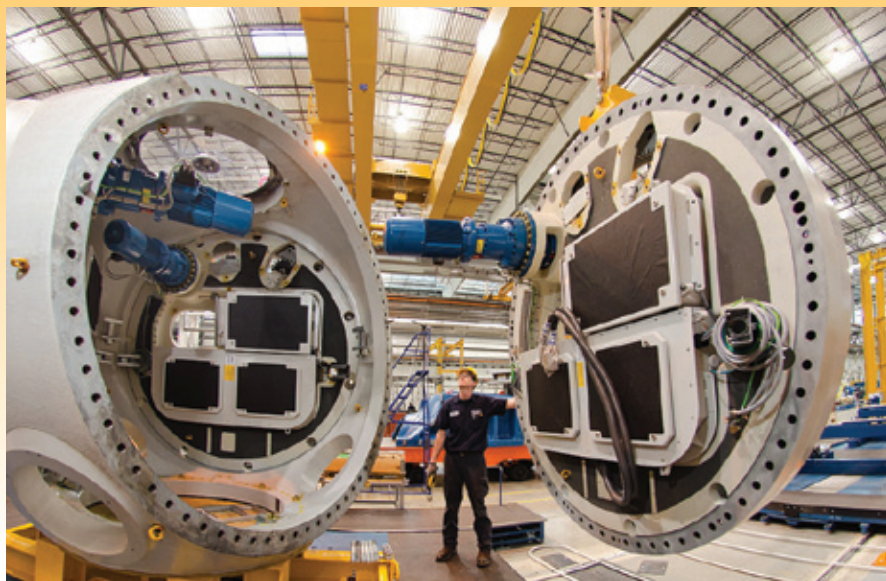


American Wind Farms: Breaking Down the Benefits from Planning to Production

September 2012



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NRDC (Natural Resources Defense Council) is a national nonprofit environmental organization with more than 1.3 million members and online activists. Since 1970, our lawyers, scientists, and other environmental specialists have worked to protect the world’s natural resources, public health, and the environment. NRDC has offices in New York City, Washington, D.C., Los Angeles, San Francisco, Chicago, Montana, and Beijing. Visit us at www.nrdc.org.

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Disclaimer

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INTRODUCTION

Stand underneath a wind turbine and it’s easy to be awestruck. Above you is a structure as tall as a 30-story building, with turbines as large as a football field and blades rotating at more than 200 mph on the tips. It is an impressive example of energy innovation, and yet one of these mammoth wind towers provides clean, renewable energy by a simple mechanical feat—the spinning turbines turn a generator that provides power for hundreds of homes.

Wind works. Over the past four decades, wind has provided an increasing amount of the energy we use. Today, wind farms generate about 50,000 megawatts of clean, renewable energy—the equivalent of the energy produced by more than 30 Hoover Dams.

As this report illustrates, clean, renewable energy is just the start of what we get from growing the number of wind farms across the country.¹ The wind industry now employs 75,000 Americans. U.S. companies and their workers produce approximately 65 percent of every wind turbine part.² And yet all of this growth and increased employment could be stopped in its tracks if Congress allows an important wind energy incentive, the Production Tax Credit (PTC), to expire. If instead Congress acts to continue the PTC, the wind industry can continue its impressive success story. The amount of wind energy generated by U.S. wind farms has nearly tripled in the past four years, and wind power has represented at least one-third of all new power added in America over the last five years.³ In fact, estimates show America could get 20 percent of its electricity from wind by 2030—about as much as we get from nuclear energy.⁴ To help show what is at stake, the following analysis details just how many jobs—and what variety—flow from a typical wind project. It is time to dispel the myths about wind and recognize the enormous value it provides to the health of our communities and the strength of our economy. Pulling the rug out from under wind now by not extending the PTC would cost jobs today and sacrifice future good, domestic jobs for many Americans across multiple economic sectors.

Extending the Production Tax Credit

Uncertainty over whether or not Congress will extend the PTC is already affecting our domestic wind industry. American companies and jobs across the wind value chain are at stake if urgent action isn’t taken soon. Here’s what some of the companies NRDC interviewed had to say about the PTC extension:

“An unacceptably large number of jobs are in serious jeopardy,” says Martin Schmidt-Bremer Jr., WindGuard North America’s Chief Operating Officer, “and while other countries move towards energy independence, we in the U.S. still rely too much on foreign oil.”

“More than anything it affects our ability to plan,” says Jason Chambers, Director of Sales and Marketing, Americas, for 3A Composites.

“While we don’t foresee a lot of wind projects in the near term due to the PTC” says Brian Tschanen, Division Manager at Vaughn Industries, “We absolutely will pursue more wind developments in the future.”

“Unless the PTC is extended soon,” says Naomi Lovinger, Head of Communications for Nordex USA, Inc., “we expect to see very few new wind farms in this country in 2013.”

THE JOB-CREATING POTENTIAL OF WIND ENERGY

This report shows that workers contributing to wind energy include everyone from engineers to construction employees; from blade manufacturers to gearbox makers; from electricians to operators. And they’re located all across the country. Our research finds that just one typical wind farm of 250-MW creates 1,079 direct jobs over the lifetime of the project.⁵ Already 25 projects of similar or greater size have been built in the United States and another 100 wind projects sized from 150-MW to 250-MW are in operation. Importantly, these jobs aren’t only created on the actual wind farm site during the installation of the wind turbines. These jobs are also created throughout the sizable wind farm economic “ecosystem”—the chain of activities and businesses that, over time, constitute the many steps of building a wind farm. To accurately measure how many direct jobs are created (excluding indirect and induced jobs), our analysis looks across the entirety of this wind farm value chain, from the measurement of wind resources at the early stages, to the project’s permitting and financing, to the manufacture of the components and materials that comprise the wind turbines, to the construction of this wind power project, and finally, its annual operations and maintenance. According to the National Renewable Energy Laboratory’s National Wind Technology Center, there are 14 key value chain activities that contribute to the production of wind power (NREL also identifies education, training, and outreach organizations, which are not included in this analysis).⁶ We analyze each of the 14 steps independently to determine the number of workers involved at each step in the building of a simulated 250-MW wind farm.

OUR RESEARCH FINDS THAT JUST ONE TYPICAL WIND FARM OF 250-MW WILL CREATE 1,079 JOBS OVER THE LIFETIME OF THE PROJECT.

