manufacturing of clean energy systems and components a national priority.

Only by ensuring that all Americans come out winners will we build enough public support to do what must be done on the scale necessary to boost the economy, stabilize the climate, and achieve energy independence.

If I leave you with one message today, it is this: We're more likely to build a new energy future with good, green-collar jobs for working Americans if we ensure that a new energy policy is an investment strategy as well as a regulatory strategy.

We have called on the "can do" spirit of the original Apollo program in our Alliance's name because we believe the American people are once again ready for a great challenge. Energy is the transformative issue of our generation.

The challenge for Congressional leaders today will be to ensure that we all get there together: working men and women alongside industry, environmentalists, and our national security community.

We're confident this great nation can get the job done; we're confident we can get there with your leadership.

Thank you.

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[Additional submission of Mr. Ringo follows:]

*Tuesday, March 24, 2009.*

Hon. NANCY PELOSI, *Speaker of the House*; Hon. HENRY A. WAXMAN, *U.S. House of Representatives, Washington, DC.*

Hon. HARRY REID, *the Office of Senate Majority Leader*; Hon. JEFF BINGAMAN, *U.S. Senate, Washington, DC 20510 Washington, DC.*

DEAR SPEAKER PELOSI, MAJORITY LEADER REID, CONGRESSMAN WAXMAN, AND SENATOR BINGAMAN: As Congress prepares to debate the 2009 energy bill, you have a critical opportunity not only to help establish America as a global leader in clean energy, but also to strengthen our middle class, which has shed 4.6 million manufacturing jobs since 1999, including more than a million since late 2007. We can accomplish both of these ends by investing in the manufacture of renewable energy and energy efficiency systems, especially the small firms that make component parts for these systems.

Demand for clean energy technology is on the rise: the domestic market for solar panels, wind turbines, and biofuel equipment will reach \$325 billion annually by 2018. A national renewable electricity standard will increase this demand, as will an eventual carbon pricing program. However, if the energy bill does not help domestic manufacturers retool their facilities and retrain their workers to produce clean energy products, we will be unable to meet this demand with American supply. And if we do not ramp up American supply, the jobs and other economic benefits of the clean energy future will go overseas, leaving us just as "energy dependent" on foreign countries as we currently are for fossil fuels.

We must invest in domestic manufacturing to ensure that clean energy products are made in America. This investment should use multiple financial instruments, including direct loans, bonds, and tax credits, and target the entire supply chain, from original equipment manufacturers to component parts suppliers. It should help manufacturers meet international product standards so that systems and components are compatible with their foreign counterparts, granting us access to overseas markets. Importantly, federal dollars should go only to firms providing well-paying jobs with benefits.

We estimate that \$50 billion in federal and private financing for industrial retooling and retraining programs could create 1 million new jobs (250,000 direct manufacturing jobs and an additional 725,000 indirect jobs) and generate as much as \$120 billion in industry revenue. This investment would capture only a fraction of the clean energy economy's potential: by installing enough new clean energy equipment to generate 25 percent of our electricity, we could create approximately 3.5 million new jobs (1 million direct manufacturing jobs and 2.5 million indirect jobs) and revenues of over \$400 billion.

Investing in manufacturing in the 2009 energy bill will ensure that clean energy technologies are not only installed in America, but made and assembled here as well. We need a strong commitment by the federal government to invest in quality manufacturing jobs, invest in energy independence, and invest in our future.

Thank you for consideration of this important request.

Sincerely,

PHIL ANGELIDES, *Chairman.*

In partnership with: Peter Altman, Natural Resources Defense Council; Bob Baugh, AFL-CIO Industrial Union Council; Robert Borosage, Campaign for America's Future; Michael Coast, Michigan Manufacturing Technology Center & American Small Manufacturers Coalition; David Foster, Blue Green Alliance; Adam Friedman, New York Industrial Retention Network; David Gardiner, David Gardiner & Associates; Leo Gerard, United Steelworkers; Carrie Hines, American Small

Manufacturers Coalition; Mike Klonsinski, Wisconsin Manufacturing Extension Partnership & American Small Manufacturers Coalition; Brad Markell, United Automobile Workers; Loch McCabe, Shepherd Advisors; Jeffrey Mittelstadt, National Council for Advanced Manufacturing; Scott Paul, Alliance for American Manufacturing; Michael Peck, Gamesa; Kevin Pranis, Change to Win; Mark Wagner, Johnson Controls, Inc.; Joel Yudken, High Road Strategies.

Chairwoman WOOLSEY. Thank you.  
Dr. Wolfe?

**STATEMENT OF DR. CLINTON WOLFE, EXECUTIVE DIRECTOR,  
CITIZENS FOR NUCLEAR TECHNOLOGY AWARENESS**

Dr. WOLFE. Madam Chairman, members of the Committee, it is an honor to testify before you today. I represent a nonpartisan organization whose several hundred members are concerned about our energy policy, greenhouse gas emissions, acidification of the oceans, and the future of this planet. Our mission is to educate relative to all things nuclear, including commercial nuclear power.

We are headquartered in Aiken, South Carolina, and we are very proud that more than half of our electricity in South Carolina comes from nuclear power plants and more is on the way. We are also proud that our entire federal delegation, senators and representatives, Republicans and Democrats are strong supporters of nuclear power. We believe this is the way it should be. After all, nuclear energy provides the least expensive, cleanest, safest source of energy for our citizens.

How shall we define green jobs? It seems to me that we should define green as being low or no harmful emissions released to the environment such as particulates, carbon, sulfur, or nitrogen oxides. Two types of electrical generation need to be satisfied in the future. One will be niche applications to bring power to a remote location or a mobile facility, or to augment power from the grid in certain commercial and real estate applications.

A second need, requiring many times more energy than niche markets, is baseload energy. This is the electricity that is produced 24 hours a day, 365 days a year. We have basically two options for providing baseload electricity: fossil fuel and nuclear.

Some will argue that wind and solar energies can provide baseload energy, but by definition baseload is consistent and these two sources are extremely variable. Nuclear already provides 20 percent of our nation's electricity which equates to 75 percent of our country's emission-free electricity production.

We believe that workforce development to support a needed nuclear renaissance is vitally important. Retirement rates among existing nuclear workers may exceed 50 percent in less than 10 years, and the pipeline of new workers hasn't been filled for 30 years.

We should maximize the social good to come from these programs by investing in skills, trades, and education. We should not spend the money training people to perform menial tasks associated with a particular technology and then be faced with retraining when the demand for that particular task diminishes.

When we talk about workforce development for the nuclear renaissance, we are talking about skills and crafts such as certified welders, pipefitters, health protection technicians, maintenance mechanics, operators, electricians, as well as graduate engineers in

nuclear, civil, materials, chemical, electrical and mechanical fields, not to mention all the support personnel. We are talking about investing in people in a way that they can be a resource for the economy in good-paying jobs, no matter in which industry they eventually work.

Supporting workforce development in the nuclear industry will provide short-term education and training for needed replacements in the industry and will make it possible for new nuclear plants to be designed, licensed and built. Hundreds of thousands of jobs are likely to be created. Quick action is needed if we are to fill those jobs domestically instead of importing people with the required skills from other countries.

One scenario for energy independence is that if we move toward electric vehicles, plug-in hybrids, or hydrogen powered autos, we will need enormous amounts of electricity that must be produced in a clean, safe manner. This would require a huge expansion of the nuclear energy supply and perhaps open opportunities in the niche markets for solar and wind power, and we would be independent of foreign oil.

In August, 2008 the laboratory directors of the Department of Energy's National Laboratories issued a report entitled, "A Sustainable Energy Future: The Essential Role of Nuclear Energy." This report is a roadmap for nuclear energy policy produced by the leaders of some of our greatest science and technology resources. Dr. Chu himself is a signer of that document. One of the marquee recommendations of the report is, "Establish a national priority to immediately deploy advanced light water reactors to meet our nation's increasing energy demand while limiting greenhouse gas emissions."

In conclusion, I would like to emphasize that we believe nuclear is the greenest of the green energies, and we request that Congress pursue public policy initiatives that will support growth of the nuclear industry to help make us energy independent. Thank you for allowing me to speak and I will be happy to take questions.

[The statement of Dr. Wolfe follows:]

**Prepared Statement of Clinton R. Wolfe, Ph.D., Executive Director,  
Citizen's for Nuclear Technology Awareness (CNTA)**

Madam Chairman, members of the Committee, it is an honor to testify before you today. I represent a nonpartisan organization whose several hundred members are concerned about our energy policy, greenhouse gas emissions, acidification of the oceans, and the future of this planet. Our mission is to educate relative to all things nuclear, including commercial nuclear power. We are headquartered in Aiken, SC. We are very proud that more than half of our electricity in SC comes from nuclear power plants and more is on the way. We are also proud that our entire federal delegation, senators and representatives, republicans and democrats are strong supporters of nuclear power. We believe this is the way it should be. After all, nuclear energy provides the least expensive, cleanest, safest source of energy for our citizens.

How shall we define Green jobs? It seems to me that we should define "Green" as being low or no harmful emissions released to the environment such as particulates, carbon, sulfur, or nitrogen oxides.

What are the needs addressed by Green jobs? Two types of electrical generation need to be satisfied in the future. One will be "niche" applications to bring power to a remote location or a mobile facility, or to augment power from the grid in certain commercial and real estate applications. A second need, requiring many times more energy than niche markets is baseload energy. This is the electricity that is produced 24 hours a day, 365 days a year. We have basically two options for pro-

viding baseload electricity—fossil fuel and nuclear. Some will argue that wind and solar energies can provide baseload energy, but, by definition, baseload is constant and these two sources are extremely variable. Nuclear already provides 20% of our nation's electricity which equates to 75% of our country's emission-free electricity production. We believe that workforce development to support a needed Nuclear Renaissance is vitally important. Retirement rates among existing nuclear workers may exceed 50% in less than ten years, and the pipeline of new workers hasn't been filled for 30 years.

What are the desirable characteristics of the jobs created? We should maximize the social good to come from these programs by investing in skills, trades, and education. We should not spend the money training people to perform menial tasks associated with a particular technology and then be faced with retraining when the demand for that particular task diminishes. When we talk about workforce development for the Nuclear Renaissance we are talking about skills and crafts such as certified welders, pipefitters, health protection technicians, maintenance mechanics, operators, and electricians as well as graduate engineers in nuclear, civil, materials, chemical, electrical and mechanical fields not to mention all the support personnel. We are talking about investing in people in a way that they can be a resource for the economy in good paying jobs, no matter in which industry they eventually work.

What is the role in the economic recovery and long-range impact? Supporting workforce development in the nuclear industry will provide short-term education and training for needed replacements in the industry and will make it possible for new nuclear plants to be designed, licensed and built. Hundreds of thousands of jobs are likely to be created. Quick action is needed if we are to fill those jobs domestically instead of importing people with the required skills from other countries.

One scenario for energy independence is that, if we move toward electric vehicles, plug-in hybrids or hydrogen powered autos, we will need enormous amounts of electricity that must be produced in a clean, safe manner. This would require a huge expansion of the nuclear energy supply and perhaps open opportunities in the niche markets for solar and wind power, and we would be independent of foreign oil.

In August, 2008 the laboratory directors of the Department of Energy's National Laboratories issued a report entitled, "A Sustainable Energy Future: The Essential Role of Nuclear Energy." This report is a roadmap for nuclear energy policy produced by the leaders of some of our greatest science and technology resources. Dr. Chu is a signer of that document. One of the marquee recommendations of the report is "Establish a national priority to immediately deploy advanced light water reactors to meet our nation's increasing energy demand, while limiting greenhouse gas emissions \* \* \*"

In conclusion, I would like to emphasize that we believe nuclear is the greenest of the Green energies and we request that Congress pursue public policy initiatives that will support growth of the nuclear industry to help make us energy independent.

Thank you for allowing me to speak and I will be happy to answer your questions.

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[Additional submissions of Dr. Wolfe follow:]

**"There's a Green Hangover Coming"**

*A modified version of an op-ed that Dr. Clinton R. Wolfe submitted to Aiken Standard newspaper on January 30, 2009. It ran on Monday, February 2, 2009.*

The recent holidays may have provided some Americans another reason to try the latest hangover remedy. Our nation wrestles with solutions to hangovers of a different sort. First we had a housing crisis, then a credit crisis. The big three automakers awakened to a realization that they have over imbibed. Global warming concerns all of us and we are dependent on fossil fuels for transportation and more than 70% of our electricity generation.

In our eagerness to remedy the energy issues, state after state and even the federal government mull mandates that some fixed percentage of a state's energy be derived from "green" sources. Now most people will agree that it is worthwhile to strive for such a goal if what we mean by "green" is that the source is "no, or low emissions" energy. Actually, the country already produces 20% of its electricity from nuclear power plants so mandates that encourage states with less than 20% nuclear to build more nuclear capacity would be most welcome and it would not represent a technological hurdle. The problem with merely expanding nuclear capacity to meet our "Green" goals is that nobody makes a buck at the federal trough. You see, we know how to integrate more clean, safe, cost effective nuclear capacity into our na-

tionwide grid and we don't need incentives to do that, other than loan guarantees to protect utilities and ratepayers against external events not of their own making.

If we exclude nuclear from the candidate technologies to receive the government dole, then the mandates will have to be met by entrepreneurs hawking solar, wind, biomass, chicken manure, or whatever else they can dream up in their garages. We will pay handsome incentives to them for producing very expensive energy at very inopportune times. The timeliness of energy delivery is a very important parameter. Utilities depend upon coal and nuclear plants to provide what is known as "baseload" power. "Baseload" power is just what its name implies. It is the minimum steady state electricity requirement 24 hours a day, 365 days a year. When electricity demand rises above that minimum, most power producers rely on natural gas powered turbines to provide this "peaking" power or "load following" capability, because these turbines can be started, stopped and throttled much more easily and rapidly than coal or nuclear fueled plants. Natural gas, of course, is a greenhouse gas producer and the fuel is very expensive compared to nuclear.

It is important to make some obligatory comments relative to the "Green" movement. First, the first law of thermodynamics tells us that "energy can neither be created nor destroyed", therefore, there is no such thing as "renewable" energy. Call it sustainable, inexhaustible, low emission, but don't call it "renewable." Those who attempt to exclude nuclear from consideration as satisfying "Green" requirements often cite noncompliance with "renewable" as their rationale.

Secondly, I strongly support significant investment in research and development of alternative energy candidates. Expenditure of federal funds in qualified research, development and demonstration projects is appropriate as we look for advances to bring these technologies closer to economic viability. The objection arises when we try to leapfrog decades of needed development and force compliance with mandates that can't be met with today's technology, unless of course, we count nuclear.

Florida recently commissioned an independent study that concluded that their proposed mandates would cost two to three times more if supplied by wind and solar than if the energy were supplied by nuclear.


OK, so your state won't be able to meet its mandates for "Green" energy, so what? Well, we did call them mandates, not goals. That means that somebody will interpret that to mean that if you can't produce your quota of energy from trough-eligible technology, you will have to import it from someplace that has an excess of it. Oh happy days in the Dakotas! Wait! It gets better. You will have to pay for the transmission and distribution of the energy produced from places where the wind comes sweeping down the plain. Most of the areas likely to generate wind power are located a half a continent away from the population centers that will use the electricity. Now that wouldn't be so bad if there is enough of it at a baseload rate, but wind is quite fickle and most wind turbines operate at less than 30% of capacity. That means you have to build transmission and distribution infrastructure sized at three times the amount of electricity you will actually generate.

I'm sorry, there's still more. Now that this wind generated electricity is flowing to us whenever the wind blows, we have an increased need to load follow with gas turbines because now both the supply and the demand are variable. One can envision a scenario where some areas may have to take emission free nuclear offline to make room for the wind energy and load follow with natural gas turbines. So the upshot is that the more wind (or solar) we use, the more greenhouse gas we produce! What's wrong with this picture?

Some have been promoting wind power as an answer to our energy woes. I don't know if they own any windmills, but I'll bet they own some natural gas. Tell your congressmen, senators and representatives to think this one through.


## A Sustainable Energy Future: The Essential Role of Nuclear Energy

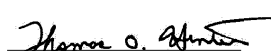
August 2008


  
Michael Anastasio, Director, LANL

  
Samuel Aronson, Director, BNL

  
Steven Chu, Director, LBNL

  
John Grossenbacher, Director, INL


  
Thomas Hunter, Director, SNL

  
Michael Kluse, Director, PNNL

  
Thom Mason, Director, ORNL

  
George H. Miller, Director, LLNL

  
Robert Rosner, Director, ANL

  
Sanjiv Bhattacharyya, Director, SRNL

### A Sustainable Energy Future: The Essential Role of Nuclear Energy

The Directors of the Department of Energy (DOE) national laboratories strongly believe that nuclear energy must play a significant and growing role in our nation's — and the world's — energy portfolio. This conclusion is based on an analysis of national and international energy needs in the context of broader global energy, environmental, and security issues. This paper provides details regarding our position in relation to nuclear energy. It is intended to be used as a basis for further discussion with stakeholders to help in developing specific near-term actions as well as a coherent long-term strategy incorporating the items listed below:

- Make maximum use of the current 'fleet' of operating light-water reactors, including plant life extensions, extended fuel burnup, and power uprates.
- Establish a national priority to immediately deploy advanced light-water reactors to meet our nation's increasing energy demand, while limiting greenhouse gas emissions and continuing to provide critical support to the Nuclear Regulatory Commission (NRC).
- Employ an integrated approach to manage used nuclear fuel and high-level waste, including interim storage, licensing of the Yucca Mountain Repository as a long-term resource, and exploration of optimal future waste management options.
- Implement an aggressive research and development (R&D) program on advanced reactors, reprocessing, waste management, and fuel fabrication concepts to enable timely identification of the technological options for a sustainable closed fuel cycle.
- Pursue partnering with other countries and implementation of an international regime that discourages the spread of enrichment and reprocessing capabilities and promotes the assurance of worldwide fuel supply and effective waste management.
- Strengthen international safeguards through aggressive R&D, thereby revitalizing U.S. safeguards technology and human capital and providing for U.S. leadership to help in assuring achievement of international security objectives and nonproliferation goals.
- Form a robust public-private partnership to ensure that (1) nuclear energy plays a more significant role in energy independence and environmental health, and (2) human infrastructure is rebuilt across industry, government, and academia.
- Incorporate independent and authoritative guidance and peer review from government and nongovernment entities to ensure that the U.S. nuclear energy agenda is responsive to current and future national needs and international conditions.



