BLUEGREEN ALLIANCE

BUILDING THE CLEAN ENERGY ASSEMBLY LINE:

HOW RENEWABLE ENERGY CAN REVITALIZE U.S. MANUFACTURING AND THE AMERICAN MIDDLE CLASS

We must make a commitment to rebuild America with clean and green products built here, to develop new forms of clean, renewable energy and provide incentives to further their deployment. This report includes policy recommendations that provide a blueprint for creating 850,000 green manufacturing jobs.

— LEO W. GERARD, INTERNATIONAL PRESIDENT, UNITED STEELWORKERS

Creating good, middle-class jobs and protecting the environment go hand-in-hand. The green economy will set our country, and the planet, back on track.

— CARL POPE, EXECUTIVE DIRECTOR, SIERRA CLUB

Executive Summary

For a generation following World War II, America's factories were humming at full capacity while workers built a vibrant middle class. Thirty-five years later, our industrial heartland is fading in the face of global competition. And since the current recession began in December 2007, the manufacturing sector has lost two million jobs, or 14.6 percent of the workforce.[1] In fact, more than a quarter of American manufacturers — some 90,000 — are now deemed "at risk" due to their inability to keep pace with global competitors.[2]

Today, we need a comprehensive industrial policy to rebuild manufacturing — and by extension, "Main Street" — across the United States. A critical component of a new industrial policy will be a program to make the U.S. the world's leading manufacturer of new, green technologies and components. This is not a pie-in-the-sky goal. It makes good economic sense and we have the capacity to do it. Renewable energy technologies provide three to six times as many jobs as equivalent investments in fossil fuels, when manufacturing, installation, operation and maintenance jobs are taken into account.

This report, *Building a Clean Energy Assembly Line*, examines how U.S. manufacturers can realize significant economic benefits from clean energy development. It draws on research conducted by the Renewable Energy Policy Project (REPP), in collaboration with the Blue Green Alliance.

Our central findings show that a national Renewable Electricity Standard (RES), and other policies that can increase the U.S. electric generation share to 25 percent renewable content by 2025, would stimulate enough demand for the component parts needed to make wind turbines, solar panels and other clean energy technologies to create 850,000 jobs in ***existing*** U.S. manufacturing firms across the country.

Other key findings include:

- Scaling up renewable energy will pay big job dividends in the industrial Midwest. Of the states with the potential to create the most renewable energy jobs, six of 10 are in the Midwest, including Illinois, Ohio, Pennsylvania, Indiana, Wisconsin and Michigan.
- Four heartland states will be the big winners in wind technology manufacturing from increased renewable energy development. Of the states with the potential to create the most jobs from the manufacture of component parts for wind turbines, four of five are in the Midwest: Illinois, Ohio, Wisconsin and Indiana.
- California and Texas alone stand to create more than 155,000 jobs making the parts needed to produce wind, solar, geothermal and biomass energy.
- More than 42,000 existing manufacturers could experience growth based on increased demand for component parts needed to produce clean energy.

States with the potential to create the most renewable energy jobs:

- Illinois
- Indiana
- Michigan
- Pennsylvania
- Ohio
- Wisconsin

States with the potential to create the most jobs from the manufacture of components for wind turbines:

- Illinois
- Indiana
- Ohio
- Wisconsin

To build a national clean energy assembly line to power America, we recommend the following package of public policies:

- **Market Building.** A national RES, requiring utilities to get a minimum of 25 percent of their power from renewables by 2025 with strong interim goals, should be adopted as part of comprehensive climate change legislation. Another critical policy is a robust allocation of allowances in cap-and-trade legislation to promote the deployment of renewable electricity generation – especially emerging technologies. Other market-building public policies within a full renewable energy deployment strategy include feed-in tariffs at the state level, federal investment and production tax incentives, national net metering and interconnection standards. In addition, Energy Efficiency Resource Standards (EERS) will help create complementary green manufacturing assembly line jobs making super-efficient appliances, windows and other energy-saving equipment.[3]
- **Market Reforms.** Passing comprehensive federal climate legislation is another logical step in revitalizing the nation's manufacturing sector. Placing a federal cap on carbon emissions, while authorizing the trading of resulting emission allowances, is critical to creating a market for renewable resources in the most cost effective manner.
- **Financing.** Access to financing is a key barrier that renewable energy manufacturers and developers must overcome. Critical financing tools include revolving loan programs and other supports for manufacturers of clean energy technologies and renewable energy developers and generators, and zero-interest Clean Renewable Energy Bonds to help municipalities, state agencies and other entities finance solar, wind and other renewable power projects.
- **Capacity Building.** The U.S. Department of Commerce's Manufacturing Extension Partnership (MEP) should be expanded to fund projects designed to build supply chains to support the new clean energy economy.
- **Innovating.** Government Research and Development (R&D) investments fuel the innovation cycle. A key goal of such a strategy is to invest in early-stage basic and applied research that complements existing private-sector efforts.

Over the next generation and beyond, the U.S. — and the world — will need and demand more clean energy. By developing a robust green manufacturing sector, America can revive its economy by becoming a leading exporter of clean energy parts and technology.

The policy recommendations in this report, taken together, can reenergize the manufacturing sector and create hundreds of thousands of high-paying jobs.

Building the Clean Energy Assembly Line

The new, clean energy economy is fundamentally different than the 20th century economy and its reliance on polluting fossil fuels imported from distant regions of the world.

Whether wind or solar, biomass or geothermal, clean energy is home-grown. What's more, it can be cheap — it just needs to be captured efficiently and transformed into electricity, hydrogen or clean transportation fuels. This process of capture and transformation can jumpstart our struggling economy by lowering energy costs and creating millions of jobs, including hundreds of thousands of family-supporting manufacturing jobs.