Community Profiles: Iowa and Ohio



In Cedar Rapids, Iowa, two wind companies helped create a renewable energy technician program at Kirkwood Community College that is now training workers for new, well-paying wind industry jobs. And in Canton, Ohio, a wind company built the first wind energy research and development center of its kind.

These profiles are taken from NRDC’s report “At Wind Speed: How the U.S. Wind Industry is Rapidly Growing our Local Economies.” Read it online at <http://www.nrdc.org/energy/wind-powered-communities/>

WIND ENERGY MANUFACTURING BENEFITS, CEDAR RAPIDS, IA

- Manufacturing jobs created: 460
- Technical products manufacturing salaries increase to \$93,450 in 2011
- Creation of the Energy Production and Distribution Technologies Program at Kirkwood Community College in 2010
- Hundreds of jobs indirectly created along the supply chain

WIND ENERGY MANUFACTURING BENEFITS, CANTON, OH

- 19 companies involved in wind energy supply chain
- \$86,350 average salary for wind technicians
- Industry partnership with Stark State College
- Wind Energy Research Development Center
- Community engagement by wind companies’ “Engineer for a Day” program

The research identifies 557 total non-construction workers for a 250-MW wind farm. This includes 80 in preplanning and development, 432 workers in manufacturing, 18 in sales and distribution, and 27 in operations and maintenance.

Construction jobs add 522 jobs to the overall project. These workers are spread among three categories, with 273 working on on-site civil works, such as roads, and foundations; 202 working on mechanical assembly, such as the installation of the wind turbines; and 47 working on on site electrical work, such as grid connection.

Our analysis also confirmed that a large number of manufacturing jobs are created throughout the supply chain for a wind farm, and a growing number of the jobs are being filled by American workers.⁷ For example, the domestic content of wind turbines (the fraction of wind farm equipment sourced in America, as measured by cost) has essentially doubled in the last six years, from 35 percent in 2005-2006 to 67 percent in 2011.⁸ A recent Accenture report highlighted that companies are more and more focused on manufacturing near demand centers.⁹ In the wind industry, this dynamic is potentially even more apparent, given the size and complexity of wind turbines and therefore the advantageousness of local production for transport reasons. This report has specifically chosen to profile either American companies or foreign companies with a strong domestic presence, to highlight that all of the jobs created from U.S. wind farm development can be located in America.

COMPANIES AND COMMUNITIES ALSO BENEFIT FROM WIND POWER

In addition to jobs, wind projects boost revenues and create new markets for a wide range of companies across many different industries. Each of the 14 steps in building a wind farm outlined in this report represent new opportunities for dozens of companies across many different cities and states. In this report, we identify a number of companies that are already part of the wind supply chain and realizing these opportunities, including: Michigan-based Ventower which manufactures and supplies the steel towers for wind farms; Danotek Motion Technologies, supplying the wind industry with generators and power converters; and Maine-based Reed & Reed, a contractor that can provide a full-set of mechanical, civil, structural, and electrical work to construct wind farms, among many others.

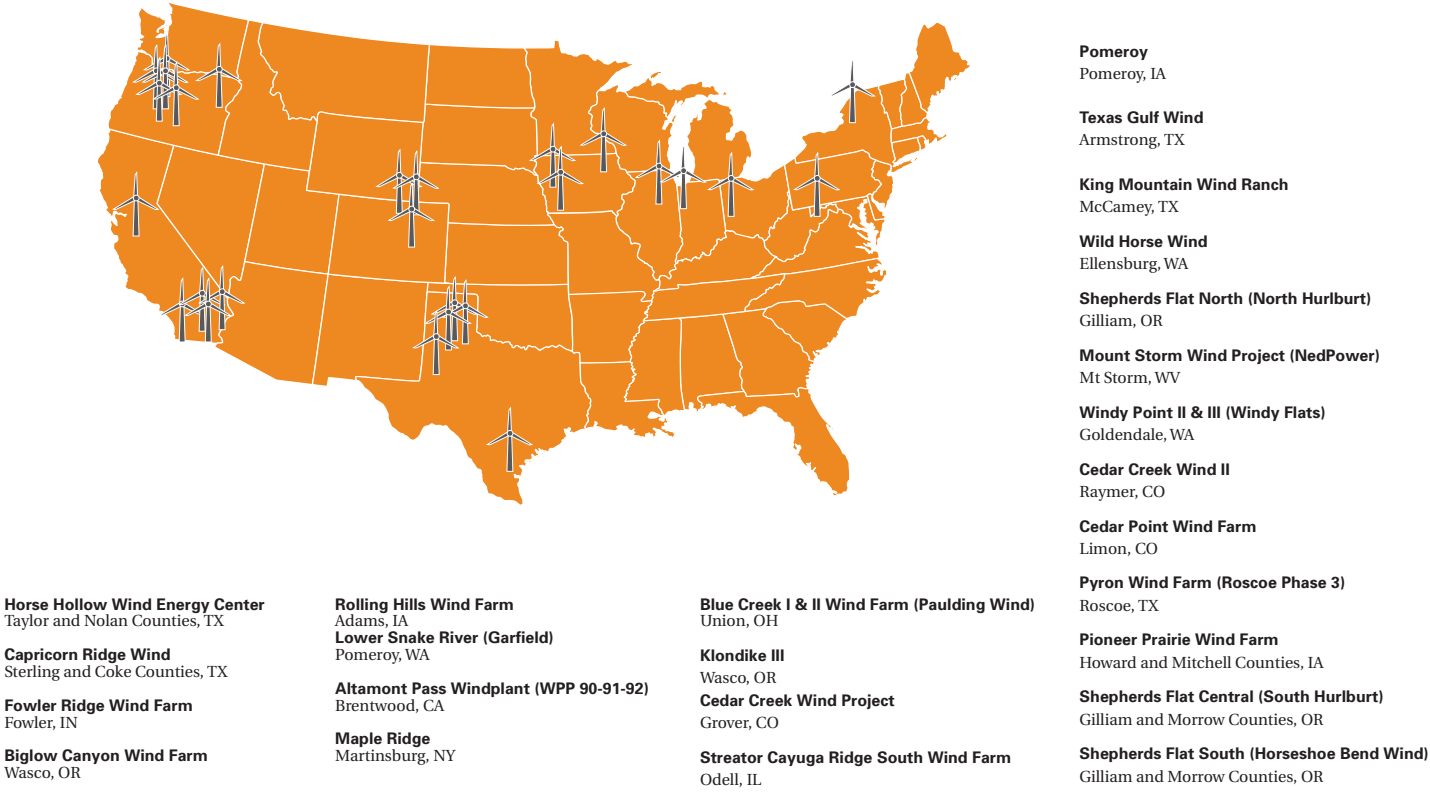
Moreover, wind power projects offers significant benefits to entire communities where these projects are built—from new earnings opportunities for farmers and landowners to additional tax revenues and lease payments that support other community priorities, such as better education, infrastructure, and economic development. This report

excerpts a separate NRDC report that highlights four case studies of communities benefiting from wind power.