## BROAD ENERGY CONTEXT

Energy is vital to human civilization and underpins national security, economic prosperity, and global stability. Worldwide demand for energy is rapidly increasing and could double by 2050. At the same time, the evidence is clear that CO<sub>2</sub> emissions must be reduced globally. Abundant, affordable, and environmentally responsible energy must be developed, both domestically and internationally, to meet that demand.

Reducing U.S. dependence on foreign oil will provide economic and national security benefits, including both industrial competitiveness and international trade. Crude oil expenditures represent the largest deficit item to our balance of trade. To reverse the trend on energy imports, while at the same time meeting required reductions in CO<sub>2</sub> emissions, the United States must use energy more efficiently. Furthermore, our nation must develop and deploy multiple energy sources in the context of a strategic and comprehensive energy plan. A broad mix of energy technologies is essential to meet the growing demand.

## BENEFITS OF NUCLEAR ENERGY

Today, nuclear energy provides 16 percent of the world's electricity and offers unique benefits. It is the only existing technology with capability for major expansion that can simultaneously provide stability for base-load electricity, security through reliable fuel supply, and environmental stewardship by avoiding emissions of greenhouse gases and other pollutants. Furthermore, it has proven reliability (greater than 90 percent capacity factor), exemplary safety, and operational economy through improved performance.

We believe that nuclear energy must play a significant role in our nation's — and the world's — electricity portfolio for the next 100+ years. Nuclear energy has great potential for contributing more to our broader energy needs, however. For example, nuclear energy could supplement or even supplant fossil fuels by providing the electricity for electric-powered vehicles, or it could be used to generate hydrogen for vehicles that utilize hydrogen fuel cells. Nuclear energy could also help to generate high-temperature process heat, provide a valuable input for feedstock to chemical production and aid in the production of freshwater from seawater and contaminated surface and groundwater sources.

## FOCUS EFFORTS AND INVESTMENTS: WHY NOW?

There are many reasons to focus on and invest in the expansion of nuclear energy. First, time-critical clean energy needs can be met through reactor life-time extensions, higher fuel burnup, power uprates, and additional deployment of existing light-water reactor technology. Second, to maximize the benefits of nuclear energy domestically, advanced fuel cycles that cost-effectively optimize energy utilization and waste management are needed; however, there is a long lead time for developing the required technologies. Third, the United States now has a window of opportunity to influence global directions in safety, security, and nonproliferation throughout the nuclear fuel cycle. A strong, sustained, integrated effort across all three areas must begin now.

## SUCCESSFUL PATH FORWARD

The directors of the DOE national laboratories remain committed to U.S. energy security and the important role that an increased nuclear energy component can and should play in strengthening our energy security. Essentials for success are a strategy that integrates across DOE as well as other federal agencies; a concentrated effort to rebuild the necessary nuclear enterprise, including a broad-based R&D effort; and engagement with industry and the international community. Key to ensuring a successful effort is decisive leadership and a strong public-private sector partnership.

### *Strategy and Policy Development*

To facilitate that leadership, all stakeholders must work together to develop a comprehensive strategic plan that has broad, bipartisan support and clear, consistent communications among government, researchers, the international community, industrial stakeholders, and the public. The development and implementation of a strategic plan should include:

- A clear statement of national energy policies. The full range of benefits and risks involved in nuclear energy create an inextricable link between government and industry. Furthermore, government policies and programs should be harmonized with those of the private sector. This relationship must be a partnership.
- A clear differentiation between short- and long-term goals. Private sector providers of nuclear power have expressed their priorities, but they are inevitably short term in nature and may not necessarily include long-term, national priorities.
- A sustainable approach to used fuel disposition and waste management. Confidence must exist in the ability to manage nuclear fuel and to dispose of nuclear waste safely so as to enable the sustainable expansion of nuclear energy.
- A clear focus on strengthening the nonproliferation regime. Enhanced safeguards and physical security, international fuel service arrangements, and new nuclear fuel cycle technologies can advance our nonproliferation objectives.
- A mechanism for review by the stakeholders to ensure that the strategy remains relevant to current and future national needs and international conditions.

### *Rebuilding of the Nuclear Enterprise*

The nuclear sector stakeholders must address three key areas: manufacturing base, science and technology infrastructure, and human capital. Expansion of nuclear energy will create stresses on the industrial resources needed to build and operate nuclear power plants. Nuclear power plants require a large forged pressure vessel and head, huge civil works, a myriad of pumps and valves, miles of piping and wiring, and robust process and system controls that must be "N-stamp qualified." To have substantial growth in nuclear energy, more suppliers are needed. The worldwide forging capacity is very limited, and

none of it resides in the United States. This example illustrates one of the many choke points in the supply chain. Transport of material, support for construction, and enrichment of uranium for the fuel supply all must be considered. Moreover, financial institutions need to have confidence that a reliable supply chain exists before they will invest in new plant construction.

The science and technology infrastructure must include modern capabilities such as irradiation systems for testing new fuels and structural materials; chemical separations and characterization capabilities; and physics facilities for radiation transport, thermo-hydraulics, cross-sections, and criticality science. These and other capabilities require modern facilities; however, our current R&D infrastructure, which was built during the Cold War, has atrophied and is obsolete. Modeling and simulation technologies have made tremendous advances since the design of the existing facilities. The design of the next-generation facilities must incorporate state-of-the-art testing and diagnostics tools and be guided by the data requirements for advancing the realism and accuracy of high-performance simulation tools and approaches.

In addition, training the next generation of engineers and scientists must be an integral part of a robust nuclear program. A recent industry study pointed out that over the next five years, half of the nation's nuclear utility workforce will need to be replaced. To satisfy the need for both professional and crafts workers, government and industry must both play important roles to stimulate workforce development for construction, operations, and R&D by providing an environment that is exciting and thriving. Industrial and federal government commitment will be required to invigorate university and trade school programs. For example, the government should establish and fund a nuclear energy workforce development program at universities and colleges to meet the expected need.

#### *Research and Development*

To reduce cost, ensure sustainability, and improve efficiency, safety, and security, investments in a sustained nuclear science and technology R&D program are needed. Such a program must effectively support and integrate both basic and applied research and use, to the extent possible, modeling and simulation capabilities to address both near-term, evolutionary activities (e.g., life extensions of the current fleet) and long-term solutions (e.g., advanced reactors and fuel-cycle facilities). Industry will pursue evolutionary R&D to further improve efficiencies along each step of the current fuel cycle. It is incumbent upon the government, however, to implement long-term R&D programs for developing transformational technologies and options for advanced nuclear fuel cycles. Including regulators in the research and evaluation of results will facilitate the development of licensing and regulation of future nuclear facilities and technologies. Review of research plans and results by expert peer reviewers and open availability of the results will strengthen these efforts.

#### *International Engagement*

Thirty countries currently operate nuclear power reactors, and approximately thirty-five reactors are under construction outside the U.S. An additional two dozen countries

that have never used nuclear power to generate electricity (e.g., Egypt, Indonesia, Turkey, Vietnam) are now expressing serious interest in the technology, citing stability, security, sustainability, and environmental stewardship as key drivers. As a result, the amount and types of nuclear material in the world will grow, commerce in nuclear technology and materials will increase, and there will be interest in assuring a reliable supply of nuclear fuel. Ongoing bilateral and multilateral engagement will provide opportunities for improving our understanding of the needs, plans, and initiatives of other countries; the potential benefits and risks of these initiatives; and ways to positively impact technological development and choices. The R&D of viable technical options for the United States will also maximize our ability to influence the expanding global commercial enterprise.

#### CHALLENGES AND OPPORTUNITIES

Important challenges and opportunities are on the horizon: near-term expansion, used nuclear fuel disposition, a sustainable “closed” fuel cycle, and nonproliferation and security. These are discussed below.

##### *Near-term Expansion*

An urgent need exists to extend the life of our existing nuclear plants; to begin building new plants, including addressing the financial constraints; and to implement further cost improvements. Relicensing for 60 years has already occurred for many existing reactors and is being aggressively sought for the remaining plants. In parallel, R&D activities that explore the technical feasibility and path forward for long-term operations to 80 years should also be pursued.

Capital investments required for construction of nuclear plants are substantial, and private sector investment decisions must seriously consider risks over a long planning horizon, including the ability to recover capital costs through the rate base. Since new nuclear power deployments are in the national interest, the private sector and government share the responsibility for undertaking the activities needed to ensure that the investment risk associated with constructing, licensing, and operating new light-water reactors is reduced sufficiently to enable commercial investment and deployment. The Energy Policy Act of 2005 provides important loan guarantees, standby support, and tax credits to mitigate financial and regulatory risks that need to be implemented: the financial community and rate regulators must be engaged to enable nuclear energy expansion. Finally, critical support of the NRC for license review and approval also needs to continue to ensure timely review of new license applications.

Further cost-effective technical improvements to light-water reactors are feasible. In addition to simplified reactor and ancillary systems, areas of emphasis include the development of sensing capabilities, robust communication systems, and development of advanced approaches to safeguards and physical protection. The achievement of a simplified safe and secure plant will also require systematic consideration of human factors as a major contributor to a plant’s economics, safety, security, and operational performance. Many of these advances can also provide cost-efficient operations and maintenance of existing plants.

*Used Nuclear Fuel Disposition*

The disposition of used nuclear fuel must be considered from both a short- and long-term perspective. Confidence regarding the disposal of waste is needed before the NRC will grant a license for a new plant and before private investors will accept the financial risk of ordering new nuclear plants. In the short term, this confidence can be achieved by continuing the licensing of a geologic repository at Yucca Mountain and enabling the continued interim storage of used nuclear fuel in dry casks and fuel pools.

Dry cask storage is a safe and secure interim solution, either at existing reactor sites or consolidated regionally if future circumstances dictate. Through policy and investment actions, government can make it clear that interim storage is not intended to push the burden of an ultimate solution to a future generation, but rather to keep waste management options open, pending the results of continued R&D investments. The use of dry casks incorporates proven technologies and regulatory regimes to protect the public from hazards during handling, transport, and storage.

The design and operation of the repository may evolve as knowledge advances. Yucca Mountain Repository was envisioned at a time when the country did not have plans for significant nuclear energy expansion. At that time, used reactor fuel was considered "waste"; thus, direct disposal was chosen as the approach. In the long term, given the envisioned expanded use of nuclear energy, it is both appropriate and timely to reconsider the sustainability of the fuel cycle and to recognize that even with recycling, a geologic repository will be required. In our opinion, R&D must be conducted, and a comprehensive evaluation of disposition pathways must be performed.

*Sustainable "Closed" Fuel Cycle*

As nuclear energy expands, the traditional once-through fuel cycle will not be sustainable. To maximize the benefits of nuclear energy in an expanding *nuclear energy future*, "closing" the fuel cycle will ultimately be necessary. Simultaneously addressing such issues as the full utilization of the fuel's stored energy content, waste minimization, and strengthening of the nonproliferation regime is essential and will require systems and economic analysis; and investigation of new technologies. Thus, the immediate urgency of our efforts should be directed toward conducting broad-based R&D to support an informed decision on how to proceed. The results of these investments will yield a deeper understanding of the above issues, and will provide the basis and timing for closing the fuel cycle. We believe that the decades-long hiatus in U.S. investment provides an opportunity and an advantage to avoid reliance on a dated recycling infrastructure. As a result, our nation has the opportunity, through new technologies and business models, to determine the best path forward.

An evaluation for light-water reactor recycling in the near-term must consider the increased efficiency in the use of fissile resources, the alteration of waste forms and reductions in overall waste burden, the anticipated need for plutonium/actinides to fuel fast reactors for burning or breeding, and U.S. nonproliferation objectives. Other considerations include establishing a credible U.S. role in an international fuel supply regime, getting our nation back into industrial-scale reprocessing, and demonstrating U.S.

leadership in providing nuclear safety, safeguards and other essential disciplines in the global nuclear renaissance. Integrated analyses of the factors above have not provided sufficient direct evidence to date to support substantial Federal Government investments to deploy existing technology for commercial scale recycling in light-water reactors. It is incumbent upon the Federal Government to establish the policy framework and working with industry ensure that technologies are available for deployment that satisfy that framework, including the non-proliferation and waste management considerations discussed in this paper, while the marketplace will ultimately determine the need for implementation within that framework.

*Nonproliferation and Security*

Strengthening the nuclear nonproliferation regime in the context of the global expansion of nuclear energy will require a multipronged approach. While the nonproliferation regime and other institutional measures will continue to provide the primary framework to ensure that the growth of nuclear power does not increase proliferation and terrorism risks, there should be a strong emphasis on limiting the spread of enrichment and reprocessing capabilities and enhancing our ability to track, control, and protect nuclear materials.

Three key areas will help to accomplish this focus: an assured fuel cycle service system with incentives for foregoing enrichment and reprocessing capability, improved safeguards technologies and transparency, and "safeguards by design" (i.e., designing safeguards technologies and methodologies into new facilities or systems). These key areas should be tightly integrated with other nuclear fuel cycle R&D and be informed by a risk assessment methodology. This methodology will enhance our ability to understand the benefits and risks of fuel cycle choices in the context of the overall fuel cycle system. These choices include technology options, framework options, and policy options. As an example, formulating international frameworks that support U.S. nonproliferation policy objectives will require understanding the energy goals and objectives of other countries, options for meeting these objectives, and a clear understanding of any specific trade-offs.

**COMMITMENT OF THE NATIONAL LABORATORIES**

Our nation is facing urgent problems in energy, environment, and national security. Nuclear energy can play a vital role in meeting our future energy needs, reducing our dependence on foreign oil, and protecting our environment. However, a clear national strategy with bipartisan support and strong U.S. leadership is necessary. The national laboratories, working in collaboration with industry, academia, and the international community, are committed to leading and providing the research and technologies required to support the global expansion of nuclear energy.

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Chairwoman WOOLSEY. Thank you, Dr. Wolfe.  
Ms. Krepcio?

**STATEMENT OF KATHY KREPCIO, EXECUTIVE DIRECTOR,  
JOHN J. HELDRICH CENTER FOR WORKFORCE DEVELOPMENT,  
RUTGERS UNIVERSITY**

Ms. KREPCIO. Good morning, Chairwoman Woolsey and members of the Subcommittee. I am the Executive Director of the John J. Heldrich Center for Workforce Development at Rutgers University, and as one of the nation's leading university-based research and policy centers dedicated to the American workforce, the Heldrich Center believes that the emergence of a green economy will lead to

a new generation of jobs as well as the eventual transformation of traditional occupations across many industries.

As our country transitions to a cleaner energy economy, many are working to identify the specific occupations and skills that workers must have to succeed. To assist them, the Heldrich Center recently produced a brief entitled "Preparing the Workforce for a Green Jobs Economy" to assist educators and others interested in preparing workers for green employment. Based on our research, my testimony will quickly look to answer six key questions.

First, what is a green job? Green jobs can be broadly defined as jobs that involve protecting wildlife, reducing pollution, or reducing energy usage. In the nation's energy sector, green jobs are concentrated in two areas: energy efficiency and renewable energy.

The energy efficiency sector generally involves retrofitting residential and commercial buildings to use less energy and the manufacture of products that save energy. This sector will likely provide the greatest number of green jobs, at least in the short term.

The renewable energy sector involves creating, installing, and maintaining technologies that generate energy from resources that are naturally replenished, such as wind and solar. Our findings show that the majority of green jobs in the energy sector will not be new occupations immediately, but will be traditional occupations that may require an additional layer of green skills and knowledge.

Second, what drives growth in green jobs? There are three primary drivers: technological advances and the pace of those advances, economic conditions and energy prices, and the presence of federal and state energy policy that can drive investment or demands.

Third, are the green job numbers a myth? Green jobs are extremely difficult to quantify. At present, there is no clearly defined federal government standard for counting green jobs and an unclear consensus on what is a green job.

However, if you look at the energy industry, we know that the majority of green energy jobs are currently found in the energy efficiency sector. According to the American Solar Energy Society, in 2007 95 percent of all green energy jobs were in the energy efficiency sector, and only about 5 percent in the renewable energy sector. While today's renewable energy job numbers appear to be smaller, it is predicted that they will grow faster, mostly because of public policy efforts to increase the degree of the nation's energy supply that comes from renewable sources.