Development of clean energy invests directly in people, substituting labor for fuel expenses. *It is this fundamental fact that allows renewable energy technologies to provide, on average, three to six times as many jobs as equivalent investments in fossil fuels when manufacturing, installation and operations and maintenance jobs are taken into account.*[4]

While not the primary subject of this report, the construction and maintenance of wind farms, solar, biomass, geothermal and other renewable energy projects also create hundreds of thousands of jobs.[5] Consider the following:

- Investments in just the construction of natural gas power plants generate only about one job for every seven or more created as a result of similar investments in solar photovoltaic (PV) power technologies.[6]
- One study suggested the gap was as large as 33 jobs to one in favor of solar PV over natural gas, not including manufacturing employment.[7]
- Mortenson Construction, a leading wind power contractor in North America with approximately 27 percent national market share, reports nearly 400 construction workers on their wind power construction job sites on any given day around the country.

The Renewable Energy Policy Project (REPP), in collaboration with the Blue Green Alliance, has examined how existing U.S. manufacturers — makers of steel towers, controls, ball bearings and other components — could create even more new jobs in the manufacturing sector if global warming regulations and renewable energy programs are intelligently designed. A June 2009 report, entitled *How to Revitalize the Middle Class with the Clean Energy Economy*, showed that meeting the levels of carbon reductions assumed in this analysis would require installing 18,500 megawatts (MW) per year of wind, solar, geothermal and biomass plants. This is roughly equivalent to supply delivered under a national Renewable Electricity Standard (RES) of 25 percent renewable content by 2025.[8]

Under such a clean energy growth scenario, REPP projects that if all renewable energy components were made in the U.S., there would be a manufacturing job opportunity for 850,000 full-time equivalents created across all 50 states by U.S. firms that already exist.[9]

Shifting Plant from Coal to Biomass adds 200 Jobs

Ed Good, age 50, had a great job as an electrician at the R.E. Burger Power Plant for 31 years. But things looked grim last Christmas, as the 300 MW coal plant operated by FirstEnergy in Akron, Ohio, was on the chopping block. The costs associated with bringing the plant in compliance with new air quality regulations rendered it uneconomic – and a deadline for showing compliance was looming.

"We were told on December, 23, 2008, we were done," lamented Good, who is active with Local 350 of the Utility Workers union. Just before the end of last year, however, active lobbying of Governor Ted Strickland by Good and other labor officials resulted in a 90-day extension to come up with an alternative plan that could retain the facility's 105 jobs in a very depressed regional economy. "We had an incredible safety record at the plant and all of us working here take immense pride in our work," said Good.

Working hand-in-hand with FirstEnergy during negotiations with regulators, a surprising solution emerged to the dilemma: the R.E. Burger power plant is being converted to burn biomass, a broad term that incorporates dedicated crops such as switch grass and poplar trees (as well as agricultural and forestry wastes). Instead of investing in as much as $380 million for pollution controls, FirstEnergy will instead invest as little as $200 million to convert the plant into the largest biomass electricity plant in the U.S. In the process, conversion to biomass will create an additional 200 jobs for as many as three different companies to gather biomass fuel for the facility.

Though the refurbished plant will not come on-line until January 2013, Good is incredibly grateful that his job and those of his colleagues have been saved, and that they've become a part of the new green economy.

"I am so excited and thrilled about what has happened. I would have never guessed something like this would have happened during the holidays last year. This was a plant that is almost 60 years old, and had been criticized in the past due to air emissions typical of coal plants of that vintage," said Good. "I have to give credit not only to the government officials and regulators, but to FirstEnergy itself. They brought organized labor to the table as a full partner, and working together, we helped transform what was perceived to be an environmental liability into an economic success story."

Rather than sending more jobs to China, India or other parts of the world, why not secure opportunities for economic advancement for the middle class right here in the United States?

The Blue Green Alliance (BGA) is a national partnership of labor unions and environmental organizations dedicated to expanding the number and quality of jobs in the clean energy economy. Launched by the United Steelworkers and Sierra Club in 2006, BGA has since grown to include the Communications Workers of America, Natural Resources Defense Council, Laborers' International Union of North America, Service Employees International Union, Utility Workers Union of America and American Federation of Teachers.

This policy brief will highlight the positive economic benefits clean energy development can bring to manufacturing regions throughout the country — including regions that are home to existing companies that can become part of the supply chain supporting the new clean energy economy.

To build a national clean energy assembly line to power America, the following public policies are critical:

Critical Public Policies:

- Market Building
- Market Reforms
- Financing
- Capacity Building
- Innovating

- **Market Building.** A national RES, requiring utilities to get a minimum of 25 percent of their power from renewables by 2025 with strong interim goals, should be adopted as part of comprehensive climate change legislation. Another critical policy is a robust allocation of allowances in cap-and-trade legislation to promote deployment of renewable electricity, and especially emerging technologies. Other market-building public policies include state level feed-in tariffs for early-stage and distributed renewable energy generators, federal investment and production tax incentives and national net metering and interconnection standards. Federal legislation that fosters investment in new transmission infrastructure through planning, permitting, and cost allocation will also be necessary to connect clean power to consumers. In addition, while not the focus of this analysis, Energy Efficiency Resource Standards (EERS) will help create complementary manufacturing jobs making super-efficient appliances, windows and other energy-saving equipment.
- **Market Reforms.** Passing comprehensive federal "cap-and-trade" legislation is also necessary to help revitalize the nation's manufacturing sector. Placing a federal cap on carbon emissions, while authorizing the trading of resulting emission allowances, is critical to creating a market for renewable resources in the most cost effective manner. A fair portion of allowances, and a significant portion of auction revenue, should be dedicated to funding development of renewable energy resources, including expansion of our domestic manufacturing base.
- **Financing.** Production and investment tax credits have historically been used to commercialize our clean energy technologies and attract financing to projects. Revolving loan programs, which provide much needed capital for the deployment and manufacturing of clean energy technologies, and zero-interest Clean Renewable Energy Bonds, are also important financial instruments underwriting a clean energy revolution. The "Investments for Manufacturing Progress and Clean Technology (IMPACT) Act of 2009," sponsored by Senator Sherrod Brown (D-Ohio), creates a $30 billion manufacturing revolving loan fund over the next 10 years to help manufacturers retool for clean energy markets and adopt innovative, energy-efficient manufacturing technologies. In the current economic recession, these programs need to be overhauled and backstopped with government loan guarantees to ensure continued access to credit.
- **Capacity Building.** The U.S. Department of Commerce's Manufacturing Extension Partnership (MEP) should be expanded by funding projects designed to build up supply chains to support the new clean energy economy. The 59 MEP centers around the U.S. are currently able to assist only a small portion of the country's 330,000 small- and medium-sized manufacturing plants.
- **Innovating.** Government Research and Development (R&D) investments fuel the innovation cycle. Over the past decade, the amount of federal R&D investment steered towards renewables has been woefully inadequate. Furthermore, these funds have been focused on products, not manufacturing techniques and other upgrades that would allow the U.S. to have a competitive advantage. A substantial federal industrial research and development initiative, based on public-private partnerships, could accelerate development in the clean energy economy with new products and services that help companies meet