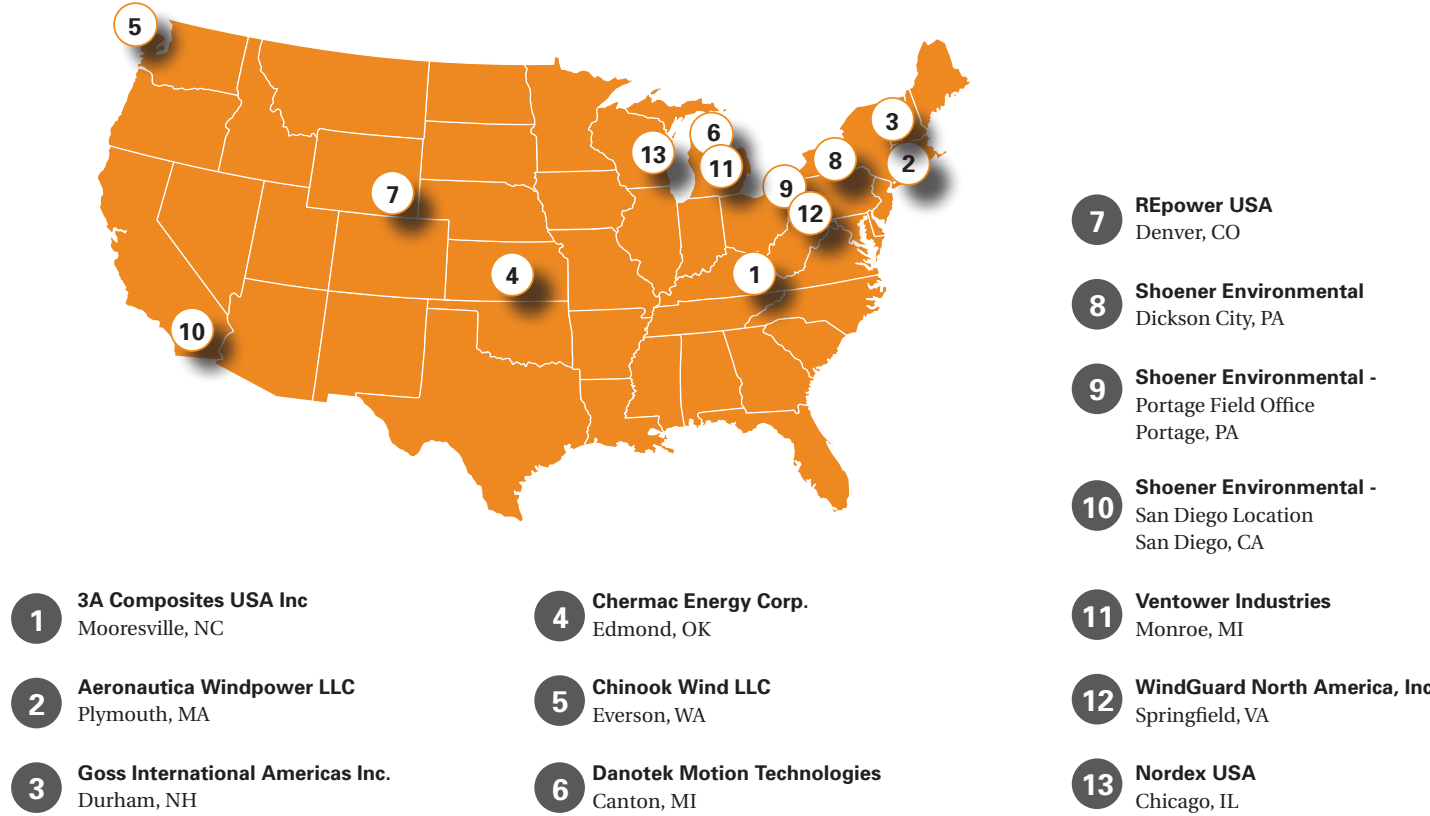
Unfortunately, misconceptions about the viability of wind power downplay the strong economic and employment benefits of wind power, and ignore the continued innovation in this sector. This report is ultimately an exercise in telling the story of one large wind farm—showing the full economic impact—to demonstrate the impressive value created by these projects, to highlight the opportunities for American companies, communities, and workers, and to caution what is at risk if we don’t continue to invest in these renewable technologies.

Across America, the U.S. wind industry is exceeding expectations. This report offers a snapshot of this emerging trend, and points the way forward for a clean energy future. We must continue this momentum, by promoting strong energy policies, beginning with an extension of the Production Tax Credit for wind energy, a crucial step towards building a strong, sustainable, market-leading U.S. wind industry.

Location of Wind Farms 250 MW and Above in the United States



Map of Existing Wind Companies Featured in This Report



DATA VISUALIZATION: THE 14 KEY VALUE CHAIN ACTIVITIES AND JOB CREATION

THE WIND FARM SUPPLY CHAIN

12

TOTAL JOBS CREATED

SITE IDENTIFICATION, ASSESSMENT AND PRE-DEVELOPMENT

Conducting a wind resource assessment, testing the site and evaluating infrastructure options, among other activities

Occupations include scientists, analysts, administrative assistants, accountants and consultants.

STEP 1

50

TOTAL JOBS CREATED

PROJECT DEVELOPMENT, LEGAL, REGULATORY AND FINANCE

Behind-the-scenes aspects of wind farm project development, including engineering, legal and regulatory aspects, and project financing.

Occupations include attorneys, administrative assistants, engineers, consultants, accountants, real estate professionals, and finance specialists.

STEP 2

18

TOTAL JOBS CREATED

PROJECT PERMITTING: REGULATORY, ENVIRONMENTAL, OR WILDLIFE ASSESSMENT

Preparing and applying for relevant required permits, documenting compliance with regulations and assessing wildlife and environmental impacts of wind farm activity.

Occupations include scientists, consultants, administrative assistants, and clerks.