Fourth, where will the green jobs be located? Well, since the majority of energy efficiency jobs are in the retrofitting of buildings, these types of jobs will be widespread across most states. However, the demand for renewable energy jobs and skills will vary by state. Our findings show that four critical factors play a role in the demand for green energy workers, especially in the renewable energy area: the strength and characteristics of any area's workforce, the natural resources and geography of a particular area, the depth and breadth of an area's industrial infrastructure, and the level and nature of state, regional, and local energy policy and leadership to affect change.

What skills are green energy employers seeking? As I mentioned earlier, green energy jobs will most likely be traditional jobs, many

of which require a new green layer of skills and knowledge. Employers that we spoke to tell us that workers will need to have what they always need to have—skills. That is basic academic and workplace readiness skills as well as traditional job-specific skills and credentials. A carpenter or plumber needs first and foremost to know how to be a carpenter or plumber. Eventually workers will need green job-specific skills and knowledge and credentials as the industry grows and matures.

Finally, what can the nation’s workforce and education systems do to prepare workers for green jobs? Well, number one, talk and listen to employers. They will be the best source for information on the type of skills and information needed for a job.

Track those drivers of energy sector job growth: technology, economic conditions, and public policy. They will dictate the pace and scale of jobs and where new occupations are emerging.

Coordinate education and training with economic development efforts and the emerging workforce needs of employers by creating a green job talent network. And finally, focus education and training efforts on providing workers with skills to meet the as-they-emerge industry-determined needs, develop pathways for workers, and look to complement, not duplicate, already existing employer-and labor union-led training efforts.

Thank you for this opportunity.

[The statement of Ms. Krepcio follows:]

**Prepared Statement of Kathy Krepcio, Executive Director, John J. Heldrich Center for Workforce Development, Edward J. Bloustein School of Planning and Public Policy, Rutgers, the State University of New Jersey**

Good morning, Chairwoman Woolsey. My name is Kathy Krepcio and I am the Executive Director of the John J. Heldrich Center for Workforce Development at Rutgers, the State University of New Jersey. I am pleased to offer testimony today about preparing the nation’s workforce for a ‘greener energy’ economy—with a special focus on green collar jobs in the energy industry.

As one of the nation’s leading university-based research and policy centers dedicated to the American workforce, the Heldrich Center believes that the emergence of a “green” economy will lead to a new generation of jobs—as well as the eventual transformation of traditional occupations across many industry sectors.

As the United States makes its transition to a cleaner energy economy, state and national policy makers are working to identify the specific occupations and skills that workers must have to succeed in this emerging energy revolution. To assist them, Heldrich Center researchers recently produced a research brief to assist educators and others interested in training “green” workers in the skills employers are and will increasingly demand. This report, entitled *Preparing the Workforce for a Green Jobs Economy*, defines the types of entry level and middle-income “green jobs” that are most likely to grow, describes the factors driving the anticipated growth in different industries, and outlines strategies for training a 21st Century workforce with these relevant skills.

*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. Our research focused on the nation’s energy industry, and in that vital sector green jobs will be concentrated in the energy efficiency (EE) sector, with growth also expected in the renewable energy (RE) sector.

The Energy Efficiency sector generally involves retrofitting residential and commercial buildings to use less energy, as well as developing and manufacturing products that save energy. Weatherization and building retrofits will likely provide the greatest number of green jobs—at least in the short term. For residential weatherization, most jobs require low- to moderate-skills preparation. In commercial and industrial retrofitting, there is a wider range of educational and training needs. Common occupations in these areas include:



- Electricians
- Building Weatherization Occupations
- Heating/Air Conditioning Installers
- Electrical Engineers
- Carpenters, Carpenter Helpers
- Mechanical Engineers
- Construction Equipment Operators
- Cogeneration Construction and Operation
- Roofers
- Measurement and Verification Technicians
- Insulation Workers
- Energy Management Analysts
- Construction Managers
- Building Inspectors, Auditors

The Renewable Energy sector focuses on creating, installing, and maintaining technologies that generate energy from resources that are naturally replenished and generally do not emit the greenhouse gases that contribute to global warming. Renewable Energies include wind, solar, geothermal, and hydropower.

While the majority of Renewable Energy occupations are now 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. Sheet metal workers are needed in the production of wind turbines, and construction workers will build cogeneration units and work on upgrading the nation's electric grid.

For example, common occupations in wind energy include:

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

There is a widespread misconception that the vast majority of “green jobs” will be in the Renewable Energy area. In fact, most of the immediate job opportunities will be created in the Energy Efficiency sector as homes and businesses are retrofitted to use less energy, and as manufacturers develop new energy-saving products. In terms of money saved, Energy Efficiency may be the cheapest ‘alternative fuel’ around.

A key point is that many Americans do not realize that most immediate green job openings will not be “new” occupations, but rather traditional occupations, some with a new layer of “green” skills, knowledge, and credentials. These green job workers will include construction workers, cost estimators, financial analysts, auditors, 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.

And, the main distinction between jobs in the Energy Efficiency and Renewable Energy 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 various jobs.<sup>1</sup>

While green job occupations will be found across all industries and at all levels of education, the largest number of green jobs in the nation's energy sector will be in occupations that require an apprenticeship, professional certificate, or one to two years of postsecondary education. 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.

As you know, the development of green jobs is receiving a significant boost from passage of the new Federal stimulus bill, the American Recovery and Reinvestment Act. Although the general direction of “green job” growth is clear, our research report *Preparing the Workforce for a Green Jobs Economy* stresses that the specific hiring and training needs of clean energy employers will vary significantly from state to state.

A significant challenge for education and training providers will be how to best prepare jobseekers with the right skills for the right jobs at the right time that meets emerging demand for workers in real time. To meet this challenge of getting the balance of skilled workers into jobs that exist, our researchers recommend that

education and workforce professionals work closely and collaboratively with energy policy makers and energy employers to track the primary drivers of job growth—that is, technology development, economic conditions and energy policy.

#### *What Drives Growth in Green Jobs?*

To understand what fundamentally drives growth in green jobs, and thus where best to invest education and training dollars, it is important to know that transformation to a new energy economy and thus growth in 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 less expensive, the market will adopt them faster. It is impossible to predict which emerging technology—wind, solar, hydrogen—will dominate future energy markets and therefore employ future workers. It is much more likely that the nation's energy future will be a patchwork of many different clean energy resources.

**Economic Conditions.** Because Energy Efficiency and Renewable Energy 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. 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.

**Federal and State 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, public policies designed with a long-term goal in mind give businesses the signal they need for wide-scale investment in green energy and technologies.

#### *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 today on what constitutes a green job.

Today, most green energy jobs are currently found in the Energy Efficiency sector. According to the American Solar Energy Society, in 2007 there were 3.75 million jobs in the Energy Efficiency area, and 218,000 jobs or about 5% of all green energy in the Renewable Energy area.<sup>2</sup> While today's renewable energy job numbers are smaller, it is predicted that they will constitute the faster growing jobs—most significantly because of public policy efforts to increase the degree of the nation's energy supply that comes from renewable sources.

Various industry associations and research organizations, however, have attempted to provide estimates of green jobs in order to offer a better understanding of the potential magnitude of jobs in the energy efficiency and renewable energy areas. But, these green job growth projections vary widely, owing to many factors—such as the ambiguity of green jobs, unknowns about future economic conditions and/or the pace of technological advances, the degree and types of federal and state public policies (including stimulus dollars) and their eventual impact on job creation, and whether economists are calculating direct and/or indirect jobs (like administrative or information technology staff) created by the green energy industry.

It remains to be seen 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 federal government 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 public and private sector's uptake of key energy efficiency and renewable energy incentives. Again, it is important that workforce stakeholders work closely with industry to provide knowledge and skills training, both traditional and green, that will be necessary to meet the new, emerging demand.

#### *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 Energy Efficiency jobs are in the retrofitting of buildings.

However, the demand for Renewable Energy jobs and skills will vary by state, as other factors such as workforce strengths, natural resources and geography, infrastructure, and policy priorities also play a large role in where renewable energy industry is located.

**Workforce Strengths.** Since demand is fairly consistent for Energy Efficiency, 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>3</sup>

**State, Regional, and Local Policy.** In the absence of centralized, national, long-term energy strategies, several states are leading in Energy Efficiency and Renewable Energy 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>4</sup> The economic incentives attached to these 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.

For example, 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>5</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.

Newton, Iowa is another 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>6</sup> As a result of TPI Composites' new facility, 500 green jobs were created.

#### *What Skills and Competencies are Green Energy Employers Seeking?*

As noted earlier, green energy jobs will most likely be 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 our research 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.

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 Renewable Energy and Energy Efficiency 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 Energy Efficiency and Renewable Energy 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 Amer-

ican 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 eventually broad sets of green knowledge, which cross many industries and occupations, will become 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 the Nation's 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 very 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:

*Use Federal and State Public Policy as a Roadmap*

Develop “green jobs policy experts” in educational institutions and workforce development organizations who can create partnerships with employers, 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 or 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.

- **Cultivation of 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, 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.

- **Alignment of 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.

- **No Duplication of 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 Energy Efficiency and Renewable Energy industries have enormous potential to 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 are several of many factors that will determine how many jobs are ultimately produced in the green economy.

States and communities with innovative energy policies and coordinated workforce development systems aligned with employers 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 well coordinated, flexible strategic partnerships among industry, labor unions, community based organizations and educators.

All and all, green jobs employment and training efforts will be better poised to succeed by:

1. 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.

2. Creating a green jobs talent network to coordinate education and training with economic development efforts and the emerging workforce needs of employers.

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

We believe that taking these steps will enable state, regional, and/or local green jobs initiatives to build a more responsive, 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.

Thank you for this opportunity to testify and share these research findings from the Heldrich Center for Workforce Development.

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[Additional submission of Ms. Krepcio follows:]

John T. 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**

**A**midst 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 gases 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.)

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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 intelligent use and control of 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. In residential weatherization, most jobs require low to moderate skills preparation, while in Commercial and Industrial weatherization, a wide range of educational and training needs. Common occupations in these areas include the following:

<p style="text-align: center;"><b>Residential Weatherization</b></p> <ul style="list-style-type: none"> <li>• Electricians</li> <li>• Heating Air Conditioning Installers</li> <li>• Carpenters, Carpenter Helpers</li> <li>• Construction Equipment Operators</li> <li>• Plackers</li> <li>• Insulation Workers</li> <li>• Construction Managers</li> <li>• Building Inspection Auditors</li> </ul>	<p style="text-align: center;"><b>Commercial and Industrial Retrofits</b></p> <ul style="list-style-type: none"> <li>• Building Weatherization Occupations</li> <li>• Electrical Engineers</li> <li>• Mechanical Engineers</li> <li>• Construction Consideration/Preparation</li> <li>• Measurement and Verification Technicians</li> <li>• Energy Management Analysts</li> </ul>
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For residential 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 require similar training, there are also jobs associated with heavy iron, steel and installation, and operation and maintenance. For example, in the wind energy sector, the occupations vary from entry-level construction laborers to advanced engineers.

<p style="text-align: center;"><b>Wind Energy Jobs</b></p> <ul style="list-style-type: none"> <li>• Constructional Energy Engineers</li> <li>• Iron and Steel Workers</li> <li>• Sheet Metal Workers</li> <li>• Machinists, Millwrights</li> <li>• Electrical Equipment Assemblers</li> </ul>	<ul style="list-style-type: none"> <li>• Construction Equipment Operators</li> <li>• Industrial Truck Drivers</li> <li>• Industrial Production Managers</li> <li>• Operators, Machinery Technicians</li> </ul>
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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

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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 largest in its history to the clean energy industry in U.S. history, comes in the form of tax incentives, loan guarantees, and grants to both energy consumers in the public and private sectors, encourages development of alternative energy technologies like wind and solar, and fixes the electric grid more efficiently. 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 with the Energy Security and Independence Act of 2007, but never funded.

Provisions of the Green Jobs Act direct 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 apprenticeship grants that will be awarded to energy sector collaborative partnerships that connect industry employees with labor organizations, community organizations, educators, and extension facilities in the workforce system. Beyond the \$500 million associated with the Green Jobs Act in 2009, 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 directs about \$30.5 billion in energy efficiency and almost \$6 billion in renewable energy to promote job creation. Some important provisions include:

- \$3 billion to weatherize homes of four million low-income families.
- \$6.3 billion for energy-related goods to states.
- \$0.5 billion to retrofit federal buildings, and
- \$1.7 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 more than 50% of the cost of building a new wind energy facility. Wind and solar energy developers have recently seen much of their financing disappear as the mortgage market collapsed and banks' capacity to provide loans for developers dried up. The alternative fuel vehicle rebate rose to \$4,000 from its previous \$2,500 level, and \$4.3 billion will be directed to research and development in basic energy science and EE and RE areas.

Not only can the stimulus package help create the promised 300,000 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 will spend the stimulus money will affect the number of jobs that are created by the stimulus plan, as well. The pass of the stimulus package will help to lay the energy efficiency and renewable energy incentives. Workforce development should be a primary objective of stimulus packages to provide cross-sector and skill 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>5</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.

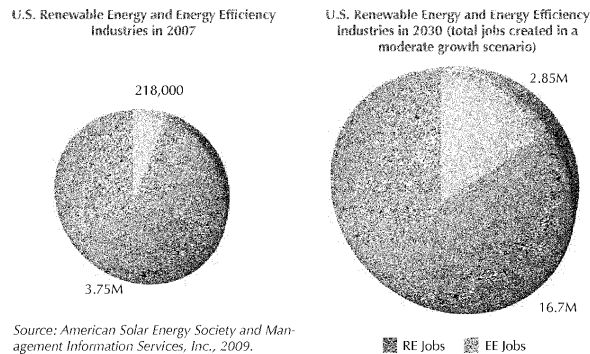
Projections of green job growth in the future vary widely, owing to the ambiguity of green jobs and whether economists are calculating direct and/or indirect jobs (like administrative or information technology staff) created by the green energy industry. The Peter G. Peterson Institute for International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



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

**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 quite Sun-Belt, has the second highest number of solar installations behind California—over 7,000 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, this large number of flat roofs on warehouses and big box retail stores provide the infrastructure for capturing the sun's energy.

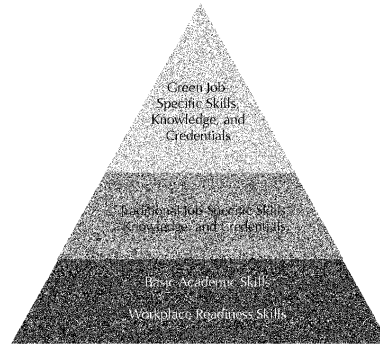
targets or goals will play a powerful role in creating demand for workers. In addition, numerous states or regional associations have designated economic development initiatives for clean energy sectors.

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.

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

- **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 as varied as the standards established by nationally recognized credentialing bodies. Organizations that provide certifications commonly offered or required by employers include:

- **The Association of Energy Engineers** provides energy efficiency-related certifications for facilities managers, HVAC installers, and other professionals in the field.
- **The North American Board of Energy Practitioners** attributes certifications for photovoltaic PV and solar thermal installers, as well as a micro generator level certificate in PV technology that encompasses a wide range of existing circuits from construction and trades to engineering.
- **The Building Performance Institute** offers certifications for building analysis, 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 for contractors on energy efficient building design.
- **Solar Energy International** is a private training provider that offers both on-site 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 credential 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>

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


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- **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.



## research brief

- 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.
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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.

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#### Preparing the Workforce for a "Green Jobs" Economy

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#### 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).

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Chairwoman WOOLSEY. Thank you very much.

Before we proceed on to the questions, I would like to enter a written statement by Raymond Uhalde, senior advisor to the secretary of labor at the U.S. Department of Labor, and it is just his input into this Committee, into this hearing. Without objection, we will include this in our record.

[The statement of Mr. Uhalde follows:]

**Prepared Statement of Raymond J. Uhalde, Senior Advisor to the Secretary of Labor, U.S. Department of Labor**

Thank you for the opportunity to discuss the role of green jobs in our country's economic recovery.

In this statement, I will provide an overview of how Secretary of Labor Hilda L. Solis has deployed, and will deploy in the coming months, the funding made available to the Department under the American Recovery and Reinvestment Act (Recovery Act) to promote green jobs and the green economy.

The Recovery Act, signed by President Obama on February 17, 2009, is the most significant single payment our Nation has ever made to ensure our future economic success. The Recovery Act will enable the repair and improvement of the country's infrastructure, fund innovative research and development initiatives, create job opportunities for Americans, and propel the growth of "green jobs". This landmark legislation will put us on a course toward economic recovery and growth.

While there is considerable discussion about the role of green jobs in the economic recovery, there is not yet an agreed upon definition of green jobs. The provisions of Title X—Green Jobs of the Energy Independence and Security Act of 2007 set forth one definition that includes a wide array of industry sectors. These occupations range from construction and skilled trade work retrofitting buildings for energy efficiency to manufacturing work implementing sustainable processes, as well as jobs involving renewable energy installation and maintenance, such as building and servicing wind turbines.