these requirements, thereby driving economic recovery, job creation and economic growth. This initiative should:

- significantly increase federal R&D funding overall;
- direct additional funding to programs that enable high-risk, long-term bets to take advantage of the dynamic and unpredictable nature of innovation;
- ensure the private sector plays a large role in innovation; and
- use multi-decade climate legislation to provide a stable funding stream, which can ensure continuity and availability of R&D funds and eliminates some of the volatility inherent in the appropriations process.

Sharp Solar Plant in Memphis, Tennessee Hits Milestone

Sharp Manufacturing Company of America, part of Japan's Sharp Corporation, was established in Memphis, Tennessee in 1978 for the production of color TVs. A few years later, production lines for microwave ovens were added.

Today, this facility supplies the U.S. and Canada with solar photovoltaic (PV) panels for a company that has produced more solar cells than any other company in the world. Since 1963, more than 2 gigawatts (GW) of total solar electric capacity have been manufactured by Sharp at sites in Japan, Europe and the U.S.

Sharp began assembling solar modules in Memphis in 2003. Total production capacity of solar modules has increased five-fold from 20 MW in 2003 to 125 MW in 2009. The plant reached a major milestone last year as the one-millionth solar module rolled off the Memphis production line.

Along with increasing production of solar modules, the Memphis plant has also boosted local employment. At present, the facility employs 300 International Brotherhood of Electrical Workers (IBEW) Local 474 union members in the production of solar modules, up from 230 at the end of 2007.

One of the few unionized solar manufacturers in the U.S., this facility put together solar modules for North America's largest solar PV power plant at Nellis Air Force Base just outside Las Vegas, Nevada. "We bought Sharp solar panels for Las Vegas precisely because they were domestic and unionized," commented George Sterzinger, director of Nevada Energy Independence Partners. The 14 MW solar plant was installed by IBEW Local 357.

"The U.S. is one of the world's most attractive markets for solar power, which is why Sharp chose to invest here," said Christopher Loncto, Director of Public Relations for Sharp Electronics Corporation. "As the U.S. solar market continues to grow, Sharp will look to expand our manufacturing capabilities in the U.S., hoping to add more green jobs to the U.S. economy."

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Short Versus Long-Term Green Job Growth

New clean energy projects benefit the economies where they are installed. The 230 MW Wild Horse wind farm developed in Kittitas County outside Ellensburg, Washington, provides visible evidence of clean energy's economic impact. This is a big project that has provided local jobs for workers installing and maintaining the facilities — jobs that cannot be sent offshore. However, this wind farm did not account for U.S. manufacturing jobs.

Why? Because the federal government in the U.S. has failed to adopt long-term, sustained regulatory policies like the RES and programs that provide stability and clarity to investors and business while encouraging domestic manufacturing of new renewable energy technologies. That has allowed Europe, Japan, China and other countries that do have such policies to capture the lion's share of green manufacturing jobs.

In the 21st century, the U.S. needs to put in place smart public policies to rapidly expand production of new renewable energy technologies right here. Despite limited federal policy support for incentives, such as production tax credits, which have faced continuous reauthorization battles, wind-power manufacturing is beginning to grow domestically as a result of strong support at the state level. Twenty-nine states already have their own RES. In addition, more companies are willing to brave the risk of erratic federal policy to pursue the reward of the world's largest potential market for wind turbines. Strong and consistent federal policy support, including passage of comprehensive climate and energy legislation, would greatly accelerate growth in wind-turbine manufacturing, and extend economic opportunity to smaller and less mature industries in the solar, geothermal and biomass sectors. We need robust supports for manufacturing in such legislation to ensure that strengthening and revitalizing America's manufacturing base is a national priority. There is no reason why America and its workers should not lead the world in green manufacturing.

Failure to support a world-class domestic renewable manufacturing sector in the U.S. in the face of greatly expanded demand for renewable energy will likely have negative consequences for job creation in the U.S. Foreign competitors will capture most of the new manufacturing sector jobs and revenues. U.S. demand for renewable energy technologies currently exceeds domestic manufacturing capacity, which can lead to critical component supply bottlenecks or temporary price increases for clean power. Establishing a U.S. commitment to renewable energy with a strong RES will send a global signal to build manufacturing bases in the U.S. and help match domestic supply with our current demand for clean energy.

The growth in demand for renewable energy technologies comes at a critical time for the U.S. manufacturing sector, and especially for small- and medium-sized component suppliers. More than seven million jobs have been lost in the U.S. since the current economic recession began in December 2007, with the nation's manufacturing sector experiencing unemployment of 12 percent. The nation's manufacturing sector currently provides just over 8 percent of total U.S. employment. Hundreds of factories have shut down all across the country.