STEP 3

21

TOTAL JOBS CREATED

MANUFACTURING OF POWER EQUIPMENT AND ELECTRONICS

Manufacturing power equipment and electronics, including gear boxes, generators, braking systems, and power couplings.

Occupations include engineers, technicians, assemblers, clerical workers, and managers.

STEP 7

91

TOTAL JOBS CREATED

NACELLE ASSEMBLY

Assembling the nacelle, the box-like structure on the wind tower holding gears, electronics and other equipment that turns a turbine blade and harnesses wind power

Occupations include assemblers, engineers, sales staff, clerical workers, and technicians.

STEP 6

57

TOTAL JOBS CREATED

BLADE MANUFACTURING

Manufacturing turbine blades, each about 15 meters, typically near the wind farm. Composites and resins used in blades are often locally sourced.

Occupations include scientists, engineers, trade workers, assembly workers, clerical staff, and technicians.

STEP 5

91

TOTAL JOBS CREATED

MANUFACTURING OF ENGINEERED STRUCTURES

Manufacturing "engineered structures", such as the towers on which nacelles are installed, and the components that go into the towers.

Occupations include engineers, sheet metal workers, clerical staff, managers, and trade workers.

STEP 4

10

TOTAL JOBS CREATED

MANUFACTURING OF DRIVE TRAINS

Assembling completed drive train units that include a gearbox and a generator, which are housed in the nacelle.

Occupations include assemblers, trade workers, clerical staff, managers, and sales and distribution workers.

STEP 8

162

TOTAL JOBS CREATED

MANUFACTURING OF SUB-COMPONENTS AND MATERIALS

Manufacturing goods such as wiring, fasteners, composites and resins, metals, and concrete which are sub-components and raw materials for construction of wind farm.

Occupations include technicians, trade workers, clerical staff, scientists, assemblers, and managers.

STEP 9

18

TOTAL JOBS CREATED

DISTRIBUTION OR TRANSPORT OF WIND ENERGY PRODUCTS

Moving goods from manufacturing facilities all across the country to the construction site

Typical occupations include truck drivers, logistics, sales, administrative duties, and management.

STEP 10

273

TOTAL JOBS CREATED

ON-SITE CIVIL WORKS

Heavy construction including clearing and grading sites, clearing roads, pouring foundations, and otherwise preparing the site for tower construction and assembly

Occupations include engineers, heavy equipment operators, trade workers and laborers, and managers.

STEP 11

1,079

TOTAL JOBS CREATED

27

TOTAL JOBS CREATED

OPERATIONS AND MAINTENANCE

Ongoing operations and maintenance, including inspecting blades and turbines, routine maintenance, and overall management of energy production.

Occupations include technicians, engineers and professional staff

STEP 14

47

TOTAL JOBS CREATED

ON-SITE ELECTRICAL WORK

Developing electrical network and connecting wind turbines to the substation and the electrical grid.

Occupations include engineers, electricians, trade workers, inspectors, and managers.

STEP 13

202

TOTAL JOBS CREATED

ON-SITE MECHANICAL ASSEMBLY

Assembling all components, erecting towers, and installing nacelles and blades, typically with heavy equipment

Occupations include heavy equipment operators, engineers, trade technicians, inspectors, and clerical staff.

STEP 12

12

TOTAL JOBS CREATED

SITE IDENTIFICATION, ASSESSMENT AND PRE-DEVELOPMENT

Conducting a wind resource assessment, testing the site and evaluating infrastructure options, among other activities

Occupations include scientists, analysts, administrative assistants, accountants and consultants.

STEP 1

This segment includes activities that occur on- and off-site during the planning stage. The first step in the process is identifying a site. This includes conducting a wind resource assessment, testing the site and evaluating infrastructure options, and other key factors for a successful site.

Example occupations for this segment include scientists, analysts, administrative assistants, accountants and finance specialists, and consultants. The work conducted in this phase of the project is focused on determining the best site for the farm, developing a preliminary layout plan, choosing a turbine make and model, conducting inspections, and meeting with the local community. Also during this phase, initial financial plans and feasibility studies are conducted.

The broad spectrum of workers in this initial phase illustrates the importance of planning of wind energy projects. Scientists, analysts, and engineers must test the site to determine the substrate stability, history of natural disasters, hydrologic activity, and other scientific processes that could impact construction of the site. At the same time, other analysts and scientists must review the wind resource in detail.

The scientific components are not the only considerations in this phase. Proximity to transmission lines and customers, availability of cost-effective land, and local support must also be considered.

NRDC research indicates that this work is typically conducted by at least two separate firms. A 250-MW wind farm creates six jobs at each firm, for a total of 12 workers.

PROPER WIND SITING

Development of renewable resources at multiple scales, including utility scale, is essential if we are to address the challenge of climate change in transitioning from a fossil fuel-based economy to a clean energy economy. However, if utility-scale projects and the transmission lines necessary to transport the electricity they generate are not sited and built responsibly, their construction and operation will seriously harm unique and sensitive wildlife, wildlands, and cultural resources and foreclose future options for climate adaptation for species and habitats. Ensuring that both wind generation and transmission projects are sited appropriately is the most expedient solution to deploying renewable energy quickly with a minimum of environmental damage and conflict.

NRDC believes that a smart from the start approach to siting is the best way to ensure that renewable energy development is properly deployed. Wind energy projects present potential risks to many species of concern, such as migratory birds, bats, eagles, and prairie and sage grouse. In particular, risks may include collision with turbines and associated infrastructure; habitat loss, degradation, and fragmentation; species displacement and behavioral changes; altered predator and prey populations; and introduction and proliferation of invasive species. Wind energy development in some areas may be precluded by state or federal law, while other areas may simply be inappropriate for development based on high natural resource or wildlife values. Responsible renewable energy development must include guiding development to appropriate places—areas with good renewable resources, proximity to existing roads and transmission lines, previously disturbed lands when available, and limited conflicts with important wildlife habitat, wildlands, and other resources and values.