The investment in green jobs will not only help to re-start the economy and put Americans back to work, but will also help make America more energy independent. The investment in our Nation's clean energy future will not only secure America's energy supply, but will do so in a way that promotes economic stability and the advancement of all of our communities. For instance, many green jobs are likely to be in the construction trades, and these jobs tend to pay above averages wages. The May 2007 National Occupational Employment and Wage Estimates published by the Bureau of Labor Statistics (BLS) indicate that construction and extraction occupations pay a median hourly rate of \$17.57 as against \$15.10 for all occupations. In addition, data from the Current Population Survey published by BLS indicates that 21% of construction workers were represented by a union in 2008. Therefore, we can expect that many green jobs will pay 10% to 20% better than other jobs and will be unionized. These are jobs that will provide economic security for our middle-class families while reducing our nation's energy dependence.

BLS Commissioner Keith Hall testified at the House Appropriations Subcommittee on Labor, Health and Human Services, Education and Related Agencies on March 25, 2009, about the effort to measure green jobs. In his testimony, Commissioner Hall noted several challenges in measuring green jobs: 1) green activities often cut across industries and occupations, or 2) green jobs account for a subset of activity within an individual industry and occupational category. These challenges are present whenever we try to measure jobs in an emerging sector of the economy, such as information technology and biotechnology. However, there are green jobs that can be easily measured in categories such as the production of renewable electric power. BLS is currently developing approaches to measure green jobs, including surveying workplaces in industries where green activity is expected to occur to identify both the extent to which they are performing green activities and the occupations of the employees who are doing such work.

While BLS is working on ways to measure green jobs, billions of dollars have already been distributed across the Federal government to the states for infrastructure investments and research and development investments that that will create opportunities for green job growth. For its part, the Department has already made available \$3.47 billion of the Recovery Act to support workforce investment activities. Such activities include retraining dislocated workers, summer employment for youth, and community service employment for low-income seniors. The Recovery Act also makes available \$250 million in funds for Job Corps projects. Future construction and repair of Job Corps facilities will incorporate green technologies. Job Corps will also develop and implement green jobs training into their curricula at all Centers.

The Department of Labor consistently invests in America's workforce by supporting training and re-training of workers, and providing assistance in getting them jobs. As we work to expeditiously and effectively carry out our responsibilities under the Recovery Act, the Department and other Federal agencies are collaborating to identify effective green training approaches and opportunities.

The Department and other Federal agencies have already begun to coordinate their work to strategically implement programs that ensure the connection between investments in infrastructure and research and development to job training and worker placement. For example, during a recent visit to the Community College of Allegheny County Secretary of Labor Solis and Secretary of Energy Steven Chu recently announced a major new investment to create green jobs in Pittsburgh and

other Pennsylvania communities. With these types of partnerships, we are building both a stronger economy and a secure, clean energy supply.

Secretary Solis' primary focus in administering the Department's Recovery Act initiatives will be to ensure that green jobs workforce training is an effective and comprehensive effort to move America's workforce and economy forward. The greening of our economy will bring significant changes to the American workplace and will require the American workforce to acquire new and different skills.

The Department of Labor is developing plans for use of the \$500 million provided in the Recovery Act for research and job training projects that prepare workers for careers in energy efficiency and renewable energy, and will soon issue solicitations for grant applications. These grants will provide an infusion of workforce training funding that will help ensure there is a qualified American workforce to meet the needs of our country's expanding green industries. The Department of Labor will focus on engaging with communities, writing guidance, evaluating grant applications and leveraging funds so that we can provide grants in an efficient and effective way and impact the communities most in need.

The Department will look for ways to make the workforce investment system responsive to the labor market demands for workers in green industries. In fact, the Department recently issued guidance to states to help implement the job training provisions of the Recovery Act, noting that the energy efficiency and renewable energy industries offer workers new opportunities that may require additional training and certification. Through the Recovery Act, a number of other Federal programs will receive large investments in programs and projects that could create green jobs. These include investments in renewable energy infrastructure, energy-efficiency home retrofitting, biofuel development, and advanced drive train/vehicle development and manufacturing. As states receive Recovery Act funding and implement training and reemployment strategies, the Department encourages states to recognize opportunities to prepare workers for green jobs related to other sources of Federal funding. The Department has also encouraged states to expand existing training programs, such as registered apprenticeship programs that have the potential to prepare workers for careers in the renewable energy sectors and for other green jobs. Finally, the Department's guidance has encouraged states to identify regional and local environmental resources, businesses, and pre-apprenticeship programs promoting green jobs and products to provide youth summer work experiences that prepare them to compete in a "green" economy. With green jobs workforce training, we will ensure that American workers have the needed experience and expertise to succeed in the green economy.

The Department of Labor is directing its efforts and resources to assist American workers in acquiring the skills they will need to access the new job opportunities that will become available in the green economy, thus ensuring that employers in existing and emerging high-growth industries will have the skilled and innovative workforce. We must ensure that there is an effective pipeline for training which allows people to have both short-term training opportunities and the opportunity to advance into higher-skilled jobs. The workforce investment through the Recovery Act will help enable our economic recovery, promote future economic growth, and advance shared prosperity for all Americans.

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Chairwoman WOOLSEY. So, thank you all. You have given us way too much to think about. My head is spinning, and—but I keep getting back to two main questions that, assuming that we know that we are going to have green jobs, green technology, because that is the future of the United States of America, it is the industry of our future, and it will include workers, from inventors and scientists, and the developers and the producers, and then the installers. I mean, we have—it is everybody. It is every place.

So one of my main concerns would be that some critics of green jobs, that when we talk about green jobs say that they are only entry-level jobs, they won't do that much for stimulating our economy—but I disagree with that—but I would like to hear your—what you think about that. I would like you to tell me where you think green job training will take place and how we get the entry-level green job worker—give them their promotion opportunities, how they can—we can prevent them from being in dead end jobs.

So some of that, I think, Dr. Roy, you would be—you are experiencing that with or without green jobs, so how would you continue this?

Mr. ROY. I would like to address one of those issues. Certainly at my company, Serious Materials, we have—I will get back to you on the specific numbers, but I believe we have a couple dozen Ph.D.s, scientists, and engineers that are working on our new technologies all the time. Now, those are really high-end—very high-end jobs.

It goes all the way up through our chain, down to the installers; you have system installers all the way up to Ph.D. engineers. You also have quite advanced manufacturing and logistics analysis going on all the time. So these aren't just entry-level jobs; some of these are quite high-end. That is how we get the technology that becomes cost-effective and attractive to deploy.

Now, with respect to the downstream: in installation, certainly it is important. For example, with windows you have a two-person crew if you want to be logistically effective. You have a two-person crew that goes through, changes a lot of windows. One of those has to be a skilled windows installer with proper training, proper certification. The other one is an assistant, learning, quickly becoming a highly-skilled installer.

It is a very interesting track for that second person, and we are not going to run out of opportunities for—in that narrow space of windows installers. There are something like 30 million low-income households that are highly inefficient for which there are cost-effective energy efficiency upgrades waiting to be done.

Chairwoman WOOLSEY. All right.

Ms. Krepcio?

Ms. KREPCIO. As I had pointed out, I mean, the range of jobs are going to be anywhere, as I said, from entry-level to middle-skill, to high-level jobs. And as we know, they will all evolve as the industry evolves. I mean, certainly, you know, one of the things that we at the Heldrich Center are very concerned about is, entry-level workers get put on pathways, so if they start off as somebody who is helping to retrofit and building and caulking a window, you don't need a lot of skills to be able to do that, but you do need to have good workplace skills and basic skills, that eventually they might be participating in pre-apprenticeship training programs so they can become licensed plumbers or carpenters and participate in that, and eventually maybe they want to become a contractor. So there are certain pathways and certain industries in energy efficiency, and clearly there is going to be the need for scientists and technologists to be able to produce the new technologies of the future.

Chairwoman WOOLSEY. Right.

Mr. Ringo?

Mr. RINGO. Thank you very much, Madam Chair.

At Apollo, we have really focused on a level playing field, that those that are engaged in these jobs are from businesses and individuals who might invest in green technologies or get involved in owning businesses in green, but also those people who are unemployed, laid off out of our manufacturing industries, and even the poor, those people who daily must begin their day having to make

a decision after whether they should purchase a gallon of gas or a gallon of milk.

I was in Arkansas last week, Madam Chair, and there are 400,000 homes that are in line to be weatherized through the stimulus money that is going to be available in the state of Arkansas. But prior to weatherization of those homes, mainly poor people, there must be energy audits done of each home. Of the 400,000 homes that are awaiting weatherization in Arkansas, there are only five certified energy auditors in the entire state. That is a green job.

Chairwoman WOOLSEY. That would be.

Ms. Sherman, could you add a little bit to—

Ms. SHERMAN. Yes.

Chairwoman WOOLSEY. My time is up, and I am going to—I will be back. We will have a second round.

Congressman Price?

Dr. PRICE. Thank you, Madam Chair. Before I begin I would like to ask unanimous consent to include in the record a letter that all members have received from the Associated Builders and Contractors regarding this issue.

Chairwoman WOOLSEY. Without objection.

[The information follows:]

ASSOCIATED BUILDERS AND CONTRACTORS, INC.,  
March 31, 2009.

Hon. LYNN WOOLSEY, *Chairwoman*; Hon. TOM PRICE, *Ranking Member*,  
*Subcommittee on Workforce Protections, House Education and Labor Committee*,  
*Washington, DC 20515.*

DEAR CHAIRWOMAN WOOLSEY AND RANKING MEMBER PRICE: On behalf of Associated Builders and Contractors (ABC) and its 25,000 contractors, subcontractors, material suppliers and construction related firms across the nation, I am writing to thank you for holding today's hearing on "Green Jobs and Their Role in Our Economic Recovery." ABC member companies have been at the forefront of green construction since before this terminology came into use. However, we are greatly concerned with recent statutory language which would prohibit over 84% of the construction industry from accessing federal dollars to train construction workers in green fields of works and strongly urge you to maintain open access to these important funds.

Open shop contractors, which make up over 84 % of the private construction industry, recognize the growing market force of green buildings and are adapting their training methods to prepare workers for this ever expanding segment of the construction industry. In fact, for the past several decades millions of square feet of "green" and LEED certified building space has already been built using open shop contractors and the specialized skills of their workforce.

ABC chapters and member companies are actively engaged in training workers in a wide variety of skilled occupations and are constantly striving to keep pace with technology and innovation in order to make certain America has the skilled workforce it deserves, and that all American workers, regardless of union affiliation, enjoy equal opportunity of access to critical job training. However, the continued participation of open shop contractors, and the job opportunities for over 84% of the construction workforce they employ, in the booming green building market is threatened by the efforts of many in Washington, D.C. to exclude nonunion companies and training providers from participating in new government funded green jobs training programs.

The Green Jobs Act, enacted as part of the "Energy Independence and Security Act of 2007" which was signed into law in December 2007, establishes National Energy Training Partnership Grants to fund training programs targeted at creating an efficient energy and renewable energy skilled workforce. Specifically, the Green Jobs Act would require any entity applying for these grants to partner with organized labor. The reality is that this language would bar the numerous open shop training programs from receiving this grant funding.

Organized labor makes up just 16% of the private construction workforce and likely represents a similar amount of work in the green building market. Given the desire to see a continued increase in the use of green building and green technology, it seems that limiting the ability to participate in green training to such a small percentage of the construction industry would make this growth difficult. If the green building market is going to continue to expand in the coming years as some groups predict, the participation of the open shop will be a crucial factor in ensuring there are enough skilled workers to meet the demand.

To that end, ABC, along with many other construction and business groups, strongly supports the "Green Jobs Improvement Act" soon to be introduced by Congressman John Kline which would amend the Workforce Investment Act to allow both union and open shop training providers access to the federally funded energy efficiency and renewable energy worker training programs. This bill would give all workers the opportunity to train in the ever increasing field of green construction and would not block certain training providers access simply because they choose not to be affiliated with organized labor.

The advances in the technology and skill involved in green building, and the benefits of their use, is indeed a welcome trend for contractors, skilled workers and the end user. It is our view that the most efficient path to encouraging this continued growth of this sector is by giving all training providers, regardless of union affiliation, access to federal training programs so that the greatest numbers of workers can be trained in green jobs. In today's tough economic times, especially in the construction industry, Members of Congress have a responsibility to provide all workers with training opportunities paid for by their tax dollars.

Again, thank you for your work, and we look forward to your continued efforts to promote green building opportunities for all contractors.

BREWSTER B. BEVIS, *Senior Director,*  
*Legislative Affairs, Associated Builders and Contractors.*

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[Additional submission of Mr. Price follows:]

J. DOUG PRUITT, President  
 TED J. AADLAND, Senior Vice President  
 KRISTINE L. YOUNG, Vice President  
 SAMUEL C. HUTCHINSON, Treasurer  
 STEPHEN E. SANDHERR, Chief Executive Officer  
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**AGC of America**  
 THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA  
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April 14, 2009

The Honorable Lynn Woolsey  
 Chairwoman  
 Subcommittee on Workforce Protections  
 U.S. House of Representatives  
 Washington, DC 20515

The Honorable Tom Price  
 Ranking Member  
 Subcommittee on Workforce Protections  
 U.S. House of Representatives  
 Washington, DC 20515

Dear Chairwoman Woolsey and Ranking Member Price:

The Associated General Contractors of America believes that "green jobs" will play an important role in the nation's economic recovery because many green jobs, both in the energy-efficiency and renewable-energy sectors, are traditional construction jobs that pay well, offer opportunities for advancement, are accessible to minorities, and cannot be outsourced overseas. However, our nationwide association of 33,000 firms working in the commercial construction industry is concerned about the federal government's efforts to direct money to train workers for "green jobs" without a universally accepted definition of a "green job."

If one defines a "green job," as: "Jobs that have a direct, positive impact on the environment," — as did the Washington State Employment Security Department in a January 2009 report — then a laborer, electrician, mason, construction manager, heavy equipment operator, supervisor, carpenter, painter, or any other construction worker helping to retrofit an existing building, construct a new green building, or perform some other traditional construction task necessary to build and connect a renewable energy source to the nation's power grid — such as erecting a windmill or installing solar panels — is a "green collar" worker.

The U.S. Office of Management and Budget (OMB), in its recent update of the standard occupational classification (SOC) system, "analyzed over 80 unique suggestions regarding 'green' occupations," rejecting all but two — wind turbine service technician and solar photovoltaic installer. In explaining its final decision in the January 21, 2009 Federal Register, OMB noted: "In many cases, the work performed in the 'green' job was identical or similar to work performed in existing SOC occupations."

The recent report: "U.S. Metro Economies: Green Jobs in U.S. Metro Areas," prepared for the U.S. Conference of Mayors and the Mayors' Climate Protection Center, noted: "We should not expect to see a new industry populated by a new breed of 'green construction workers.' As green



building technology becomes increasingly popular ... traditional contractors will develop their skill sets and expand their knowledge bases in ways that will allow them to transform large numbers of ordinary buildings into some of the most energy efficient in the world.”

The Washington state report added: “Green jobs are not necessarily new jobs, but often traditional jobs in industries and companies that are adapting to new markets and opportunities.”

Economic Modeling Specialists Inc.’s report issued December 2008 weighed in with: “The consensus among those economists who address these issues is that the designation ‘green’ turns not on the specific task associated with an occupation, but rather on the specific outcome of the occupational effort.”

Given these definitions of “green jobs,” it is easy to see why AGC and its member companies are concerned that a disproportionate amount of the American Recovery and Reinvestment Act training funds will be spent on training workers for jobs in nascent “green” sectors, when a much larger proportion of “green jobs” are being held by workers in traditional construction jobs — workers who would *benefit by*, but do not *need*, training in green practices in order to work successfully on a green project.

For instance, the transportation sector — defined as the movement of goods and people from one place to another — accounts for 27 percent of the nation’s total energy consumption and 31 percent of manmade carbon dioxide (CO<sub>2</sub>) emissions. Contractors (and the subcontractors who work with them) not only reduce transportation congestion — a major source of both wasted energy and CO<sub>2</sub> emissions — through expansion and improvements to roadways, airports, railways, waterway systems, and the construction of mass transit options, they also are recycling at the highest levels in the nation.

According a recent Environmental Protection Agency report, structural steel is recovered at 97.5 percent and reinforcement steel at 65 percent, together equaling 40 million tons of material recycled and 71.6 million metric tons CO<sub>2</sub> emissions avoided. The recovery rate for asphalt is 80 percent, which equals 139 million tons recycled and 4.17 million metric tons CO<sub>2</sub> emissions avoided. Concrete is estimated at 1.4 million metric tons CO<sub>2</sub> of annual emissions avoided through recycling. (Note: EPA did not calculate the percentage of concrete recovered.)

Construction contractors also improve the environment through habitat restoration; wetlands mitigation; brownfields cleanup and redevelopment; the cleanup of Superfund sites; and construction of and upgrades to wastewater treatment plants and drinking water facilities.

According to EPA, construction equipment and energy use contributed only an estimated 1.7 percent of total U.S. greenhouse gas emissions during 2002 (the latest year for which statistics are available). Meanwhile, according to the U.S. Bureau of Labor Statistics (BLS), construction is one of the nation’s largest industries, with 7.7 million wage and salary jobs and 1.9 million

self-employed workers, and approximately 883,000 construction establishments in the United States in 2006.

Recycling, improving our nation's infrastructure, rehabilitating toxic land sites — construction has been at the forefront of all of these efforts for years, without very much special "green" training. Nevertheless, AGC contends that the workers on all of these projects, and more, are "green collar" workers who deserve the very best training.