Leo W. Gerard, International President of the United Steelworkers, and Leo Hindery Jr., chair of the Smart Globalization Initiative at the New America Foundation, sum up the challenge facing the U.S. manufacturing sector in this way:[10]

> *If these conditions continue, we will head not just toward a jobless, and a manufacturing jobs-less, recovery but toward an even more weakened economic base that is incapable of sustaining a vibrant middle class. And yet the conditions will continue unless the [Obama] administration addresses two serious shortcomings in its economic program.*
>
> *First, aside from its emergency restructuring of Chrysler and GM, the administration has not outlined a national manufacturing industrial policy designed to ensure the competitiveness of U.S.-based businesses.*
>
> *Second, the administration has yet to begin the promised reform of our trade policies with China and the other economies that do not play by the same rules we do.*

Spanish Wind Power Company Creates 1,100 Jobs in Pennsylvania

When Troy Galloway, age 45, lost his job at a steel mill after 15 years of steady employment, he wasn't sure how he was going to make ends meet. The region had already lost over 25,000 local steelworker jobs in the past few decades. The forecast for work employing his skill-set looked bleak. He tried real estate, which blew hot and cold, and then tried to "beat the bushes" for construction jobs. "After no work for January and February three years ago, my wife said: 'This is not working out.'"

Luckily for Galloway, the Spanish company Gamesa, the second-largest wind-turbine maker in the world, came to Ebensburg, Pennsylvania, to open up a new blade factory in response to the passage of a state RES. Galloway reasoned that the wind industry could provide him with stable and long-term employment, so he submitted his resume, and got a job. His previous experience operating machines was a nice fit for his present occupation, which makes the spars that serve as the backbone of wind turbine blades that span 150 feet.

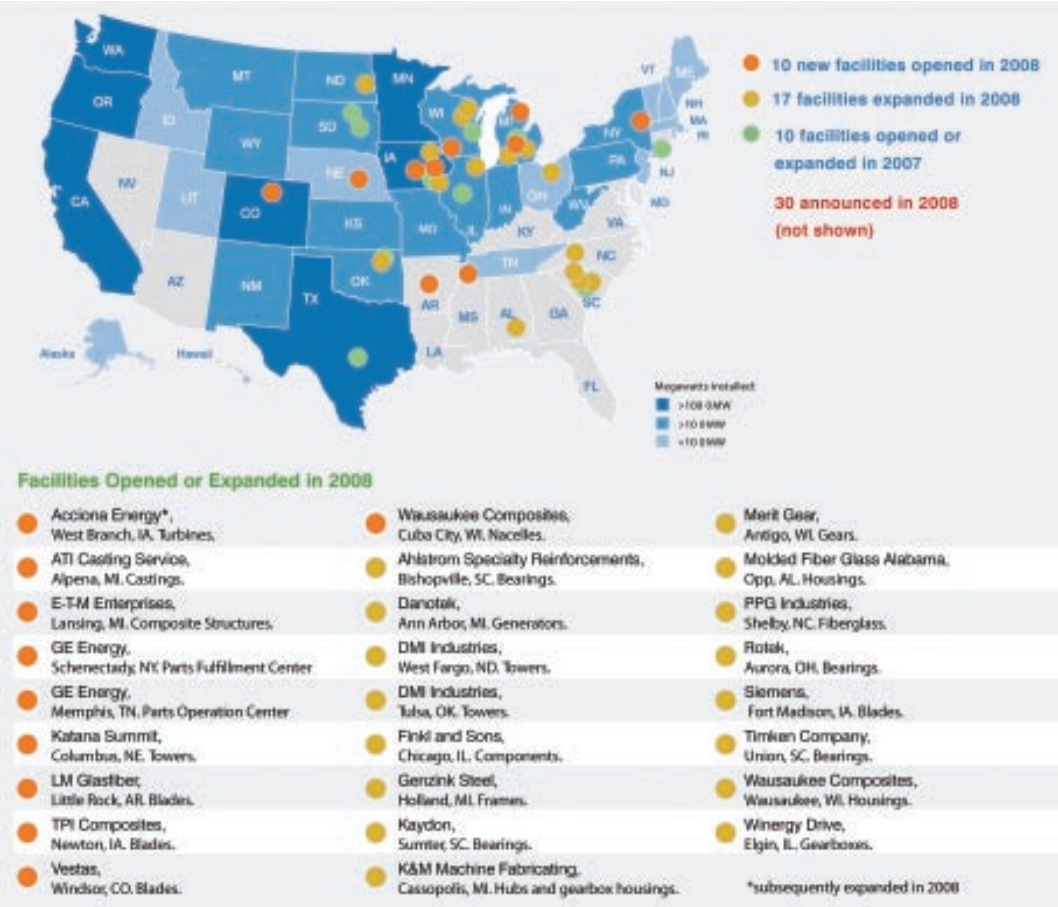
"Now I not only have a good job, but a job that feels good," said Galloway. "Working in the wind power sector is a great opportunity to reduce our dependence on foreign oil, help the environment, as well as future generations, our children, and our children's children," he said. To top if off, he's making a little more money now. Since he was president of the local United Steelworkers union, he admires the pro-labor stance of Gamesa. "Even some of their management is unionized," he acknowledged.

According to REPP, Pennsylvania ranks sixth in the nation in potential new manufacturing jobs from renewable energy development. Some of the blades produced by this factory have been installed at a nearby wind farm that Gamesa, a vertically-integrated wind turbine manufacturer, developer and maintenance company, has recently brought on-line. "I drive by the wind turbines that I helped make every day on the way to work," he concluded.

The Blue Green Alliance and its partners and allies are encouraged by the promise of clean energy. In the wind industry, foreign manufacturers are bringing jobs to the U.S., instead of the other way around. New factories have been opened up by foreign-based manufacturers in Colorado, Minnesota, Indiana, North Dakota and Pennsylvania.

The American Wind Energy Association (AWEA) estimates that, until recently, U.S. suppliers comprised less than 30 percent of the domestic wind industry's supply chain. The good news is that the domestic share of the wind industry's supply chain is now about 50 percent due to a spate of new factories opening up, many by foreign wind companies, particularly in the Midwest. All told, 20 new facilities opened up in 2007 and 2008, with another 17 existing factories expanded to keep up with demand for wind turbine components and systems. Another 30 factories were announced in 2008 that are part of the new clean energy assembly line, but are not shown in the map on the following page.