Company Profile: Chinook Wind

John Bosche's foray into the wind industry began when he serendipitously walked into an American Wind Energy Association (AWEA) convention in 1990. Inspired by the pioneering spirit of the several hundred already working in the wind power business and the steady cost declines of electricity generated from the renewable resource, he found a job. "It was like being an aircraft engineer right after the Wright brothers," Bosche says.¹⁰

In 2001, he founded Chinook Wind, an engineering consulting firm located in Everson, Washington that assesses land to determine its suitability for wind farms. The company grew from just Bosche to a firm of 15 by 2009, as decreased wind costs and better turbine technologies helped the industry and Chinook to pick up business. Chinook primarily works with project developers to conduct pre-site assessments. That involves anything from setting up meteorological monitoring equipment and determining how the wind farm can be financed to recommending turbine layout of the farm and monitoring the construction once the project breaks ground. Chinook Wind also has the capacity to monitor turbine and wind farm performance after construction and ensure the wind turbines are delivering their expected power.

While the majority of its business is concentrated within the United States, Chinook is also working globally, with major companies like GE Wind, BP Alternative Energy, Key Band, and Veolia.

Traveling to wind project sites all over the nation, Bosche anecdotally says he notices the economic impacts in communities like Tehachapi, California; McCamey, Texas; and the Columbia River Gorge in Washington, where multimillion-dollar projects have been built.¹¹ From the hotels and restaurants used by construction workers, operations jobs in tiny communities following farm completion, and the tax dollars from wind power sales dedicated to improving local schools, a wind project injects much-needed labor and capital into communities.

STEP 1

STEP 2

STEP 3

STEP 4

STEP 5

STEP 6

STEP 7

STEP 8

STEP 9

STEP 10

STEP 11

STEP 12

STEP 13

STEP 14

STEP 2: PROJECT DEVELOPMENT, LEGAL, REGULATORY, AND FINANCE—50 JOBS CREATED

50

TOTAL JOBS CREATED

PROJECT DEVELOPMENT, LEGAL, REGULATORY AND FINANCE

Behind-the-scenes aspects of wind farm project development, including engineering, legal and regulatory aspects, and project financing.

Occupations include attorneys, administrative assistants, engineers, consultants, accountants, real estate professionals, and finance specialists.

STEP 2

This segment is focused on the engineering, legal, and financial plan for the development of the wind farm. This work includes finalizing the plans created during pre-development, acquiring project financing, negotiating contracts, and preparing for legal and regulatory findings. It can also include acquiring real estate through lease or purchase and obtaining insurance to ready the land for construction. This phase also often includes negotiation with utility providers and municipalities as well.

Typical occupations in this segment include attorneys, paralegals, administrative assistants, engineers, consultants, accountants, real estate professionals, and finance specialists.

The legal, regulatory, and finance teams are behind-the-scenes workers who are primarily responsible for drafting contracts for purchase or leasing of property, subcontractor agreements, insurance reviews, and project finance arrangements. Often, these specialized activities are conducted by boutique firms, each contributing expertise to their niche activity. The typical wind farm requires a combination of companies (such as a law firm and a financial services firm). As a result, the total contribution of this segment for a 250-MW wind farm is 50 employees.

Company Profile: Chermac Energy Corp.

After 17 years as a petroleum engineering and oil and gas company, Chermac Energy Corporation entered the wind business in 1999. The Oklahoma City-based company is responsible for 364 MW of wind-generated power to date, with almost 3,000 MW of development currently in the works in Oklahoma, Texas, Kansas, and New Mexico.

Chermac performs all necessary tasks for wind development to start construction. The company leases land for wind development; installs meteorological (MET) towers for collecting wind data; performs cost estimations, finance modeling, and technical evaluations; and supervises environmental and electrical studies. The largest wind farm in the Chermac pipeline is the 765 MW North Buffalo project located in Harper County, Oklahoma, while the 10 MW EVA I wind farm in the Oklahoma Panhandle is the smallest. Years of experience in energy development enable Chermac to tailor its services to each endeavor, giving it the versatility required to succeed in the increasingly competitive wind industry.¹²

STEP 3: PROJECT PERMITTING: REGULATORY, ENVIRONMENTAL, OR WILDLIFE ASSESSMENT—18 JOBS CREATED

18

TOTAL JOBS CREATED

PROJECT PERMITTING: REGULATORY, ENVIRONMENTAL, OR WILDLIFE ASSESSMENT

Preparing and applying for relevant required permits, documenting compliance with regulations and assessing wildlife and environmental impacts of wind farm activity.

Occupations include scientists, consultants, administrative assistants, and clerks.

STEP 3

This segment of activities includes preparing and applying for relevant required permits and assessing wildlife and environmental impacts of wind farm activity. Specifically, this includes documenting compliance with federal, state, and municipal regulations.

Occupations with firms that conduct project permitting activities include scientists, consultants, administrative assistants, and clerks.

Numerous project permits and approvals are required to construct a wind farm, at the federal, state, and local levels. These may include site plan approvals, electrical and building permits, special use or zoning variances, stormwater discharge plans, and state utility or energy department approvals, among others. At a minimum, approvals and permits are required for impacts to avian species, wetlands, protected species of plants and animals, cultural sites, sound, flight pathways, and cell signal or other telecommunication interference. Each of these approvals can often require significant study to measure impacts over time.

Approving agencies include municipal zoning and building offices, state energy commissions, and federal agencies such as the Federal Aviation Administration and the Department of Defense.

According to the research conducted for this study, a wind farm project uses one or two firms to conduct permitting activities. The net employment impact on this segment for project permitting is 18 workers.

Company Profile: Shoener Environmental

With offices in Dickson and Portage, Pennsylvania, and San Diego, California, Shoener Environmental is a bi-coastal environmental consulting firm that provides a vast array of services to energy ventures, both large and small. The company began helping clients site, construct, and manage wind energy projects in 2000, when NextEra Energy Resources—then known as FPL Energy—called on Shoener to assist in building Waymart Wind Farm in Wayne County, Pennsylvania. At 64.5 MW, it remains Pennsylvania's second-largest wind farm.¹³

Today, more than half of the firm's work comes from the wind energy industry. The company performs site assessments to determine the best location for turbine positioning and then guides its clients through the permitting process. Once construction begins, Shoener's civil engineers help develop the site, while its scientists ensure that the project operates safely and meets all legal requirements. Even after the wind farm is operational, Shoener helps manage its compliance with federal regulations and performs “mortality monitoring”—studying the wind turbines’ impacts on birds and bats.