AGC also is concerned that when the energy-efficiency sector is discussed, the construction of new, energy-efficient buildings is excluded. In recent reports and, indeed, in testimony before this Subcommittee, the energy-efficiency sector is described as primarily concerned with the retrofitting of existing buildings, with no mention of all the jobs created, and savings incurred, from the construction of new buildings using green technology. The mayors' report, which focused on "current and potential green jobs in the U.S. economy," failed entirely to address the jobs created as a result of new green buildings.

"Building green is one of the best strategies for meeting the challenge of climate change because technology to make substantial reductions in energy and CO2 emissions already exists. In comparison to the national building stock, the average LEED® certified building uses 24% less electricity and saves 13.86 million metric tons of CO2 emissions annually," according to the New Buildings Institute. Since the commercial and residential building sector accounts for 39% of the CO2 emissions in the United States each year, more than any other sector according to the Environmental Information Administration, a new certified "green building" certainly qualifies as "green," as do the workers building it.

Green building rating systems — of which LEED® is one of several — take into account incorporation of efficient heating, ventilation, and air conditioning systems, use of state-of-the-art lighting and daylight, reduction of potable water, use of renewable energy, implementation of proper construction waste management, proximity to public transportation, and use of locally produced building products. Green buildings are designed to conserve raw materials, use less energy, and use renewable energy sources.

According to a McGraw-Hill report, "Green Outlook 2009: Trends Driving Change," the value of green building construction starts has risen from \$10 billion in 2005 to an estimated range of \$36 billion to \$49 billion in 2008. Further, the report said the value could hit \$140 billion by 2013. While there is no hard data on the numbers of workers needed to build all those buildings, suffice to say it reaches into the tens, perhaps hundreds, of thousands.

As an example, the Washington Nationals Park, the nation's first major professional stadium to become LEED® Silver Certified by the U.S. Green Building Council (USGBC), cost more than \$600 million and employed more than 1,000 workers during the 26 months it took to build. Keep in mind: that one project constituted just over 1 percent of the total spent on new green building starts in 2008.

When it comes to renewable energy, construction is at the forefront of these efforts. While it is true that there are some new types of installers and technicians needed to connect renewable

energy sources to our nation's power grid, it is also true that the bulk of the work is performed by traditional construction workers, such as the paving crews, cement masons, heavy equipment and crane operators, and others who prepare the site, roads and foundations needed before a windmill can be erected.

Where needed, of course, AGC is in favor of green training and, to that end, has worked extensively to provide our members with basic and advanced curricula to further their understanding of their role in the green construction process. Among AGC of America's numerous green offerings:

- The LEED® Estimating for Green Building Course, introduced in 2007. To date, nearly 400 people have taken the class.
- The Building to LEED® for New Construction full-day course. Since its rollout in March 2008, 17 AGC chapters across the nation have held the course, with nearly 750 people successfully completing it.
- The Contractor's Guide to Green Building Construction LEED® and Building to LEED®-NC books.
- AGC has offered numerous green construction sessions at our annual meetings, and we have teamed up with both the USGBC and the Green Building Initiative to offer training.
- Our 90<sup>th</sup> Annual Convention, held in March 2009, offered eight green building sessions for attendees and a special green section in the exhibit hall.
- Articles, fact sheets, webinars, an environmental network, and an extensive cache of online resources all geared toward contractors working in a green economy.

Our craft training partner, the National Center for Construction Education and Research, introduced a green module in spring 2008 called "Your Role in the Green Environment." The module is designed for entry-level craft workers or for anyone wishing to learn more about green building. The module is currently being used by construction industry-sponsored training programs, community colleges, and high schools around the nation. Additionally, for AGC members whose craftworkers are unionized, there are joint labor-management training programs, including those offered through the International Brotherhood of Carpenters and Joiners, and the Laborers-AGC, among others, that provide green training.

AGC provides tools, such as our Supervisory Training and Project Manager Development Programs, for our members to provide a pathway for their employees to advance to positions of greater responsibility. Both of these programs include information on the knowledge and practices of green construction.

In 2003, AGC and the federal Environmental Protection Agency formed the AGC-EPA Sector Strategies partnership, focused on: improving environmental regulations, expanding the use of

environmental management systems, and exploring ways to assess environmental progress. We value our partnership with EPA and other federal partners and have two staff members devoted to environmental concerns, including a Director of Green Construction, whose job is to work with the industry — both internally and externally — to promote best practices in green construction and environmental management.

AGC recently began a new partnership with EPA and the Industrial Resources Council to facilitate the recycling and the environmentally safe reuse of non-hazardous industrial materials as part of EPA's national Resource Conservation Challenge. It is anticipated that the group's joint efforts to provide leadership, technical expertise, and assistance will increase the amount of materials recycled or reused each year — resulting in cost savings; beneficial impacts to the environment, including a reduction in greenhouse gas emissions; stimulation of local markets; and a reduction in the use of landfills.

In addition, AGC has implemented an environmental agenda that includes:

1. Encouraging environmental stewardship among AGC members through education, awareness, and outreach;
2. Recognizing environmentally responsible construction practices;
3. Strengthening government support for positive incentives for environmental excellence;
4. Facilitating members' efforts to recycle or reduce construction and demolition debris;
5. Identifying and maximizing the contractor's role in "green" construction; and
6. Identifying ways to measure and report environmental trends and performance indicators of such trends.

As you can see, AGC of America, our member firms, and their employees take our role in the green economy very seriously, both in educating our current workforce and in preparing the next generation to build green.

While AGC understands the interest in tying green the definition of "green jobs" to good-paying jobs that allow a worker to support a family, we would prefer a definition that does not advocate a particular labor posture.

According to the BLS, "Earnings in construction are higher than the average for all industries." A report prepared by FMI for AGC of America found that the non-residential construction craftworker earned \$19.83 an hour in 2007, compared to \$18.52/hour for a craft-level worker in natural resources, \$17.17/hour in manufacturing, and \$15.78/hour in trade (transportation, distribution, retail, and logistics).

And, those good-paying craft jobs have the potential to turn into entrepreneurial ventures: "Opportunities for workers to form their own firms are better in construction than in many other industries," according to the BLS.

As noted above, AGC members work in both the open shop and union sectors and we are advocating investment in training programs for all construction industry workers. Since only 13.9 percent of the nation's construction workforce is unionized, according to the BLS data on 2007 employment, and since AGC believes that an increasing number of construction jobs are "green jobs," there is no reason to tie "green jobs" to "union jobs," which would leave out more than four-fifths of the eligible construction labor force from the "green" designation.

With regard to how the federal government can support greener construction practices, AGC recommends changes to the Energy Independence and Security Act of 2007, which includes plans to establish an energy and renewable energy worker training program through a provision known as the Green Jobs Act. AGC is hoping to see some changes prior to any grant solicitations under this program. The Green Jobs Act, as currently written, would limit training grant funding to entities that coordinate with labor organizations. AGC is supportive of the grant program as part of an effort to create an efficient and renewable energy skilled workforce. However, it is our belief that the opportunity to apply for such grants should be open to all contractors, both union and open shop, that have accredited training programs.

In the 110<sup>th</sup> Congress, a bill was introduced on the House side that would open up the Green Jobs Act to allow any accredited training program, regardless of labor posture, to compete for grants under the Green Jobs Act. AGC supported this bill and expects the same bill to be reintroduced soon in the 111<sup>th</sup> Congress.

As for a definition of "green jobs" as those that are available to "diverse workers from across the spectrum of race, gender, and ethnicity," as included in the U.N. Environmental Programme, Labour and the Environment Unit's definition, we would point to the growing number of Hispanics in the construction industry and the efforts of industry to reach out to non-traditional labor pools, including minorities, females, and veterans.

Hispanics increasingly have found work in construction, accounting for 25 percent of the total employed in construction nationwide and the numbers are growing. The Pew Hispanic Center said two of every three new construction jobs in 2006 were filled by a Hispanic worker.

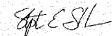
Among the AGC's most recent initiatives to inform minorities and females about career opportunities in construction and to develop the workforce needed to rebuild the nation's crumbling infrastructure, are partnerships with the Boys & Girls Clubs of America and the Girl Scouts of America. Our members and chapters have provided thousands of youths active in these two programs with donated Build Up! educational kits that introduce them to the importance of the construction industry to our nation, as well as their future possible role in helping to build the nation's infrastructure. Additionally, many AGC chapters and members have made substantial commitments to construction career academies and charter schools, such as AGC of St. Louis's success with the Construction Careers Center in St. Louis, Mo., and AGC of Metropolitan Washington, D.C.'s financial and intellectual support of the new Phelps Architecture, Construction and Engineering Academy in Washington, D.C., both of which serve

a largely African-American population. These are only a few outreach efforts among hundreds in which AGC members and chapters nationwide play a substantive, often leading, role.

In summary, AGC of America believes that training funds spent on traditional construction industry apprenticeship and training programs — in both the union and open shop sectors — constitute one of the nation's most cost-effective and beneficial routes to increasing the number of green collar workers in America and we look forward to helping the nation's economy rebound, become greener, and regain its prominence in the world economy.

By building energy efficiency into existing and future infrastructure, the construction industry is an essential partner in the nation's efforts to nurture a green economy.

Sincerely



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["7 Myths About Green Jobs," University of Illinois College of Law, by William T. Bogart, et al, may be accessed at the following Internet address:]

<http://papers.ssrn.com/sol3/papers.cfm?abstract=id=1357440>

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Dr. PRICE. Thank you.

I want to thank the witnesses for their testimony and their contributions to this issue. I think the vision and the goal of all of us is the same: We all want a clean environment, and we want to preserve and protect and increase the number of jobs. I would suggest,

however, that all Americans are getting more and more suspicious of governmental activity and the intrusion of government into the private sector. And certainly that suspicion has been increased over the past couple of weeks.

Your testimony resulted in much discussion about the benefits of green jobs, and I think we can all agree, that is great to hear.

Dr. Bogart, I was struck by your comments regarding the lack of transparency and the different definitions of what a green job is and how depending on how you define that it allows for the government to pick winners and losers. Would you mind commenting on that, and also, what you would suggest as we try to move forward in properly defining green jobs?

Dr. BOGART. Thank you. Yes. Actually, that is one of the difficulties, and it was one of the reasons we dug into this research, is that various groups define green jobs very differently and count different technologies as green, and the concern is that that lack of transparency will lead to money being wasted as people just try to define anything as being green. Again, to hearken back to events of last year, all of a sudden everybody wanted to be a bank, and I think that if we aren't careful, every job turns into a green job.

Now, that said, there is a sense in which the increasing price of energy over time does turn every job into a green job because businesses and consumers have an incentive to economize on that more expensive energy by finding new technology and by buying energy efficient products, and we should encourage all of those types of activities.

Dr. PRICE. You mentioned the processes by which one might define a green job. Do you have a working definition that you use for green jobs?

Dr. BOGART. Not a short one. I find it very hard to find one that is that short—

Dr. PRICE. That is clearly the challenge that we have.

You also brought out the interesting point of a net increase in jobs, and I wondered if you might care to comment a little more on losses of jobs as a consequence of decisions that might be made.

Dr. BOGART. Yes, sir. Thank you.

There are two ways to see this. One, again, is if we produce the same amount of energy but we change sources, the people that were previously employed producing energy, let us say, from oil, coal, nuclear, will lose jobs as jobs are gained in solar, wind, or biomass. The other way to see it, and this is what we are seeing in the European experience, most recently with the report from King Juan Carlos University in Spain, is that higher energy prices drive businesses out of the country, and low energy prices in much of the United States has been an advantage for various types of producers, and also keeping consumer prices low, which is important for our competitiveness.

Dr. PRICE. Thank you.

Dr. Wolfe, I want to thank you for your testimony as well, and as a strong supporter of expansion of nuclear energy, I think that many nations of the world have proven that that is indeed a responsible way in which to proceed. I wonder if you might comment on the difference between the sustainable and renewable energy and how both of those might fit into green jobs?

Dr. WOLFE. Yes. I don't mean to be provocative, but I have a literal problem with the word "renewable." Frankly, no energy is renewable. The laws of thermodynamics say we can't create or destroy energy. We can change its form; we can, you know, recharge a battery; we can do things like we can convert from potential to kinetic and kinetic to potential energy; but we can't make energy.

And so with that semantics issue aside, I view the green energies as being those that don't produce pollution, that don't produce by-products that are harmful to human health, and that we encourage an energy source that is sustainable—that word I am okay with; it means we can do it for a long, long time without fear of running out of it or having someone hold us hostage because we don't have it. So I prefer words like sustainable to describe the nature of the jobs, because renewal is technically not correct.

But realizing that it is well-established and been used for years and years and years, the problem is defining even renewable. You know, what is that? There are a number of applications of "renewable energy," that I don't think are environmentally-friendly. I personally don't think that using 5,000 square miles of biomass to be the equivalent of one nuclear power plant is being environmentally-friendly. Likewise, I have issues with wind and solar in that regard; the land-use issues are significant.

Dr. PRICE. I thank you for your comments, and as the chairwoman said, we will be coming around for a second round of questions.

Chairwoman WOOLSEY. We will. Thank you.  
Congressman Sablan?

Mr. SABLAN. Thank you, Madam Chair. And thank you for having this hearing today.

Just a very simple question: Ms. Krepcio, help me understand this. A plumber, a plumber, a person who is a plumber who gets trained to now retrofit pipes and things for solar power, or just—that would be a green job, in your opinion?

Ms. KREPCIO. Well, you know, it really does depend. Because right now, would you call a plumber who is installing a low-flush toilet a green job? I am not quite sure that I would call it a green job. But eventually, as the industry matures, there may be a green type of plumber.

I mean, I sort of liken this to the I.T. industry. Could we have, when the I.T. industry and computers first emerged, have conceived of a chief technology officer or a network administrator before those types of technologies existed? And I think that is the same thing that we are struggling with right now, is these kinds of definitions, which I said right at the beginning, you know, green jobs will be really just traditional jobs of which someone is going to now install insulation that they might have ever installed, or they are now retrofitting buildings with Energy Star appliances.

Mr. SABLAN. Thank you.

Dr. Wolfe, in your testimony, you said you call nuclear energy the cleanest, safest source of energy. Is it really safe? Is that why people don't want it in their backyards? I am from the islands; I have never seen a nuclear plant—power plant—that is why I am asking you, sir.



Dr. WOLFE. Yes. Well, you know, one of the popular things that you read in the media is that we “have to make nuclear safe if we are going to use it.” I don’t know what else we can do. We have operated for 50 years and never had a fatality in generating commercial nuclear power in this country. There is no other industry of this magnitude that can claim anything like that. Even the wind industry in Europe has had 14 deaths to the public from, you know—

Mr. SABLAN. Thank you.

Dr. WOLFE [continuing]. Windmills flying off or something. So—

Mr. SABLAN. Well, thank you—my time, I only have 5 minutes. But it is not renewable, is it?

Dr. WOLFE. It is quite sustainable.

Mr. SABLAN. My question is, it is not renewable?

Dr. WOLFE. No. I just said a few moments ago that none of these technologies are renewable. They are, depending upon how you want to define them, sustainable. And here is the reason that nuclear is sustainable: That pellet right there out of this fuel rod will provide your electricity for a year that you need. Now, you compare that to what you see with fossil fuels, which would take—we would have to fill this room with coal, you know. So, I mean, so this is a sustainable—

Mr. SABLAN. I am not against nuclear power, I am just asking a question. It is not renewable?

Dr. WOLFE. Nuclear is not renewable and no other energy source is renewable.

Mr. SABLAN. All right.

And I have no more questions, Chair. Thank you.

Chairwoman WOOLSEY. Congressman Kline?

Mr. KLINE. Thank you, Madam Chair.

Thank the witnesses for being here today, for your terrific testimony. I am fascinated by the discussion that has come up over what is a green job. I mean, I guess I had that question, but I see virtually everybody, it seems like, at the table has the same sort of questions.

Ms. Krepcio, I noticed you sort of highlighted that for a bit—what is a green job and a job that is a regular job today, or a non-green job today could be a green job tomorrow, and a great example of if a plumber comes in and puts in a pipe for a low-volume flush, is that a green job? And yet, at the same time, you had numbers—percentages and statistics: You said that 5 percent of the green jobs were in the renewable area and 95 percent were in the efficiency. Well, how do you arrive at such a number if we don’t know what one of those is?

Ms. KREPCIO. Well, I used the statistics from the American Solar Energy, and those—and as, you know, when I think one of the things this panel points out is a lot of different places have a lot of different estimates, and I think it is very important. I mean, our research shows that consistently people are saying—organizations are saying—energy efficiency jobs are much more greater than renewable energy jobs.

But you are absolutely right. There is not a consensus, as I said in my testimony, and there is not a federal standard. So I think

it is great to have these kinds of conversations and dialogues, but my guess is there may never be a immediate consensus because could—as I said earlier, could they have come to a consensus on, what are those kind of job numbers in the information technology field? And it is an evolving area, clearly.

Mr. KLINE. Right. Thank you. And I appreciate, frankly, the clarity. Even though it is an unclear subject, I appreciate your clarity in explaining its unclearness. That is sort of the world that we are in here today.

Ms. KREPCIO. What an academic.