Total direct employment in the domestic wind energy sector grew by 35,000 in 2008, totaling 85,000 jobs. These jobs not only include wind turbine manufacturing, but project development, operations and maintenance, legal and marketing services.



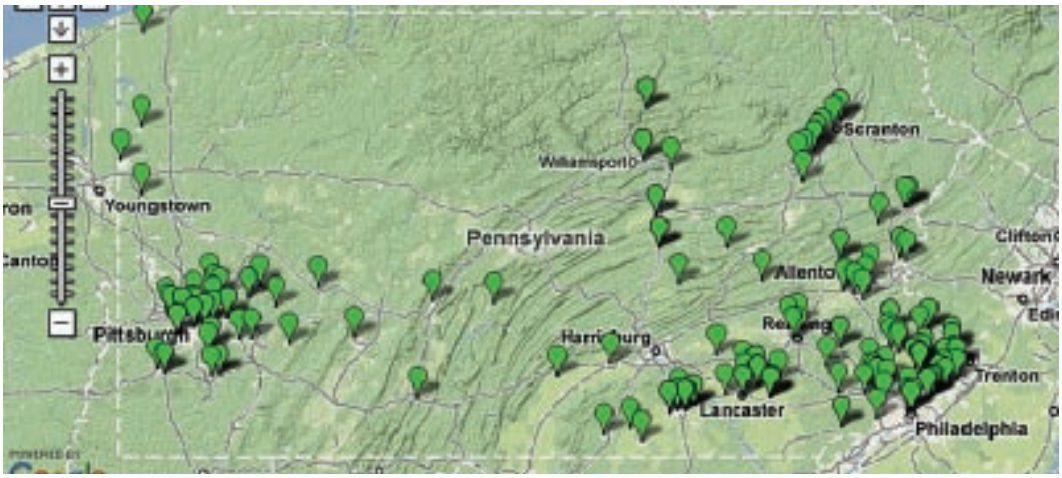
A modern wind turbine is composed of some 8,000 parts, from massive steel towers and blades to high precision gearboxes to state-of-the-art software control systems. While much attention is paid to the company that assembles and puts its name on the wind turbine — high-profile names like GE and Siemens — most of the supply chain is composed of small specialty manufacturers. One firm will roll large plates of steel into the towers that support the turbine. Another firm will make the huge turbine blades from special carbon fiber materials. Still another will make the electronic computerized control systems allowing wind turbines to adjust to changes in wind speed and direction.

In this regard, a wind turbine looks a lot like a car, truck or tractor. American car companies may be headquartered in Detroit, but their assembly plants are spread around the world, and are fed by thousands of small component suppliers that are located in every state of the union.

And while more large components, such as blades and towers, are being made in the U.S., many of the "high value engineering" components, such as large bore bearings, gears and drive train components are still imported, primarily from Europe. Clipper Windpower, an Iowa-based assembler, sold more than $1 billion worth of wind turbines in 2008. "Wind is heavy manufacturing and we are talking high volume," says Ian Cluderay of Clipper Wind. "It is like the automotive industry in terms of components. But the U.S. has been behind the curve in terms of capability. Some of the sourcing we have had to do is to look overseas because we have not seen the capabilities here."

For every MW of new wind power capacity — enough potential clean electricity to power up to 300 homes — REPP estimates 4.85 Full Time Equivalent (FTE) jobs are created to manufacture, install and then operate and maintain the wind farm. About 70-75 percent of the total labor required for a typical wind turbine or solar panel is in manufacturing the various component parts that could be supplied by existing U.S. businesses. These are the potential "green jobs" that are key to revitalizing the U.S. and global economy. Without new policies promoting domestic manufacturing, an unnecessarily large portion of these jobs will remain overseas.

Supply chain opportunities are not limited to wind power, or even the four main technologies profiled in this report. The map below shows the locations of existing companies operating in Pennsylvania that make components for a variety of clean energy power generation facilities, including Concentrated Solar Power (CSP), a technology that harnesses the power of the sun to turn a traditional steam turbine that generates electricity.



Supply chain firms, primarily CSP, capable of manufacturing components for the renewable energy sector in Pennsylvania. (Note: companies are added on an ongoing basis; particularly as new supply chain studies are completed. See the website below for a list of these individual companies)

Source: EDF, LessCarbonMoreJobs.org

Blue Green Alliance Executive Director David Foster described these "green jobs" as "blue-collar jobs with a green purpose." BGA supports comprehensive clean energy and climate change legislation that outlines a long-term vision for the transition to a clean energy economy and ensures that domestic manufacturing can compete in the global economy while reducing the nation's dependence on foreign oil. The labor unions and environmental organizations that make up the Blue Green Alliance have outlined principles for legislation to put Americans back to work building the clean energy economy. To find out more, visit **www.bluegreenalliance.org**.

Clean Energy Manufacturing Spreads Economic Benefits

Iowa and Clipper Windpower illustrate how manufacturing supply chains throughout the U.S. benefit from a growing renewable energy industry. Iowa has become a global leader in wind power with nine manufacturing plants, including Clipper Wind's Cedar Rapids facility, which has employed as many as 400 workers directly onsite. Iowa now gets 15 percent of its electricity from wind, the highest percentage of any U.S. state. It passed California to become second only to Texas in the nation in terms of total installed wind power capacity.

But not all of the benefits of wind power in Iowa accrue to Iowans. Iowa manufacturers rely upon a supply chain that spreads to other states and around the world. Rust-belt manufacturing strongholds like Ohio, Michigan and Indiana have the foundries and heavy-duty manufacturing facilities needed to supply the wind industry. Ohio is particularly well situated. The Timken Company, with sales of $5.2 billion in 2007, operations in 27 countries and 25,000 employees, makes bearings and other gearbox components for turbines at its Ohio plant. Wind is not its biggest market but is the fastest growing part of its business. The firm is also expanding operations at its existing plant in South Carolina — a state with no installed wind power — to supply the domestic wind industry, which took over the global lead in total wind power capacity in 2008.