Shoener wind farm projects span the country, from British Petroleum's Mehoopany Wind Farm in Wyoming County, Pennsylvania, to Pattern Energy's Ocotillo Wind Farm in Southern California's Imperial Valley. Every project creates local construction and managerial jobs and brings new revenues to communities that desperately need them.¹⁴

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7	STEP 8	STEP 9	STEP 10	STEP 11	STEP 12	STEP 13	STEP 14			STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7	STEP 8	STEP 9	STEP 10	STEP 11	STEP 12	STEP 13	STEP 14
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STEP 4: MANUFACTURING OF ENGINEERED STRUCTURES
—91 JOBS CREATED

91 TOTAL JOBS CREATED

MANUFACTURING OF ENGINEERED STRUCTURES

Manufacturing “engineered structures”, such as the towers on which nacelles are installed, and the components that go into the towers.

Occupations include engineers, sheet metal workers, clerical staff, managers, and trade workers.

STEP 4

Most reports of employment generated by U.S. wind farms focus only on installation and maintenance of systems. While these activities are clearly important, a comprehensive analysis of employment impacts requires a detailed assessment of manufacturing of wind energy products and components. The first of these categories is the manufacturing of engineered structures.

Engineered structures most commonly refer to the towers on which nacelles (see Step 6) are installed and the components that go into them. Occupations in this segment include engineers, sheet metal workers, clerical staff, managers, and trade workers. The predominant activity in engineered structures manufacturing is sheet metal work. These components are then shipped to the facility for construction and assembly.

The manufacturing of engineered structures is a major generator of wind energy jobs in the United States. A 250-MW wind farm has significant employment impacts in this manufacturing segment, creating 91 jobs.

Company Profile: Ventower Industries

Based in Monroe, Michigan, Ventower Industries is a manufacturer and supplier of utility-scale wind turbine towers. Ventower began production of its towers in late 2011 shortly after it cut the ribbon for its state-of-the-art 115,000 square-foot facility. The company is planning to initially produce 200-250 towers per year and is capable of building towers over 300 feet tall.¹⁵

The company’s location on the shores of Lake Erie gives it access to local and international export markets via waterway, rail, and truck transportation. What’s more, the company’s location on a brownfield redevelopment site is injecting new economic value into a place that was formerly a blight to the community.

Ventower recently completed a contract with Aeronautica Windpower supplying 65-meter-tall towers for mid-scale wind turbine projects at several different Ohio schools. It has also supplied 85-meter towers to other projects in Ohio, and Rhode Island as well.¹⁶

Ventower is adding a strong economic boost to the region: in addition to the 55 full-time workers it currently employs, it plans to hire approximately 100 more, trained through programs with local junior colleges, as it approaches full production capacity. Furthermore, it sources its steel from domestic suppliers, helping to support U.S. industries. As Mr. Viciano, board chairman of Ventower, said at the ribbon-cutting for the company’s manufacturing facility, “Our commitments to domestic manufacturing, job creating, and renewable energy have all been important drivers during our initial efforts here in Michigan.”¹⁷

STEP 5: BLADE MANUFACTURING—57 JOBS CREATED

57 TOTAL JOBS CREATED

BLADE MANUFACTURING

Manufacturing turbine blades, each about 15 meters, typically near the wind farm. Composites and resins used in blades are often locally sourced.

Occupations include scientists, engineers, trade workers, assembly workers, clerical staff, and technicians.

STEP 5

Blade manufacturing is an important segment of the value chain of wind activities in the United States. These blades, measuring about 15 meters in length, are typically manufactured near the wind farm site, as transportation of such large structures is difficult. The composites and resins used to make them are also often locally sourced, further boosting local industry growth.

Typical blade manufacturing occupations include scientists, engineers, trade workers, assembly workers, clerical staff, and technicians. These workers design and build molds, develop new or work with existing composites and plastics, and test and prepare blades for shipment.

A 250-MW wind farm, with approximately 125 2-MW turbines, generates approximately 57 jobs in blade manufacturing.

Company Profile: Siemens Energy

In 2004, Siemens officially marked its entrance into the wind power industry with the acquisition of Denmark-based Bonus Energy. Today, Siemens Wind Power employs approximately 8,000 globally. In the United States, it manufactures wind turbine blades and nacelles, develops new wind power technologies, and services turbines.

Siemens has U.S.-based operations in Texas, Kansas, Colorado, Florida, and Iowa, where it manufactures wind turbine blades in Fort Madison. The company’s IntegralBlade® turbine blades are manufactured in one piece in a closed process, eliminating glued joints.

More than 7,000 blades produced in Siemens’ Iowa blade facility have been delivered to wind farms in the U.S. and Canada.


STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7	STEP 8	STEP 9	STEP 10	STEP 11	STEP 12	STEP 13	STEP 14		STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7	STEP 8	STEP 9	STEP 10	STEP 11	STEP 12	STEP 13	STEP 14
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91
TOTAL JOBS CREATED

NACELLE ASSEMBLY

Assembling the nacelle, the box-like structure on the wind tower holding gears, electronics and other equipment that turns a turbine blade and harnesses wind power

Occupations include assemblers, engineers, sales staff, clerical workers, and technicians.



STEP 6

The nacelle, a box-like structure at the top of the tower, is one of the key components of a wind turbine. The nacelle holds the gears, electronics, and other equipment that turns a turbine's blades, allowing the wind turbine to harness the power generated by the wind.

Nacelle assembly is labor intensive and represents a specialized form of manufacturing. Typical occupations in this segment include assemblers, engineers, sales staff, clerical workers, and technicians.

Nacelle manufacturing is also technical work, requiring careful assembly of numerous components that make up the turbine. In addition to the assembly itself, quality assurance, inspection, and testing are key activities in this phase. Finished nacelles are shipped to the construction site for installation after the towers are raised.

For the purposes of this study, the research team assumed that the hypothetical wind farm uses 125 2-MW wind turbines. Assembling 125 nacelles of that size requires approximately 91 workers.