Mr. KLINE. Thank you. If we accept the notion that we need green jobs and that there is an evolving, growing, green industry, do you think—I will ask two or three of you this question—that those—that the job training for those ought to be available for all American workers?

Ms. KREPCIO. Well, I certainly think that the nation is poised to ensure that there are training available for all workers who want those kinds of trainings. I think that the American public and the American workers are probably grappling with—I know my neighbors, colleagues, and friends are going, “I would like to get into the green industry, but by the way, what is that green industry?”

And so that is one of the reasons why the Heldrich Center is suggesting that we—that the workforce development systems build a collaborative workforce model, because you need to listen to employers; you need to know where the market is going; you need to understand policy. And all that is changing quickly, and so therefore, if you want to get in the ground you need to have all these kinds of people talking together.

And the workforce system now isn’t great for having educators talking with community-based organizations, putting out information about where jobs are, but I think we are at a point that if we want this industry to succeed we need to do a much better job of having that collaborative conversation and be able to get that information out to workers so they know where to go to get the training that they need. And sometimes, as I said, they don’t need the training right away; they just need to understand maybe some very basics about what is installation and what is a low-flush toilet. And eventually, as the industry evolves, they might need some more credentials or training.

Mr. KLINE. Okay. Thank you. In fact, you said in your testimony that we need to include employers in this discussion, and your quote is, “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.” But under the current law, the Green Jobs Training Program and the Workforce Investment Act, unless you are a union workforce, you are excluded. And it just seems to me that if we really want to expand the job opportunities for the entire American workforce, that we ought to open it up for all American workers and not restrict it to only union workforces, and thereby, in a lot of ways, cutting out employers from the discussion.

Go ahead.

Ms. KREPCIO. I think it is very important that all workers have access to all kinds of jobs across the country. And one of the

things—and I think in California, you know, we have seen great promise in pre-apprenticeship programs, because a lot of workers—and we have seen this in some programs in New Jersey—really need—and as I said in my testimony, they need basic academic skills.

Some people don't have the skills to be able to pass the, you know, code requirements for being a carpenter, or a plumber, or whatever. And so I think it behooves us to really look at pre-apprenticeship programs so entry-level workers, and workers in low-income communities, and disadvantaged workers, and you know, and my people with disabilities have access to all those kinds of jobs. We need every American worker to be working, and therefore, we need to find some way to get them into that pipeline.

Mr. KLINE. Thank you very much. I will be encouraging all my colleagues to join on my Green Jobs Improvement Act so that we can include all workers.

And I yield back.

Chairwoman WOOLSEY. Congresswoman Shea-Porter?

Ms. SHEA-PORTER. Thank you.

Ms. Sherman, you were talking about the kinds of buildings that you construct, and let me make sure that I have this right: You can now construct buildings that produce 50—require 50 percent less energy?

Ms. SHERMAN. That is correct.

Ms. SHEA-PORTER. Okay. And you expect us to continue to progress in this area?

Ms. SHERMAN. Absolutely. I mean, as I said, we are hoping that we will eventually build buildings that produce more energy than they consume, so actually give energy back to the grid.

Ms. SHEA-PORTER. Okay. That is the great news. And I have to say that I don't understand why so many people in this country brag about our past technology achievements while they deride and criticize our present technology achievements and absolutely doubt this future. So when we are looking at this, we know that our future is here and it is now.

So, Dr. Wolfe, I paid very close attention to your testimony because I live in New Hampshire, and not too far from Seabrook Plant, I am sure you are familiar with it—bankrupt, a lot of problems. We now have to deal with an extra expense on our electric bill. So when you were talking about it being the cheapest form and cost savings, you know, I had to question that.

But I wanted to talk about some other things about least expensive. If we built these nuclear power plants, would you be wanting loans from the U.S. taxpayers?

Dr. WOLFE. I am sorry, would I be—

Ms. SHEA-PORTER. Wanting loans? Would the nuclear industry build their own or would they come to the taxpayer to build? And what is the default rate, please—you know the default rate when they use taxpayer money?

Dr. WOLFE. Well, okay, there are a lot of issues there. One is, would I be in favor of loan guarantees, I assume, for nuclear construction?

Ms. SHEA-PORTER. Right.

Dr. WOLFE. I certainly would be. I think that is the smart thing for the taxpayer to do; I think it is unlikely it would ever cost them anything.

Ms. SHEA-PORTER. Okay. But they didn't really ask for the kind of money that I think nuclear industry would ask. And do you know what the default rate is on these loans?

Dr. WOLFE. Well, we haven't built one in 30 years, so I mean, you know—

Ms. SHEA-PORTER. It is over 50 percent.

Dr. WOLFE. It is over what?

Ms. SHEA-PORTER. Congressional Budget Office estimated over 50 percent for a default rate, which means that this would not be the least expensive if the U.S. taxpayer has to take on the cost for doing this. And again, I see my electric bill every month and I know what happened, so I do have a personal interest in this.

But I also wanted to move on about creating jobs. The Bureau of Labor Statistics said that it will only create about 27,000 jobs and some of them, as you indicated, would come from elsewhere. And considering our unemployment rate is over 8 percent right now and we have lost millions of jobs, is this really a big job-creator when all these people sitting here are also hiring people, but at a faster rate?

Dr. WOLFE. I think you are talking about the new nuclear opportunities. There are also the replacement opportunities that I described; I think one-third of the workforce is going to retire in the next 5 years. We also have the peripheral of businesses that supply the nuclear industry, which aren't counted in those job estimates.

Ms. SHEA-PORTER. Can you tell us how many jobs you think would be generated? Everybody here has pretty much indicated something about jobs. Could you name a number?

Dr. WOLFE. Well, I think the number you used is from a study that I have read—the 27,000. The multiplier on those I would probably want to defer to Dr. Bogart or someone that is more into those multiplier figures, but it is typical that job creation will result in two to five additional jobs in the industries, and those are the kinds of numbers that I would expect.

Now, that says we are going to build—I think it is based on 17 power plants.

Ms. SHEA-PORTER. Which would take how long before you actually can start building?

Dr. WOLFE. Well, unfortunately, the system we have, if you just think of it today you will probably be 7 years before you can start building a power plant.

Ms. SHEA-PORTER. Right.

Dr. WOLFE. However, there are ways to shorten that period of time.

Ms. SHEA-PORTER. But still, we are talking 6 or 7 years before we actually have the jobs, and how long—

Dr. WOLFE. Except for new builds.

Ms. SHEA-PORTER. And once they have started to build, how long before a plant would actually go online.

Dr. WOLFE. A plant can be built from the time you break ground in about 3½ to 4 years, assuming there is no delay in the process.

Ms. SHEA-PORTER. So we are talking a long range outlook. We are looking nine to 10 years before—whereas, the people sitting here are really grappling with the issues and being able to produce solutions today.

And I have another question I am going to ask you. You talked about it being safe and the greenest, and could you and I go on a field trip to Chernobyl today?

Dr. WOLFE. That is a very, I think—it is not appropriate to the U.S. experience. Chernobyl was a very different kind of machine, a very different kind of technology, and a very different kind of culture.

Ms. SHEA-PORTER. Okay. But it is still a problem that we are left with. I have a problem in New Hampshire: We have no place to put those spent rods right now. And I think we have a problem with storage; we have a problem with our technology. And I would have to argue it is not the greenest of the green.

Thank you, and I yield back.

Chairwoman WOOLSEY. Thank you.

Congressman PAYNE?

Mr. PAYNE. Thank you very much. I might just pick up where the Representative left off.

Where do they store yours, and fuel in—you say South Carolina is proud of how much they do it—where is it stored?

Dr. WOLFE. Well, if they are in state it is pretty much where everybody's is, which is onsite at the plant site.

Mr. PAYNE. And this question never arises from South Carolinians that there is—it has been mentioned that their potential dangers would be storing of this spent fuel?

Dr. WOLFE. I am not sure what potential dangers you refer to. However, I have personally visited recently such a site. The casks are sitting there on a parking lot, and it represents all of the fuel from 1984 at the McGuire Nuclear Plant in North Carolina. It is a few casks sitting there, and they could obviously handle several decades' more in that same location if they need to. It would be preferable to have a different solution—

Mr. PAYNE. Well, why is the big debate about where is it going to be stored permanently? You know, you said somewhere out in Nevada. Nevada said, "Bring it out here." I mean, you know, it seems to be this, you know, in your judgment—you are a scientist; I am not—that there is, you know, like storing milk. There is no, I mean, it is—I would be 1000 percent supportive of all the nuclear energy in the world, I mean, just have it all—bring it all to New Jersey—if I thought that it was just the safest kind of residue, you know.

So I am a little confused at sort of the cavaliness, "There is no problem," and there has not even seemingly been a discussion about a potential problem with storage over a period of time.

Dr. WOLFE. Well, there are many facets to the issues you are raising, and I know a lot of people are concerned about. There are technical solutions to all of those new questions. The issues we have are not whether or not we have technology to solve those issues; it is more about the political will to choose a solution. And there are multiple solutions.

Mr. PAYNE. And you are not concerned about the potential dangers?

Dr. WOLFE. I am not. I used to run a business or an organization that designed those casks, and they are not going to be penetrated.

Mr. PAYNE. Okay. So like I said, it is as safe as safe can be, in your estimation. I mean, I just am asking your opinion.

Dr. WOLFE. Okay.

Mr. PAYNE. Mr. Ringo, do you have this—

Mr. RINGO. Well, Congressman, thank you very much. Congressman, I grew up in Louisiana in the infamous Cancer Alley, where there are petrochemical plants separated by poor communities, and I am not opposing Dr. Wolfe's position on—I have no position on nuclear. But we must create alternative energy sources and pursue alternative energy sources that are both people-and environmentally-friendly.

Those people that live in close proximity to those facilities have a history of being disproportionately impacted—primarily poor people and people of color. So we must pursue energy sources that are environmentally-and people-friendly, and they are out there. And no better source of alternative energy than conservation, than energy efficiency.

Those are not harmful to the environment. Those energy efficiency practices are not harmful to neighbors that live just across the fence line from petrochemical plants or any type of facility.

So I urge the U.S. government, the Congress, to encourage alternative energy practices that are going to be environmentally-friendly. And yes, there are practices that are out there.

Mr. PAYNE. Right. And finally, it seems like my time is running out. You know, several of the European countries that do so much in nuclear energy and other toxic—you know, they ship it down to some poor African country because they have—country needs income. So they don't keep it in their country, even. I am not talking about their neighborhoods, but they ship it down to the poorest African country they can find that is willing to accept anything they can simply for income.

Chairwoman WOOLSEY. Congressman Hare?

Mr. HARE. Thank you, Madam Chairman.

You know, just to the panel, we have been hearing today, you know, the definition of what is a green job. From my perspective—I come from West Central Illinois—I have counties in my congressional district that have 11 to 12 percent unemployment, so I am not here today and worried about what the definition of a job is; I am much more concerned about putting people to work. And you can call it what you want to call it. And, you know, from start to finish, as you mentioned, somebody that installs windows and then moves up—

Dr. Bogart, just one of the things I just want to take a little bit of an issue with here on the—in your first question you mentioned that the net increase in jobs that I think my friend from Georgia was mentioning producing an emerging green energy sector, and that there is a potential loss—

I would like to, for the record, Madam Chair, if I could, enter a working paper series from Robert Pollin from the University of

Massachusetts Amherst entitled, “Responses to Seven Myths About Green Jobs,” and, “Green Jobs Myths”——

Chairwoman WOOLSEY. Without objection.  
[The information follows:]

**Response to “Seven Myths about Green Jobs” and “Green Jobs Myths”**

Two new papers purport to debunk “myths” about recent students on the employment effects of investments in the clean energy economy. The full 97 page version of this work is titled “Green Jobs Myths” and the 21 page summary paper is titled “Seven Myths about Green Jobs.”<sup>1</sup>

These papers are written as a response to what they term the “rapidly gaining popularity” of four studies that attempt to show the employment gains that can emerge from investments in building a clean energy economy in the United States. The four studies to which they refer are U.S. Metro Economies: Current and Potential Green Jobs in the U.S. Economy, published by the U.S. Conference of Mayors; Renewable Energy and Energy Efficiency, published by the American Solar Energy Society; Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World, published by the United Nations Environmental Program; and Green Recovery, co-published by the Center for American Progress (CAP) and Political Economy Research Institute (PERI) at the University of Massachusetts-Amherst.<sup>2</sup>

These papers offer a few useful correctives on some detailed points regarding the links between green investments and jobs. But overall, they end up accomplishing exactly the opposite of what they intend. They attempt to identify and puncture “myths,” on the green economy, but instead offer no challenge to the central explanations as to how investing in the green economy will provide significant benefits throughout the U.S. economy.

I was the lead author of Green Recovery, and my co-authors were Heidi Garrett-Peltier, James Heintz, and Helen Scharber. I am also the Co-Director of PERI, and all three of my co-authors are also with PERI. This paper was a relatively brief interim report within an ongoing research program, on which we work closely with colleagues at CAP, particularly the managers of the project at CAP, Bracken Hendricks and Kit Batten (though Dr. Batten has recently taken a new position at the Department of the Interior).

The two “Myths” papers combine criticisms of our paper, Green Recovery, with those of the other three studies. They also discuss some issues of their own choosing, beyond the immediate themes on which our study and the other three concentrate. Within this structure, at no point do they offer a sustained point-by-point refutation of Green Recovery or any of the other three studies. They rather begin their summary paper by listing the “seven myths” and the “facts” that they claim will refute those myths. However, in the body of both the shorter and longer papers, they do not return to that basic structure of ‘myths vs. facts,’ but rather offer three broad themes, “defining ‘green jobs,’” “mistakes in economic analysis,” and “ignoring technical literatures.” These are all obviously very broad issues. As such, it will help us to focus the discussion if I respond to their claims regarding each of the seven myths.

Their Myth #1: “Everyone understands what a ‘green job’ is.”

Their Fact #1: “No standard definition of a ‘green job’ exists.”

We can dispense with this issue readily. Despite the fact that they choose to present their point in a sophomoric, unprofessional tone, (“everybody understands \* \* \*” Who is the “everybody” to whom they refer?), I nevertheless agree with them on substance. In fact, at no point in Green Recovery do we make reference to the term “green jobs.” In a recent press story, I am quoted as follows:

Exactly what a “green job” is, though, most people aren’t quite sure yet. “There’s no such thing; that’s my definition,” said Robert Pollin, co-director of the Political Economy Research Institute at the University of Massachusetts, Amherst. “I’m greatly in favor of investing in things that will promote a clean environment, fight global warming, and those investments will all create jobs, and I don’t really care what color they are.”<sup>3</sup>

I have been quoted making similar statements in other media stories. What is at issue here? Of course, there are basic commonalities between the focus in Green Recovery on green investments and job creation and the terms “green jobs” or “green collar jobs.” In all cases, we are clearly referring to initiatives that can successfully link policies to promote both a clean environment and the expansion of decent job opportunities. Moreover, the term “green jobs” obviously has wide resonance among sectors of the public—as well as the Obama administration—in suggesting the broad

range of initiatives that will have to be undertaken to build a clean energy economy over time.

Despite these commonalities, it is nevertheless the case that we face serious problems in attempting to establish a single operational definition of the term “green jobs.” For example, if a truck driver is delivering solar panels to a construction site, should that count as a “green job?” What if, the next day, the same truck driver delivers pumping equipment to an offshore oil drilling project? Even within the project to install solar panels on rooftops, we would of course consider the electricians and roofers doing the installation as having green jobs. But what about the secretaries and accountants in the back office?

This last observation raises a concern that is particularly relevant as regards the approach we took in Green Recovery and related work. That is, how should we consider jobs that are not directly involved in improving environmental conditions, but are indirectly involved? The accountants and secretaries at the back office of a construction company are two examples of this consideration. But the issue is actually still broader. In this research, we are focused not just on the jobs that are directly created by investments in energy conservation and renewables, but rather the total number of jobs created, including jobs that are both indirectly created (jobs created for suppliers of energy producing firms) and “induced” (jobs created when those newly employed by green investments in turn spend their newly acquired wages). We are also concerned to distinguish the proportion of jobs—direct, indirect, and induced—created in the domestic U.S. economy, as opposed to the jobs created in other countries when our environmental investments create an increased demand for imports.

In short, there are many useful points and positive policy ideas associated with the high level of attention now being given to the concepts of “green” and “green-collar” jobs. But in the work my co-authors and I have done, we have found it more constructive to not attempt to define these terms or rely on them in any substantive sense.

Their Myth #2: “Creating green jobs will boost productive employment.”

Their Fact #2: “Green job estimates in these oft-quoted studies include huge numbers of clerical, bureaucratic, and administrative positions that do not produce goods and services for consumption.”

Green Recovery offers arguments and evidence to demonstrate that investments in energy efficiency and renewable energy will create employment through the three channels mentioned above, i.e. direct jobs, indirect jobs, and induced jobs. Indeed, the central finding of our work is that investments of a given dollar amount in energy efficiency and renewable energy—concentrating on building retrofits, public transportation and freight rail, and smart grid electrical transmission systems in the efficiency area, along with renewable energy investments in solar, wind, and biomass fuels—will produce roughly three times more jobs than spending the same amount of money within the oil, natural gas and coal industries. That is, within the context of the U.S. economy in its present structure—and as derived from the Department of Commerce U.S. Input-Output Accounts—spending \$1 million within the clean energy areas with 70 percent of funds for energy efficiency and 30 percent for renewables, will create about 17 jobs. Spending that same \$1 million within the fossil fuel industries will create about five jobs. The authors of “seven myths” make no attempt to directly refute this central empirical finding.