Policy Reforms Needed to Build a Clean Energy Manufacturing Base

Climate change reduction targets, a federal RES and reforms of current transmission planning, siting and financing, are all critical elements needed to make the green economy work for everyone. New federal policies promoting domestic manufacturing assembly line employment are absolutely critical to maximizing the green-collar jobs opportunity for America's middle class. Due to the current economic recession, American manufacturers are struggling, despite the global boom in renewable energy.

Here are five key categories of reforms that can help make the REPP job projections of 850,000 new manufacturing employment opportunities become real jobs for middle-class Americans:

Market Building

- A national RES, requiring utilities to get a minimum of 25 percent of their power from renewables by 2025 with strong interim goals, should be adopted as part of comprehensive climate change legislation. The RES should have flexible compliance mechanisms and allow states with higher targets to pursue their more aggressive renewable energy deployment programs. This long-term national policy will provide assurances to workers, manufacturers, investors and state and local governments that they can count on the clean energy economy to be a stable source of power, revenue and jobs.

- A range of industry support mechanisms should be implemented to overcome numerous barriers to deployment of clean energy technologies. The most popular incentive in the U.S. has traditionally been production and investment tax credits. However, these incentives have been stop-and-go, previously enacted for one- or two-year periods. Only through long-term commitments to incentives will the U.S. be able to maximize the economic development impacts attached to clean energy.

  A critical policy that would establish such a commitment is a robust allocation of allowances to promote renewable electricity deployment, and especially emerging technologies. The allowances should encourage continuous innovation spanning a diverse portfolio of emerging technologies, offer a clear and stable support mechanism that increases investor security and drives large-scale investment in clean energy, and gradually phases out support for technologies as they mature to force them to become commercially competitive or make room for more successful alternatives. Other market-building public policies include feed-in tariffs for early-stage and distributed renewable energy generators at the state-level, federal investment and production tax incentives and national net metering and interconnection standards.

- Feed-in Tariffs (FITs), which have been successful in Europe, require utilities to purchase power generated by renewable resources developed in their service territories. In Germany, a Feed-In Tariff adopted 10 years ago allowed both homeowners and businesses to finance solar PV installations and create a solar industry that employs over 240,000 people today. The stable revenue stream provided by FITs is especially helpful to developers of smaller projects. FITs, however, have to be appropriately designed to avoid problems such as over-subsidization, which led to the failure of Spain's FIT. FITs involve electric distribution rate design issues, which are handled at the state level in the United States, so FITs should be implemented at the state level. Well-designed state-level FITs would be powerful drivers of renewable electricity deployment.

- Adopting a national Energy Efficiency Resource Standard (EERS) would also create a market for devices that reduce the demand for energy, thereby creating manufacturing jobs for a whole host of super-efficient appliances, windows and other equipment.

- The Advanced Energy Manufacturing Tax Credit (Internal Revenue Code Section 48C) should be extended. The American Recovery and Reinvestment Act established this tax credit, which is for retooling and retrofitting America's idle and underutilized manufacturing capacity to produce advanced energy technologies. Preference should be given to efforts to convert our country's existing capacity to making the products needed to support the transition to a clean energy economy.

- Development of new transmission lines is critical to meeting both climate change and renewable energy development goals. Federal, state and local governments should be given the tools to better plan new lines to access remote renewable energy zones while avoiding transmission development on environmentally sensitive lands and maintaining a regional planning process. A regulatory structure must be put in place to address the planning, permitting, and cost allocation needs of this new grid challenge.

Market Reforms

- Passing comprehensive federal legislation that establishes a cap on carbon pollution is another necessary step in revitalizing the nation's manufacturing sector, if appropriate complementary manufacturing policies are enacted. Placing a federal cap on carbon emissions, while authorizing the trading of resulting emission allowances, is critical to creating a market for renewable resources in the most cost effective manner.
- Carbon emissions must be capped at levels that are based on the best science. Guidance from the Intergovernmental Panel on Climate Change suggests that emissions contributing to climate change should shrink by at least 80 percent from 1990 levels by 2050 in industrialized countries. Congress should create interim targets that make steady progress toward this goal. These interim targets are more important incentives for the deployment of clean energy technology than the 2050 goal.
- Any system implemented in the U.S. should be applied across all sectors of the economy, but employ a flexible architecture that can be adjusted to address regional disparities and international "carbon leakage." Leakage refers to shifting of U.S. manufacturing capacity to unregulated countries, thereby circumventing the intent of domestic carbon regulations. Due to inefficient production methods and heavy reliance on coal, each ton of steel made in China generates 2.5 times as many carbon emissions as a ton of steel made in the U.S. This disturbing fact highlights the environmental benefits of domestic manufacturing of equipment for new renewable generation in the U.S.
- Any climate legislation passed into law must include provisions to retain and create millions of jobs in the renewable energy sector, with special emphasis on bolstering domestic manufacturing through incentives and/or other policy instruments.
- Climate change legislation should directly link economic development goals to communities with current high unemployment first, and fund training and other activities to assist in the transition to a clean energy economy.

Financing

- Valuable fiscal policy instruments more relevant in the current economy include revolving loan programs, wherein repayments of loans are circulated back into loans specifically for new renewable energy projects. These loans, which could be used for retooling or expanding operations, would also provide critical financial support for domestic manufacturers. The "Investments for Manufacturing Progress and Clean Technology (IMPACT) Act of 2009," sponsored by Senator Sherrod Brown (D-Ohio), creates a $30 billion manufacturing revolving loan fund over the next 10 years to help manufacturers retool for clean energy markets and adopt innovative, energy-efficient manufacturing technologies. In the current economic recession, these programs need to be overhauled and backstopped with government loan guarantees to ensure continued access to credit. It is projected that passage of this bill alone could create at least 680,000 direct manufacturing jobs and 1,972,000 indirect jobs through a two-year, $30 billion Manufacturing Revolving Loan Fund.
- Yet another option is federal zero-interest Clean Renewable Energy Bonds, which allow government agencies to access cheap money to underwrite renewable energy projects.