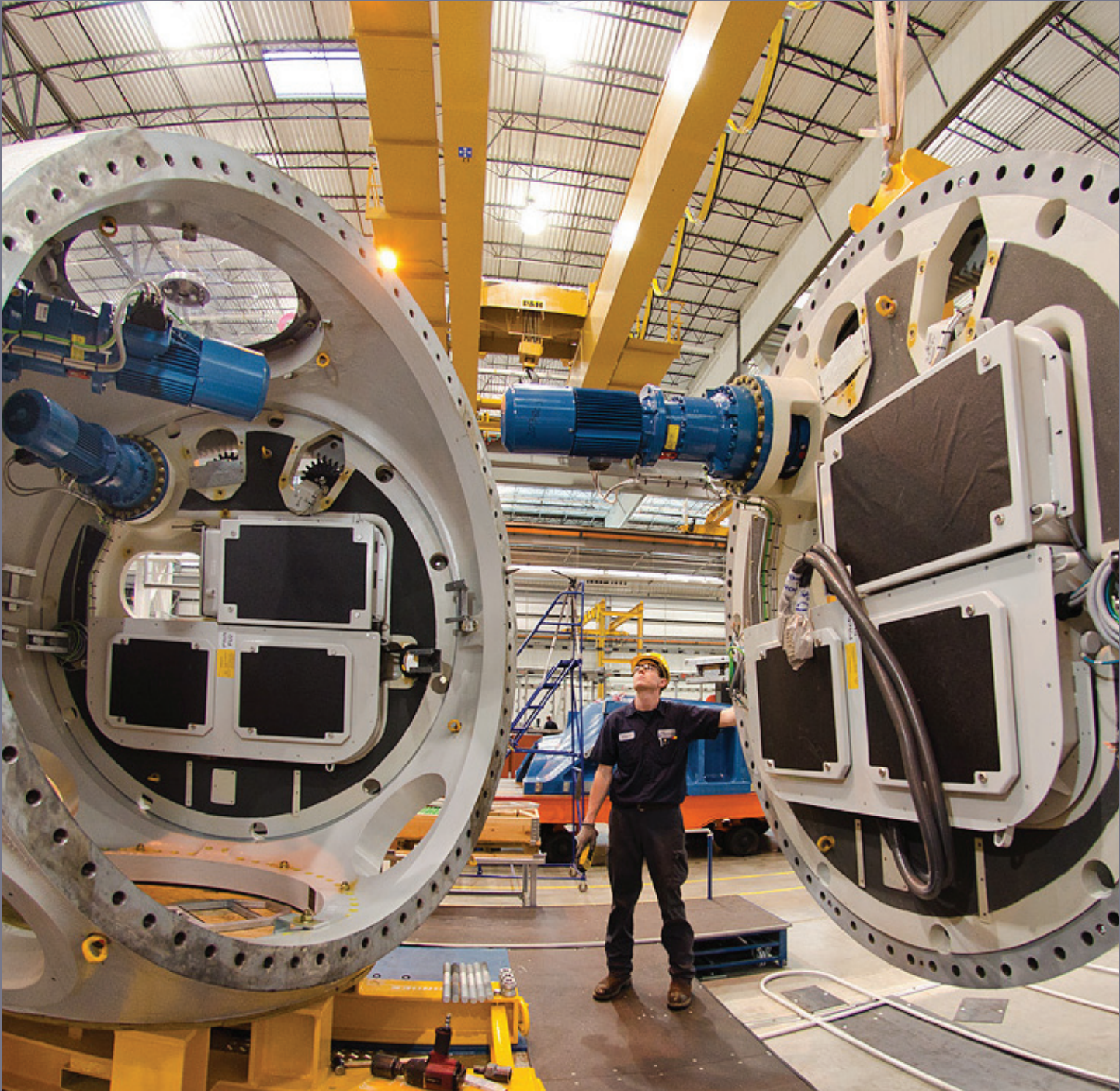
Company Profile: Nordex USA

Nordex USA, Inc. opened its U.S. headquarters in Chicago in 2008 and hit the ground running. Last year, it ranked sixth out of 27 industry competitors in the number of wind turbines installed in the United States. Nordex manufactures utility-scale wind turbines and offers a full range of services, from developing wind farms to construction and installation, commissioning, and post-operational service and maintenance. The firm will even help clients obtain crucial financing to fund their project.

The Beebe wind farm, currently under construction by Exelon in Ithaca, Michigan, epitomizes Nordex's versatility. After Beebe broke ground, Nordex took over delivery, installation, commissioning, and testing of turbines, and will provide maintenance under a 20-year contract. The company is also supplying turbines to the Hawkeye and Rippey wind farms in Fayette County and Green County, Iowa, respectively, and at Mozart wind farm near Abilene, Texas.

Many of Nordex's turbine components are assembled at its nacelle plant in Jonesboro, Arkansas. Opened in October 2010, the 150,000-square-foot production facility employs about 90 people in high-paying, highly skilled jobs. The firm is also partnering with nearby Arkansas State University to put the necessary engineering and technical programs in place to train future employees.

Just as towns like Jonesboro clearly benefit from the company's operations, so do the rural communities where Nordex is helping to build and maintain wind farms. Jobs are created, royalties flow to landowners, and tax dollars go to local schools and governments.¹⁸



A worker assembling a nacelle at a Nordex manufacturing facility.

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7	STEP 8	STEP 9	STEP 10	STEP 11	STEP 12	STEP 13	STEP 14
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STEP 7: MANUFACTURING OF POWER EQUIPMENT AND ELECTRONICS—21 JOBS CREATED

21

TOTAL JOBS CREATED

MANUFACTURING OF POWER EQUIPMENT AND ELECTRONICS

Manufacturing power equipment and electronics, including gear boxes, generators, braking systems, and power couplings.

Occupations include engineers, technicians, assemblers, clerical workers, and managers.

STEP 7

At the heart of the nacelle is the power equipment and electronics, including gear boxes, generators, braking systems, and power couplings. The electronic equipment in a wind turbine is responsible for converting and distributing the power to the grid. As vital component manufacturers, firms in this segment play an important role in the U.S. wind industry.

As with other manufacturing stages, occupations in this segment include engineers, technicians, assemblers, clerical workers, and managers. These manufacturing occupations are responsible for designing components for specific applications, assembling products, and testing and inspecting finished goods.

To produce the power equipment and electronics components required for a 250-MW wind farm, companies in this segment would require approximately 21 workers.

Company Profile: Danotek Motion Technologies



Danotek Motion Technologies, based in Canton, Michigan, is a developer and manufacturer of efficient, reliable, and competitive generation and conversion technologies. Founded in 2001 by three former GE engineers, the company, which initially focused on the small-scale distributed generation and transportation industries, is today the only U.S.-based company to supply the wind industry with permanent magnet generator technology. This innovative technology is helping to drive up the efficiency and drive down the cost of generating wind power by increasing the amount of energy that wind turbines can produce from the available wind resources.

The company relies heavily on local Michigan wind power manufacturers, and a strong technical workforce—including many former auto workers—to design its motor and generation systems. Since 2009, Danotek has expanded its workforce from 15 to more than 30 employees, with more hires planned as it commences serial production to make its generators and power converters for the world’s largest wind turbine original equipment manufacturers.¹⁹ At full capacity, Danotek will be responsible for more than 100 direct clean energy jobs in the state. Within the next few years, the company’s revenues are expected to exceed \$100 million.