They also do not make clear how they distinguish “productive employment.” Two ideas are suggested through their ‘factual’ claim regarding “huge numbers of clerical, bureaucratic, and administrative positions that do not produce goods and services for consumption.” First, they claim to know that investments in the green economy produce more “clerical, bureaucratic, and administrative positions” than investments in alternative economic activities, including, presumably, investments in fossil fuels and lobbying firms guiding credit to fossil fuel firms, and the like. But they offer no systematic evidence to support this claim. They also claim to know that “clerical, bureaucratic, and administrative positions” do not “produce goods and services for consumption.” Let us consider, for example, secretaries employed at the Environmental Protection Agency, an agency engaged in pollution control. Are the authors suggesting that these secretaries are not providing a “productive” service? Is their work less “productive” than that of secretaries working for an oil company producing a product that damages the environment? The authors offer no explanation.

Their Myth #3: “Green job forecasts are reliable.”

Their Fact #3: “The green job studies made estimates using poor economic models based on dubious assumptions.”

The authors here are actually raising two distinct questions. The first question is, Are green job forecasts reliable? I will speak only to the figures reported in Green



Recovery. Those figures, in fact, are not forecasts at all. They are figures generated directly from data from the Commerce Department's surveys of businesses within the United States, and organized systematically within their input-output model. Within the given structure of the current U.S. economy, these figures provide the most accurate evidence available as to what happens within private and public enterprises when they produce the economies' goods and services—i.e. how many workers do they hire, and what are the materials they purchase? Our methodology is to work within this detailed survey evidence and data set, and to pose simple questions within it: e.g. if we spend an additional \$1 million on building retrofits, how will businesses utilize that million dollars to actually complete the service of the retrofit?

Through this approach, we have been able to make observations as to the potential job effects of alternative energy investment strategies, at a level of detail that is not available through any alternative approach. The authors of "Seven Myths" offer no evidence that any alternative to the U.S. input-output tables can provide more reliable evidence on the detailed workings of the U.S. economy.

Now to the second question: Does our model constitute an example of "using poor economic models based on dubious assumptions?" There are certainly weaknesses with our use of the input-output model. The most important are that it is a) a static model; and b) a linear model. But these deficiencies need to be considered in the context of alternative approaches that, in my view, have even more serious weaknesses. Consider these points:

1. Static model. We are making estimates as though everything is happening at a fixed point in time. A more realistic picture of the economy would of course have to recognize that the spending effects of a government recovery program will take place over time, and that these timing effects are important. Adding a time dimension would make the model "dynamic," in the technical jargon.

The problem here is how to incorporate a time dimension in an effective way. This issue has plagued econometric forecasting efforts for a long time, and there is no sign of the problem abating. The dismal record of even the most prestigious forecasting models even over the past year attests to the issue.

Consider two highly relevant and interrelated cases in point. First, few, if any, economic forecasting models predicted that, by June 2008, crude oil would be selling at \$140 a barrel. This would include forecasts generated less than one year before crude hit \$140 a barrel.<sup>4</sup> Once the price of crude oil did rise to \$140 a barrel, few, if any forecasters then predicted that the price would collapse to \$35 a barrel only six months later. More generally, almost no economic forecasts predicted that the U.S. economy would enter into a recession in December 2007 of historic severity. This includes even the forecasts that were published after the recession had already begun.<sup>5</sup>

In principle, a dynamic model does offer a more complete picture than a static model as to how the economy operates over time. But because dynamic forecasting models are so unreliable, I think it is preferable to work within a simpler framework, and draw out assessments of how transitions over time affect the results within this simple framework.

2. Linear model. Our model assumes that a given amount of spending will have a proportionate effect on employment, no matter how much the level of spending changes, either up or down. For example, the impact of spending \$1 billion on an energy efficiency project will be exactly 1,000 times greater than spending \$1 million on the exact same project.

The most significant consideration here is that we take no account of potential supply constraints in moving from a \$1 million to a \$1 billion project. Under some circumstances, this could be a significant deficiency in the model. But under current conditions in the U.S. economy, with widespread slack in the midst of a severe recession—i.e. with deep and worsening unemployment and with private-sector lending and investment almost flat—we are on pretty safe grounds with our assumption that supply constraints will not exert a major influence how the spending on green recovery impacts the economy.

A variation on the problem of linearity in our model is to recognize that the model, in the technical jargon, is a "partial" rather than a "general" equilibrium model. The model does not take account of, for example, feedback effects of prices of solar panels when demand for these panels rises due to the stimulus program. Again, a more fully specified model would take account of such factors—that is, if the stimulus program leads to increased demand for solar panels, prices of the panels will rise, all else equal. Then for a given level of spending, fewer panels will be purchased at higher prices/panel. This will then mean that a given level of spending on panels will likely mean that fewer jobs will get created to build, deliver, and install the panels.

But here again, the forecasting record of more fully specified “computable general equilibrium models” is not encouraging. Moreover, again, the fact that we are operating within an economy with widespread slack means that these feedback effects are likely to be weak.

Overall, I am confident that our relatively simple input-output framework provides the basis for as accurate a set of job forecasts as can be obtained through the existing available models and modeling techniques. The authors of “Seven Myths” disagree. They offer brief general impressions as to what the features might be of an alternative model. But they provide no evidence showing how an alternative model will perform more effectively than our own. They also make no attempt to consider the pitfalls facing such models, suggesting perhaps that they are unaware that these alternative models have severe limitations.

Their Myth #4: “Green jobs promote employment growth.”

Their Fact #4: “By promoting more jobs instead of more productivity, the green jobs described in the literature actually encourage low-paying jobs in less desirable situations. Economic growth cannot be ordered by Congress or by the United Nations. Government interference in the economy—such as restricting successful technologies in favor of speculative technologies favored by special interests—will generate stagnation.”

The green investment agenda that we advance in Green Recovery does indeed “promote employment growth” in the precise way that we have defined that term—that is, the employment levels in a portfolio of clean energy areas generates about three times more employment than spending within traditional fossil fuel industries. As described above, we derive these findings directly from the U.S. input-output model. Despite the limitations of that model—of which I am aware and describe above—this still provides the most accurate framework for establishing the relative employment effects of alternative spending targets. The authors of “Seven Myths” offer no evidence to suggest otherwise.

But are the jobs generated by the clean energy agenda “low paying” in “less desirable situations.” Are we erroneously “promoting more jobs instead of more productivity”?

On the issue of pay levels, we were quite explicit in Green Recovery on the breakdown between high- and low-paying jobs, as well as on future job opportunities. We wrote:

Green investments generate not only significant numbers of well-paying jobs with benefits but also a relatively high proportion of lower, entry level jobs that offer career ladders that can move low-paid workers into better employment positions over time.<sup>6</sup> The average pay for employees associated with green investment areas is about 20 percent less than the average for those connected to the oil industry. But this number is deceptive because a green investment program will create roughly triple the number of good jobs—paying at least \$16 dollars an hour—as the same level of spending within the oil industry. A green infrastructure investment program creates more jobs at all wage levels than spending within the oil industry because of both higher labor intensity and greater domestic content—resulting in average wages that are lower than the oil industry but spread across a greater number of jobs created (pp 11-12).

If the green investment agenda creates three times the number of good jobs as spending within the oil industry, how is it, as the authors of “Seven Myths” suggest that all the jobs created by green investments are “low paying” in “less desirable situations?” They do so only by ignoring the evidence we have provided.

Are jobs within the green economy low productivity jobs? This is a serious question, deserving careful consideration. If we begin with the standard definition of labor productivity as output/worker, it then follows by definition that, if clean energy jobs on average operate at higher labor intensity, this means they produce less output/worker.

Yet, aside from this conventional definition of labor productivity, three other considerations are crucial here. First, by raising overall employment, the green investment agenda is giving new opportunities to previously unemployed workers. This raises the productivity level of millions of workers from zero to a positive number. Second, the green investment agenda is creating new opportunities for underemployed workers—and thereby raising their productivity from a lower to a higher level. Third, given the crisis of global warming, we need to begin incorporating environmental effects in the measurement of output and productivity. That is, spending on fossil fuels creates the output “good” of, for example, electrical power. But it also creates the output “bad” of pollution and greenhouse gas emissions. This point has long been recognized in discussions of the environmental costs of economic growth, and is included in virtually every introductory economics textbook. The authors of “Seven Myths” make no reference to such considerations.

Their Myth #5: “The world economy can be remade by reducing trade and relying on local production without dramatically decreasing our standard of living.”

Their Fact #5: “History shows that individual nations cannot produce everything its citizens need or desire. People and countries have talents that allow specialization in products and services that made their ever more efficient, lower-cost producers, thereby enriching all people.”

There is nothing in Green Recovery that suggests that the U.S. economy should “rely on local production.” On the other hand, both the current economic and the long-term environmental crisis do in fact suggest the need for ‘the world economy to be remade.’ Indeed, there is little controversy across the political spectrum as well as the economics profession on this need. The only real question is not whether the world economy should be “remade” but what exactly is the best approach for remaking it.

There are certainly benefits to be gained through international trade. The economics of the “Asian Tigers,” including now most dramatically China itself, attest to this. However, recognizing these benefits does not lead inexorably to an endorsement of unfettered free trade across all countries under all circumstances, as the “Seven Myths” authors seem to believe.

The U.S. economy has run a persistent trade deficit for over forty years, which has had destabilizing effects, most clearly through the build up of huge dollar reserves by our trading partners. We have also experienced serious political difficulties due to our reliance on foreign oil imports. The green investment agenda offers a major opportunity to reduce our reliance on foreign oil. More specifically, as we describe in Green Recovery, the domestic content of green investments is significantly higher than with fossil fuels specifically, and the oil industry in particular. This, along with higher labor intensity, are the two major factors creating relatively more jobs through the green investment agenda than through fossil fuel production.

There are two primary ways through which the green investment agenda raises domestic content. The first is through reducing oil imports. The second is from the fact that most energy-efficient investments are naturally location specific. That is, homes located in Silver Spring, Maryland can only be retrofitted by workers in Silver Spring. Similarly, the electrical grid system in Maryland can be upgraded only in Maryland. Clearly, the simple reality of location-specific activities has nothing to do with the creation of trade barriers.

The higher domestic content of the green investment agenda—as well as the net job creation effects in general—have another major benefit, which is that they offer a counterforce to the pressures on U.S. workers from global outsourcing. The potential effects of global outsourcing on U.S. workers were explored forcefully in Foreign Affairs magazine in 2006 by the Princeton economist and former Vice Chair of the Federal Reserve Alan Blinder. Blinder argued that, increasingly, services that can be carried over the internet—including the telephone operators in India with whom we are already familiar, but also back-office accountants, lawyers, engineers, and laboratory technicians as well as their support staffs—can be effectively supplied by employees in poor countries that work for, say, one-fifth the wages of their U.S. counterparts. These would be in addition to the manufacturing jobs that have long been forced to compete with China and other low-wage producers. Blinder’s conclusion was that something like 20–30 percent of all jobs in the United States today—between 30 and 40 million jobs in total—are vulnerable to these outsourcing pressures. The single most effective way to counter these pressures is for employment creation to be set as a centerpiece of U.S. public policy. The green investment agenda cannot fulfill this role on its own, but it can move us a good distance in the right direction. The authors of “Seven Myths” ignore this consideration within U.S. trade policy, despite its prominence in both academic and policymaking circles.

Their Myth #6: “Government mandates are a substitute for free markets.”

Their Fact #6: “Companies react more swiftly and efficiently to the demands of their customers/markets, than to cumbersome government mandates.”

This Myth/Fact pair has little connection to the content of Green Recovery. The programs proposed in Green Recovery include direct government spending programs, tax incentives for businesses, and loan guarantees for private lenders who will support business investment in green activities. The majority of total spending proposed in Green Recovery is channeled to private businesses through tax incentives and loan guarantees. In addition, Appendix 2 is devoted in full to analytic issues associated with maximizing the effectiveness of our proposed loan guarantee proposal. We were pleased that the Obama recovery program closely reflects this priority for private business initiatives. Moreover, private businesses will also benefit directly through the public spending features of both the program we presented in Green Recovery and the Obama plan, through new opportunities for government construction projects and the spending stimulus being injected into private markets.

It isn't clear how these business incentive programs could be construed, in the terms used in "Seven Myths" as "ignoring incentive effects" or "market hostility."

Green Recovery does briefly discuss one government mandate program, which is a cap-and-trade measure to require reductions in greenhouse emissions. The need for a carbon cap—or some variation on this, such as a carbon tax—emerges precisely through the failure of the free market to incorporate into market prices the environmental costs of burning fossil fuels. Again, such material is standard fare in virtually all introductory economics textbooks. But the authors of "Seven Myths" do not consider this even though their discussion around "Myth 6" would have been an obvious place for such a discussion.

Their Myth #7: "Wishing for technological progress is sufficient."

Their Fact #7: "Some technologies preferred by the green jobs studies are not capable of efficiently reaching the scale necessary to meet today's demands."

It is hard to take seriously assertions of this nature. Who has stated anything on the order of "wishing for technological progress is sufficient?" Certainly, nothing close to any such claims were expressed in Green Recovery.

In fact, there was a specific reason why, in Green Recovery, we proposed that 70 percent of the allocation for all green investments be channeled to energy efficiency measures as opposed to 30 percent for renewable energy. That is precisely because the technologies for achieving energy efficiency are known, relatively simple for the most part, and provide short-term, high-probability, paybacks. In Green Recovery, we work through the investment and payback opportunities available through a \$2,500 retrofit of an average-sized U.S. home, based on data available through the EPA as well as through my University of Massachusetts colleague Professor Paul Fisetete. Professor Fisetete is one of the country's leading experts on the materials science issues associated with building retrofits. We showed in our discussion that, relying on simple, available and affordable technologies, the \$2,500 retrofit would lower home energy costs by about one-third. This would mean a payback for the initial \$2,500 investment within three years (p. 15).

A wide range of such opportunities are clearly available now in the area of energy efficiency, using known technologies. The renewable energy technologies are more uncertain at present. That is why we proposed channeling a smaller overall proportion of green investment funds into these areas. The amounts we proposed will be enough to accelerate research and commercialization in renewable energy over the next decade, while energy efficiency remains the leading edge of the green investment agenda.

Again, I don't see how this approach advanced in Green Recovery could somehow be construed as "wishing for technological progress is sufficient." It would be more constructive if the authors of "Seven Myths" were to consider the arguments and evidence that were actually advanced in Green Recovery. That would have enabled us to perhaps conduct a healthy debate on these matters of great importance. That is simply not possible on the basis of the unsubstantiated claims they have chosen to make.

#### ENDNOTES

<sup>1</sup>The four authors of both papers are Andrew Morriss, William Bogart, Andrew Dorchak, and Roger Meiners. The longer version of this report is at: <http://www.instituteforenergyresearch.org/wp-content/uploads/2009/03/morriss-green-jobs-myths.pdf>; the shorter version is at: <http://papers.ssrn.com/sol3/papers.cfm?abstract-id=1357440#>

<sup>2</sup>U.S. Metro Economies: Current and Potential Green Jobs in the U.S. Economy is available at <http://www.usmayors.org/pressreleases/uploads/GreenJobsReport.pdf>; Renewable Energy and Energy Efficiency is available at <http://www.ases.org/index.php?option=com-content&view=article&id=465&Itemid=58>; Green Jobs: Towards Decent Work in a Sustainable, Low-Carbon World is available at <http://www.unep.org/labour-environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf>; and Green Recovery is available at <http://www.peri.umass.edu/green-recovery/>

<sup>3</sup>See Emily Badger, Miller-McCune Business, "What Shade of Green Best Suits the Economy," <http://www.miller-mccune.com/business-economics/what-shade-of-green-best-suits-the-economy-910.print>, 1/22/09.

<sup>4</sup>Three prominent forecasts published in 2007 of where crude oil prices would be in 2008 include JP Morgan, in August 2007, estimating \$59.75 a barrel; Goldman Sachs, in September 2007, estimating \$85 a barrel; and the U.S. Energy Information Agency, also in September 2007, estimating \$71.17 a barrel. Crude oil prices in the U.S. market are reported at: <http://tonto.eia.doe.gov/dnav/pet/hist/wtotworldw.htm>

<sup>5</sup>This general problem of making accurate economic forecasts was captured well by former Federal Reserve Chair Alan Greenspan's unintentionally amusing observation made at the 1999 annual meeting of the International Monetary Fund and World Bank that "The fact that our econometric models at the Fed, the best in the world, have been wrong for fourteen straight quarters does not mean they will not be right in the fifteenth quarter" (Martin Mayer (2001), The Fed, p. 180). This approach is consistent with the conclusions reached by Lawrence Sum-

mers in his outstanding paper, "The Scientific Illusion in Empirical Macroeconomics," *Scandinavian Journal of Economics*, 93:2, 1991, pp. 129-48.

<sup>6</sup>In fact, a high proportion of the low-paying jobs created by green investments will be in construction and manufacturing, where career ladders are substantially more effective than in service-sector areas—such as hotel and restaurant workers—associated with household consumption.