Capacity Building

- In order to match the support being offered by other foreign governments to capture manufacturing jobs in the renewable energy sector, the U.S. should develop a 10-year comprehensive clean energy manufacturing and workforce development plan.

  Included in this plan would be a requirement that manufacturing companies that receive government supports demonstrate conditions similar to those imposed by state and local economic development officials in exchange for incentives, such as the following:

  – number and quality of domestic jobs created;

  – poverty reduction targets met;

  – green production processes adopted;

  – the introduction of in-house energy efficiency, waste reduction and greenhouse gas reduction programs; and

  – the growth of domestic supply chain components in their clean energy products.

While this report focuses on clean energy, the policies above should apply to all companies manufacturing components for all types of energy production, and not just renewable energy, in order to ensure fair competition.

Innovating

- Another key to job creation is innovation. Government R&D investments fuel the innovation cycle. Over the past decade, the amount of federal R&D investment steered towards renewables has been woefully inadequate. Furthermore, these funds have been focused on products, not manufacturing techniques and other upgrades that would allow the U.S. to have a competitive advantage.
- The U.S. Department of Commerce's Manufacturing Extension Partnership (MEP) should be expanded by funding projects designed to build up supply chains to support the new clean energy economy. MEP is a national network of centers that provide companies with technical assistance and resources to enhance growth, productivity and capacity. Currently, MEP centers around the U.S. are able to assist only a small percentage of domestic manufacturing facilities. Additional funding would help MEP significantly expand its reach.
- Senator Amy Klobuchar's "American Renewable Energy Act of 2009" also contains a provision that would assist domestic manufacturers in the transition to clean energy. This measure dedicates $50 million to help remove barriers to developing domestic supply chains necessary to keep up with surging demand for clean energy products. This legislation would also offer incentives for companies that pay employees a "living wage," provide health care benefits and comply with all federal labor and environmental laws and regulations.

How Energy Links to Health Care and Trade Reforms

One must wonder why so many manufacturing jobs left the U.S. to begin with?

The issues are complex and interwoven. The U.S. has made a habit of jumpstarting renewable energy technologies, and then allowing them to be fully commercialized and then manufactured overseas.

The wind industry is reversing this typical tale. Several new manufacturing plants, built by global companies such as Vestas of Denmark, the largest wind manufacturer in the world, are now located in the U.S. These manufacturing jobs reflect the fact that the U.S. is now one of the world's top wind power markets. With additional policy support, the U.S. could emerge as one of the top manufacturing centers for the entire global wind industry.

But many of the reasons why the U.S. has exported so many manufacturing jobs overseas have nothing to do with energy policies. The fact that U.S. employers must fund health insurance, for example, becomes an additional cost. Most European and Japanese firms enjoy government-funded health care. Our current health care system puts U.S. manufacturers at a competitive disadvantage.

The so-called "free trade" policies embraced by the U.S. have also played a role in the exodus, encouraging manufacturing to take place in the countries with the lowest wages and least restrictive environmental standards. This trade model may have helped bolster a decade of short-term corporate profits, but it has aggravated both global climate change and major domestic job losses. Manufacturing products with dirty energy, dirty processes and low-cost labor before importing them back into the U.S. has resulted in emissions of carbon and other greenhouse gases spiraling out of control. China, now the world's largest emitter of global warming emissions, attributes 25 percent of those emissions to products manufactured for export.

A new trade policy that accurately prices the carbon of the products we produce is another important component of rebuilding domestic manufacturing, as well as solving global warming. Indeed, even the World Trade Organization recently signaled its willingness to accept tariffs placed on goods to reflect the environmental costs of their production.

Estimates of Renewable Energy Manufacturing Job Potential

REPP conducted a supply chain analysis that identified the component parts of wind turbines, solar panels, geothermal and biomass power plant equipment. They assigned these parts to categories established in the National American Industrial Classification System (NAICS), which is used to track manufacturing activity by U.S. companies. REPP than assumed a growing market for renewable energy equipment large enough to meet carbon reduction goals that roughly match a 25 percent by 2025 RES, or about 18,500 MW of new renewable energy capacity installations annually over a 15-year period.

Given this amount of demand, REPP identified specific, current U.S. companies in each of those NAICS categories, on the assumption that they would be the most likely firms to supply components to a growing renewables industry. This methodology was able to identify where the supply chain could be located, the amount of new revenues for these firms and new employees needed

to meet demand. The studies did not model multiplier effects, such as indirect and induced employment, nor did it quantify jobs in other parts of the supply chain, such as construction, transportation and logistics, or operations and maintenance. They assumed only that existing firms would supply new demand, not that there would be new market entrants, or that demand would be met by foreign firms. Also, REPP did not study the supply chain for concentrating solar power technologies, due to a lack of data. Lastly, REPP did not evaluate net impacts, such as potential job loss in other sectors due to a growing renewables industry.

More information about the REPP studies is available at www.repp.org.

Here is a list of the overall Top Ten job-creating states, and the Top Five in each renewable technology category, according to REPP. The following page has the complete listing of jobs for all 50 states.

Top Ten Potential Renewable Manufacturing Job States	
California	95,616
Texas	60,100
Illinois	56,579
Ohio	51,269
New York	47,930
Pennsylvania	42,668
Indiana	39,221
Wisconsin	35,133
Michigan	34,777
North Carolina	28,544

Top Five Potential Wind Manufacturing States	
California	30,046
Illinois	30,010
Ohio	29,820
Indiana	25,180
Wisconsin	25,179

Top Five Solar PV Potential Manufacturing States	
California	48,896
Texas	23,221
Illinois	19,298
Pennsylvania	15,767
New York	14,617

Top Five Geothermal Potential Manufacturing States	
California	8,465
New York	8,150
South Carolina	5,223
Ohio	5,079
Texas	4,660

Top Five Biomass Potential Manufacturing States	
Texas	7,175
New York	6,640
California	6,209
Ohio	4,537
Oklahoma	4,420

REPP Estimates for all 50 States

Location	# of Firms	New Jobs: Wind	New Jobs: Solar	New Jobs: Geothermal	New Jobs: Biomass	Total Jobs
Alabama	635	10,085	2,035	997	982	14,099
Alaska	34	131	4	14	7	156
Arizona	603	3,315	6,732	255	323	10,625
Arkansas	384	4,572	2,394	656	1,008	8,630
California	5,409	32,046	48,896	8,465	6,209	95,616
Colorado	603	2,354	3,892	414	454	7,114
Connecticut	772	6,160	7,757	812	813	15,542
Delaware	94	495	1,502	110	310	2,417
District of Columbia	1	0	14	0	0	14
Florida	1,617	8,467	7,718	1,070	1,449	18,704
Georgia	864	8,044	6,285	1,016	1,303	16,648
Hawaii	24	29	47	1	19	96
Idaho	197	820	1,347	155	153	2,475
Illinois	2,289	30,010	19,298	3,396	3,875	56,579
Indiana	1,321	25,180	7,485	3,191	3,365	39,221
Iowa	457	4,914	2,889	648	779	9,230
Kansas	425	3,934	5,430	719	1,408	11,491
Kentucky	524	5,113	4,705	1,188	1,610	12,616
Louisiana	507	4,845	1,958	660	1,054	8,517
Maine	155	1,558	1,127	1,003	423	4,111
Maryland	394	2,220	1,178	709	1,129	5,236
Massachusetts	1,193	7,971	12,264	1,186	1,286	22,707
Michigan	2,050	24,350	6,644	1,502	2,281	34,777
Minnesota	1,070	9,246	5,238	1,477	2,444	18,405
Mississippi	318	2,957	1,674	881	2,449	7,961
Missouri	785	10,260	7,532	2,907	2,097	22,796
Montana	90	620	98	19	16	753
Nebraska	200	2,817	2,368	294	731	6,210
Nevada	206	1,753	932	145	171	3,001
New Hampshire	336	2,487	2,060	132	373	5,052
New Jersey	1,351	7,870	6,741	1,620	1,467	17,698
New Mexico	150	662	2,561	32	126	3,381
New York	1,925	18,523	14,617	8,150	6,640	47,930
North Carolina	1,096	10,964	11,062	2,810	3,708	28,544
North Dakota	67	671	165	98	65	999
Ohio	2,465	29,820	11,833	5,079	4,537	51,269
Oklahoma	800	3,696	1,287	3,225	4,420	12,628
Oregon	655	2,805	6,403	645	1,338	11,191
Pennsylvania	2,188	19,588	15,767	3,402	3,911	42,668
Rhode Island	195	2,876	4,197	142	119	7,334
South Carolina	488	11,204	3,559	5,223	2,365	22,351
South Dakota	109	2,253	64	944	217	3,478
Tennessee	853	9,011	5,122	1,078	2,451	17,662
Texas	3,358	25,044	23,221	4,660	7,175	60,100
Utah	356	2,809	1,615	122	446	4,992
Vermont	109	904	743	7	179	1,833
Virginia	624	8,565	3,672	489	1,047	13,773
Washington	790	3,902	3,190	618	852	8,562
West Virginia	189	1,548	1,613	120	318	3,599
Wisconsin	1,331	25,179	4,943	2,037	2,974	35,133

[1] *Labor Day by the Numbers*, by Anna Turner, Economic Policy Institute, September 4, 2009.

[2] *Next Generation Manufacturing Study*, a research effort coordinated by American Small Manufacturing Coalition and member Manufacturing Extension Partnership (MEP) centers, June 11, 2009.

[3] EERS is an important part of the package for creating jobs through clean energy, but not the focus of this analysis.

[4] Studies performed by the California Energy Commission (2002), Union of Concerned Scientists (2006), University of California-Berkeley (2004/2008) and a compilation report of all studies on green jobs flowing from renewable energy development by the Center for Energy Efficiency and Renewable Technologies (2009), all confirm that renewable energy sources generate greater employment than equivalent investments in fossil fuels. While the job impacts vary according to specific technologies, a general rule of thumb based on conservative assumptions is three to six times as many jobs per MW as conventional coal or natural gas power supplies.

[5] Installing new wind farms, for instance, creates temporary construction employment. Laborers, carpenters and millwrights build the forms and pour the concrete for the foundations of wind turbines. Then, operating engineers run the cranes that lift the towers. Electricians perform the wiring to hook the wind turbine up to the distribution grid. Operating and maintaining these wind farms also creates permanent employment. Renewable energy projects such as these stimulate often depressed rural regions by pumping $15-20 million into the local economy for each 100 megawatts (MW) of clean energy development.

[6] CALPIRG Charitable Trust, *Renewables Work: Job Growth from Renewable Energy Development in California*, June 2002. The employment estimates for construction and operations and maintenance jobs included in this study were derived from data provided by the California Energy Commission and the Electric Power Research Institute, among other sources.

[7] "Solar Energy 101: Capacity Expansion in the PV Industry," *Barclays Capital Solar Daily*, October 24, 2008.

[8] This assertion is based on the following assumptions: The RES and the renewable energy wedge necessary to stabilize carbon emissions would be in effect for 15 years. The wedge for renewables to stabilize carbon emissions would require annual installations of 18,500 MW annually, totaling 277,500 MW. Now a 25 percent RPS would have to first calculate the level of usage in 2025. That consumption in 2005 was 3.5 trillion kWh. Assuming no growth in consumption due to energy efficiency, 25 percent of 3.5 trillion kWh equals 875 billion kWh from renewable energy resources. Assuming a renewable supply capacity factor of 40 percent results in a total capacity of roughly 250,000 MW, roughly equivalent to meeting a 25 percent RES.

[9] A full-time equivalent (FTE) is roughly 2,000 hours of work.

[10] Leo Hindery Jr. and Leo W. Gerard, "Our Jobless Recovery," *The Nation*, July 13, 2009.

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