Mr. HARE. Thank you.

How would you respond to Mr. Ringo's point that most green jobs can't be outsourced because they would have to be, you know, serving technologies and systems here in the United States. Yet I have—you know, we have seen a lot of jobs in this country move overseas.

I lost 1,600 people from Galesburg, Illinois to Reynosa, Mexico when Maytag closed their doors. You know, I would love to see those people have the opportunity to work. And again, as I—to go back to work—and again, as I said, you can call it a green job or you can call it a red job or whatever—a spotted job, I don't care what you call it, but these people desperately need to work.

And I am wondering if you would agree with me that whatever these jobs that are created would be—U.S. jobs—they would outweigh any potential job loss, and would you agree with me on that?

Dr. BOGART. Congressman, that is a great question. I think the issue is whether or not that job loss is also U.S. jobs. If these are jobs that are being created at the expense of other U.S. jobs that are being lost, then it is hard for me to completely agree with that.

I would agree with Ms. Krepcio that we do want to extend the training very broadly and look for those types of opportunities, and to encourage growth and entrepreneurship as demonstrated by the panelist to my right. I think that is exactly what we should be doing in the United States. So I would agree with you about that.

Mr. HARE. Okay.

And Mr. Ringo, I was glad that you mentioned the Manufacturing Extension Partnership, also known as MEP. I have had 65 clients in my district; it generates \$126.8 million dollars in sales, created 836 jobs in my congressional district. And I testified before the Budget Committee about the need to double this amount, to double the critical program for fiscal year 2012.

How much would—in your opinion—would we need to expand MEP funding for it to be more effective, and what is the best way to develop a green mission or focus for MEP and its clients?

Mr. RINGO. I think—

Mr. HARE. Can you turn your mic on? I am sorry.

Mr. RINGO. I believe you are correct that it should be doubled. We have just got to create these opportunities, and the bottom line is—and I fully agree with you with respect to trying to figure out what the definition is—the bottom line is, we have got Americans that are out of work.

Mr. HARE. Absolutely.

Mr. RINGO. We have got to figure out ways to put people back to work again. The fact of, "Well, we are going to lose jobs by creating new jobs," look, there are enough people out of work that if we create jobs in America, stimulate our American economy with new jobs, we must diversify our energy portfolio.

It doesn't mean that we need to shut the doors on certain petrochemical plants because we come up with new alternatives. What

we do need to do is expand our energy portfolio so we are not so single-dimensional with respect to our energy and take the necessary steps that it takes in a major way to put American manufacturers back to work again.

And if we need to increase the amounts of investment that we are making through the government to guarantee those increases in job numbers, then we need to go as far as we need to go. We need to get people back—

Mr. HARE. And one last quick one; I am out of time, almost. I also think we need to invest in our community colleges. I have a community college in my district that is training people to work in biodiesel and ethanol factories, and it doesn't do any good to have a factory if you don't have a trained workforce. I have John Deere, who is looking for welders, and I have a community college that is trying to get a welder program, and these are people who are looking for work.

So if we invest in our community colleges to train people to go to work, they are going to have the opportunity to have a job, and these are probably going to be long-term, sustainable jobs. Again, you can call it whatever you want to call it, but they are going to call it a paycheck and being able to buy a home and put their kids through school.

Thank you, Madam Chair.

Chairwoman WOOLSEY. We are going to have a second round, if you folks are willing.

Dr. Bogart, you were talking about the definition of green jobs being difficult and not transparent and we should not waste money. I would like to take that to another place, where we are talking about making coal clean and nuclear safe. And there is a limited amount of investment in this new, upcoming industry called the green industry, not just for the United States but for the world. And there will be a lot of competition.

Do you think it is wise to invest in cleaning up coal and making nuclear safe, or should we be investing in solar and wind and windows, and the kinds of things that we know we can do immediately?

Dr. BOGART. Here is why I would agree with Mr. Ringo: I think we do need to take a very broad portfolio view, and my concern is more about an overly narrow definition that leads people to try to squeeze themselves into a box that doesn't fit. I think we should be looking at all those possibilities because we need to do things in the short run that are immediate; we also need to keep planning for the future and investing for the future so that over the next few years technologies that we haven't even thought of have room to grow and develop here.

Chairwoman WOOLSEY. Mr. Ringo?

Mr. RINGO. I do want to reiterate, as we talk about that broad view, about that broad portfolio, that those items that are to be a part of that portfolio must be environmentally- and people-friendly. I want to be very clear about that.

Chairwoman WOOLSEY. Right.

Ms. Sherman?

Ms. SHERMAN. Yes. I wanted to speak a little bit to the issue of the loss of the job in one industry being replaced by another job.

You know, if that job was going away because that industry doesn't make sense anymore because the technology is changing and the world is shifting—you know, in Oregon we were a very resource-based economy, and you know, some of those jobs just went away because that resource-based economy in some respects, you know, can't work the same way anymore.

So I would sort of disagree. I think some of those jobs might have gone away regardless of the fact—you are not just replacing a one-for-one. You really are getting something.

And then on the training and the community colleges, you know, the way everyone has talked about green jobs being so broad, from entry-level to, you know, Ph.D.s, scientists, the education and training piece has that same spectrum where you are talking about technical programs in community colleges and associate degrees and certificates. So there is, you know, automotive degrees that then look at green automotive programs and so forth, all the way up to 4-year graduate schools, you know, and Ph.D.s again, who are your scientists. I think there is a real connection between that spectrum.

Chairwoman WOOLSEY. To just follow on to that, if anybody would like to respond, one of the witnesses said that community college—or, colleges and employers weren't talking together. That is totally not true in my district, north of the Golden Gate Bridge. I mean, our community college is working with the industry and our 4-year university is working with industry. Would anybody like to respond to that?

Well, let us go with Ms. Krepcio.

Ms. KREPCIO. I think it really depends on what part of the country—in some parts of the country educators, post-secondary community colleges, K-through-12 are working well with industry; in other parts of the country there is room for—there certainly is room for improvement. I think that the workforce system in this country has been okay in trying to work with educators and industry people to put people into jobs that are currently there.

I think the challenge in the green jobs movement is predicting the jobs of the future so that we have a ready-trained workforce. And I think that is why we are recommending these very interactive collaboratives.

Chairwoman WOOLSEY. Congressman Price?

Dr. PRICE. Thank you, Madam Chair.

I want to make a few comments about some of the discussion that has already occurred. I think it is important to follow up on my colleague's comments from New Hampshire about the default rate for nuclear power plants. If one were to read the transcript so far, one would be left with the notion that 50 percent of the nuclear power plants in this nation have defaulted, which simply isn't true.

It is important for people to appreciate that this estimate came from the Congressional Budget Office, which has a great history of being off by hundreds and sometimes thousands of percent. And what they use—they use this figure, the 50 percent default rate, in their financial modeling for the future in order to get money for something else to balance the budget. The CBO does things in a static way as opposed to a dynamic way, so it ought not be given

much credibility certainly by this committee, and I know it isn't across the nation.

Secondly, nuclear safety: There is a great reason why we haven't, as a nation, tackled the issue of what to do with the spent fuel rods, and that is because we haven't had the political will to be able to do it. And right now, Senator Reid is standing in the way of that and this administration is standing in the way of that for appropriately storing, safely storing the spent fuel rods in Yucca Mountain has been a challenge for decades, as all of you know, but I think it is important to bring that to light.

Let me go back to where I started, and that is the vision that we all have. We all want a clean environment, and we want to create and preserve jobs. I am with my friend, Mr. Hare, I don't care what you call them. But I do know that when we are talking as a committee and we are talking as a Congress about where we are going to put taxpayer resources, we better be able to define what we are going to do.

So from an energy standpoint, whether it is nuclear, or wind, or solar, or clean coal, or new technology, or conservation, we ought to do it all. We ought to do it all, which is what my side of the aisle has been pushing for years, and last August spent the entire month here on a quite House floor without any lights and without any microphones trying to bring a highlight to the sense that the American people have, and that is that we need a sane energy policy, which means do it all.

All also includes safe nuclear technology. It is not often that the United States looks to France for leadership and guidance, but in the area of nuclear power we certainly should—80 percent-plus of their energy has been supplied by nuclear power for decades—for decades. And I just want to highlight Dr. Wolfe's statement about the safety: not a single fatality. Not a single fatality in over 50 years of the nuclear industry in the United States.

I do want to follow up, though, on a comment made by my colleague from Minnesota, Colonel Kline, who talked about some language in the current proposal that would require that any individual, to be eligible for federal monies in the area of green jobs, would have to be a member of a union. Understanding that 84 percent of the jobs out there in private industry are non-union jobs, and 84 percent of the nation's workforce might be eligible, given this broad definition that we want to have of green jobs, do any of you believe it is appropriate to confine the use of the definition of green jobs to union jobs only? Anybody believe that is appropriate?

Mr. Ringo?

Mr. RINGO. May I respond to that?

Dr. PRICE. Sure.

Mr. RINGO. I believe that—and it is important—that we recognize the value and the role that organized labor has played in securing and guaranteeing good jobs.

Dr. PRICE. I understand that perspective, but the question is should we, as a Congress—we are going to be asked to define this—should we, as a Congress, require union membership in order to be eligible for monies—taxpayer monies—for green jobs?

Mr. RINGO. If there are guarantees that people that are non-union are going to have good-paying jobs with good benefits.



Dr. PRICE. And I would agree. That is a different discussion, though, as opposed to a definition of green jobs.

Anybody else believe that we ought to require—

Ms. SHERMAN. Well, I would just echo what Mr. Ringo said in that I think it is a shortcut to somehow know that those kind of benefits, and the living wage, and the family wage are part of the—

Dr. PRICE. But the question is, should—under the definition of green jobs, should it say union membership?

Ms. SHERMAN. But how do you know—

Dr. PRICE. The question is, should you say “union membership”?

Ms. SHERMAN. But it does matter, because—

Dr. PRICE. Does it make any difference as to whether or not that individual is building something or contributing something that will be environmentally-sensitive and sound?

Ms. SHERMAN. Well, only because if you are trying to create family wage jobs and you don't have another way to measure it or another way to guarantee it, the union, I think, has been a shortcut way to get there, to make sure those are family wage jobs with benefits, which is the other piece, I think, that has been really an important part of the conversation.

Dr. PRICE. Madam Chair, with all due respect, I would suggest that family wage jobs and unionization and the like is a different discussion and a different debate for this committee. But in terms of the definition of green jobs, I think that the American people believe that whether or not one is a union member doesn't—ought not restrict one to taxpayer money for the subsidization of green jobs.

Chairwoman WOOLSEY. You have been heard, sir.

Dr. PRICE. Thank you.

Chairwoman WOOLSEY. Congressman Hare?

Mr. HARE. Well, let me just assure my friend from Georgia that when we pass the Employee Free Choice Act, the President signs it into law, we will have a significantly higher amount of people in the labor movement, and so the point may very well be moot.

Dr. PRICE. Gentleman—will my friend yield?

Mr. HARE. No. I just want to get to Mr. Ringo, a question here.

You mentioned that we don't make most of the systems involved in producing clean energy here in the United States. In fact, you know, with half of America's existing turbines were manufactured overseas. We ranked fifth among countries that manufacture solar components, and even though the solar cells were born in America, which to me is incredible.

So I would like to know from you, how does this happen, and what can we as the Congress do, or we as a nation do to bring the production back to the United States? You know, we are shipping—it seems to me we are shipping jobs overseas and we have this crazy system here where we actually give tax breaks to people to leave instead of giving them credits or doing things to keep existing companies here that have been here, played by the rules.

And, you know, as I said about Maytag, it took \$9 million in state money, the employees—union employees—took three wage concessions, and yet, they bolted for Sonora, Mexico, leaving 1,600 people out of luck. So how are we going to get these things back, and what are we going to do, in your opinion?

Mr. RINGO. The United States graduates about 70,000 scientists a year from U.S. universities. China graduates 300,000 scientists a year from Chinese universities. I think the best start is education. We have got to begin to educate people—young people, K-through-12—and even, especially, we talked about the community college systems.

We have got to invest into those community college systems, the green jobs training, because community college—folks don't leave San Francisco to attend a community college in Pittsburgh. Community colleges embrace people within the community, and you grow and empower people within the community.

So I believe that once we begin to change, we begin to change the thought processes of the American people with respect to energy consumption and energy production, and why it is important, and how important it is that we can stimulate our economy through new green jobs and good jobs, then people will begin to accept the value of their involvement.

It is sort of like, I mentioned to Congressman Payne earlier, in the minority communities of this country and poor communities of this country, people have not been engaged in the green movement over the years because their priority has been focused on next month's rent. But now, when people begin to see the value of involving—in getting involved in green and how it can stimulate their quality of life, they tend to get involved. So we have got to invest in educating our people into seeing the value of—

Mr. HARE. Well, I think you just hit the key word: We need to invest. I mean, what this Committee—and I have often said, and I will talk about expense—what are you going to spend on education? It is not what we are going to spend on education, it is what are we going to invest in education? We have a country that spends more to put one person in a federal penitentiary for 1 year than we do on a child for K-through-12.

We don't give the kinds of funds that we want to our community colleges to train people for these jobs. We can talk all of this green technology and jobs—sustainable jobs—but when we are making the wind or whatever, when we are making these products overseas.

And I just have to tell you, you know, pardon my rant, but I am a little bit tired of seeing a nation as great as this that can't manufacture a camera made in this country, a VCR, a television set anymore that used to have Venus and a number things in my home state—it is gone. And we are on the verge of losing the very base that built this nation.

And so from my perspective, what I want to see us do is invest. And you hit the word, Mr. Ringo, right on the—that is exactly what this is. You know, if we have got money to throw at the banks, then we have got money to invest in our students and young people, and invest in the types of jobs that we are talking about here today regardless of where they are from. Because the ultimate goal, I think, of this nation is to get people back to work so they can put their kids through school, have health care, be able to afford a house, and at the end of the day be able to retire with a pension. And, you know, they are not asking to live and drive a Lexus; they

just want to keep their Ford pickup and be able to put their kids through school. This is not rocket science.

And so, I appreciate you all being here today, and this investment that we make in this country—that is the bottom line. That is what we should be doing, as a Congress, is investing in our people. And I think that whether—as I said before, whatever you call these jobs, whatever color you want to name them, let us get this country back to work again.

Thank you, Madam Chair.

Chairwoman WOOLSEY. Thank you, Mr. Hare.

Mr. Price, for closing remarks?

Dr. PRICE. Thank you, Madam Chair.

I want to thank the witnesses again for their testimony and revisit my opening statement: We all want a clean environment. The vision that we have is to create and protect jobs across this nation. There is unanimity of opinion on that, and we ought to embrace the common opinion and common perspective that we have and move forward as opposed to cloud it.

I can't let the comments of my friend go without my comment, though, and that is, he says we can't create—we can't manufacture a camera or a television in this nation, and those jobs are gone. It is true that they are gone. Why are they gone, would be an appropriate question to ask in this nation, and we have asked that. It is not because the workers aren't there; we have the highest-quality workers in the world.

I would suggest, as many of my colleagues would, that it is because of specifically federal taxation, regulation, risk of liability, federal rules that make it so that jobs move offshore. So I would also agree that we ought to invest in our people by sound policy.

I would also make the comment that my friend talks about Card Check, which is, as people know, the Secret Ballot Destruction Act; it would remove the secret ballot from the ability to have a secret ballot for the formation of a union. I would point out that a recent study by Anne Layne-Farrar, an economist with the nonpartisan LECG Consulting, shows that that bill alone would cost 600,000 jobs in this nation in the first year—600,000 jobs.

So I would hope, Madam Chair—I want to thank the witnesses. I would hope that we would coalesce around those items upon which we can agree, and I think that we can if we work positively and cooperatively together and not cloud the issue of a clean environment and green jobs, which I believe ought to be an expansive definition that actually incorporates all those folks—the folks that are putting the caulk in the window and the like—because that is the only way we are going to be able to create real jobs in this nation.

Thank you.

Chairwoman WOOLSEY. Thank you very much. I was told that I didn't have to give you closing remarks, and I said, "Oh, yeah I do." Well, maybe I won't.

[Laughter.]

Yes, I do. I would never not.

Thank you all for attending. This was a great hearing. It was really something.

And your availability as witnesses tells us how important this is to you as well as it is to us. What we have heard today makes it absolutely clear that we need to form a consensus around the definition of green jobs, and we know that in the end it will be defined in partnership with the Department of Labor, and that we are going to ensure that green jobs enhance our environmental quality. And we know there are existing jobs; we know that there are jobs that are being created; there are good jobs that create a pathway for workers into sustainability so they can raise their families and send their kids to college and retire in dignity. That is our goal. If it means they have to be union workers to make that happen, so be it, but I think that if we set the standard we will make it happen so that we aren't investing in a technology, a future, an industry in this country that leaves the workers poor. That can't happen, and we won't let it happen.

So let us work together. I appreciate you. I appreciate you, Congressman Price. And we have got a ways to go; it is very obvious. But we are on our way.

So thank you very much for being here. I need to say that as previously ordered, members will have 14 days to submit additional materials for the hearing record. Any member who wishes to submit follow-up questions in writing to the witnesses should coordinate with the Majority staff within 14 days.

And without objection, this hearing is adjourned.

[Whereupon, at 11:46 a.m., the Subcommittee was adjourned.]