STEP 8: MANUFACTURING OF DRIVE TRAINS—10 JOBS CREATED

10

TOTAL JOBS CREATED

MANUFACTURING OF DRIVE TRAINS

Assembling completed drive train units that include a gearbox and a generator, which are housed in the nacelle.

Occupations include assemblers, trade workers, clerical staff, managers, and sales and distribution workers.

STEP 8

In addition to engineered structures, nacelles require drive train components. These component manufacturers typically assemble complete drive train units that include a gearbox and a generator. These systems are critical in creating power from the movement of the blades.

Occupations in this area include assemblers, trade workers, clerical staff, managers, and sales and distribution workers. Because drive trains are critical nacelle components, workers in this field must design drive trains to the nacelle specifications and test them rigorously for quality.

According to the research, a 250-MW wind farm creates an average of 10 workers in this segment.



STEP 9: MANUFACTURING OF SUB-COMPONENTS AND MATERIALS—162 JOBS CREATED

162
TOTAL JOBS CREATED

MANUFACTURING OF SUB-COMPONENTS AND MATERIALS

Manufacturing goods such as wiring, fasteners, composites and resins, metals, and concrete which are sub-components and raw materials for construction of wind farm.

Occupations include technicians, trade workers, clerical staff, scientists, assemblers, and managers.

STEP 9

Wind farm components require numerous sub-components and raw materials for the ultimate construction of the wind farm. These subcomponents and materials include wiring, fasteners, composites and resins, metals, concrete, and other manufactured goods.

The firms and related occupations vary widely in this segment. Typical occupations include technicians, trade workers, clerical staff, scientists, assemblers, and managers.

Subcomponents and materials includes everything from fasteners to wiring to base materials. These subcomponents and materials firms are suppliers to the other manufacturing activities cited in this report.

The research shows that the hypothetical 250-MW wind farm, with its 125+ turbines, would require the services of at least four companies to produce subcomponents and materials. Such a project would create approximately 162 jobs.

Company Profile: 3A Composites

3A Composites—the global market leader in structural core materials—operates a 125,000-square-foot factory in High Point, North Carolina, where raw components sourced from the company's factories and industry partners around the globe are converted into exceedingly strong, lightweight materials. One significant use for the factory's end products is in the manufacture of wind turbine rotor blades. For 20 years, 3A Composites has played a major role in developing engineering solutions that have allowed wind turbines to grow incredibly large and powerful, with rotor blades now exceeding 200 feet in length.

At its High Point conversion center, 60 employees produce the company's trademarked core materials, Baltek, a composite made from balsa wood that is particularly suitable for high shear and compressive forces, and Airex, a polymer-based foam that assures optimal strength-to-weight ratios in all parts of the rotor blade.²⁰ These high-tech components are shipped to rotor blade manufacturers around the world.²¹



Workers applying materials that will create a strong turbine blade.

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7	STEP 8	STEP 9	STEP 10	STEP 11	STEP 12	STEP 13	STEP 14
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STEP 10: DISTRIBUTION OR TRANSPORT OF WIND ENERGY PRODUCTS—18 JOBS CREATED



The construction of a wind farm requires substantial moving of goods from manufacturing facilities to the construction site. The moving of goods across distances requires workers focused on truck driving, logistics, sales, administrative duties, and management.

Transportation and logistics are important for developing a wind project on time. Materials and goods come from all across the country. The main activities in this segment are truck driving, weighing, and loading of goods.

For a 250-MW wind farm, approximately 18 workers are required to transport wind products to the site.

Company Profile: REpower USA

Situated on the Eastern edge of the Rocky Mountains, REpower USA has sought to take advantage of the surge in domestic wind farm construction in the past five years. The U.S. subsidiary of REpower Systems SE—a global leader in the manufacture of wind turbines—opened its doors in 2007 and now sells, installs, and maintains turbines in the 2-MW class, supplying projects in 10 states. REpower USA employs upwards of 150 engineers and industry experts, with a core group in Denver and others dispersed at sites across the country.

In Ferry, Alaska, REpower USA is installing its turbines, built with American components, at the 25-MW Eva Creek Wind Project which, when completed, will be the largest wind farm in the state. In Kern County, California, the 138-MW Pacific Wind Project, powered by REpower's MM92 turbines, went online in August 2012 and was one of many projects that recently helped push domestic wind energy generating capacity to more than 50 GW.²² And construction of the Twin Ridges Wind Farm is under way in Somerset County, Pennsylvania, with 68 REpower turbines going up over the next few months. Once completed, Twin Ridges will generate enough electricity to power more than 45,000 homes.²³

Each of these wind projects is boosting local economies, with school districts, municipalities, landowners, construction crews, and virtually every business in the community reaping benefits—the Twin Ridges Wind Farm, by itself, will result in \$2.5 million in expenditures on local goods. But these engines of prosperity are endangered.²⁴



Company Profile: Aeronautica Windpower, LLC

Aeronautica Windpower is a wind turbine manufacturer based in Plymouth, Massachusetts, that produces and markets mid-scale turbines. Founded in 2008 by Brian Kuhn and five other partners, the company got its start in refurbishing turbines before realizing it could easily—and more profitably—manufacture new turbines by sourcing components from domestic companies.

After deciding to make 225- and 750-kW machines to respond to the need for smaller, community-scale projects, Aeronautica contracted Goss International, a Durham, New Hampshire-based manufacturer that formerly made printing presses to produce nacelle components. As Kuhn said during a phone interview, it “was a natural marriage. The manufacturer already knew how to make heavy equipment that spins fast at close tolerances.”²⁵ Beyond its nacelle manufacturer, Aeronautica sources the majority of its components domestically, and its final products are “Made in the USA”-certified.

The mid-size turbines that are Aeronautica’s niche have broad applications in community-scale wind projects such as a Chicago-based LEED-certified food distribution center and local schools, including three school projects in Ohio where the company is installing turbines. The company’s turbines are also well-suited for islands with limited infrastructure; Aeronautica now does business in Cape Verde, the Caribbean, Kenya, Northern Ireland, and other island locations. The company supports between 50 and 75 manufacturing and assembly jobs in the New Hampshire and Massachusetts area, with hundreds more at the component companies with which it does business.


STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7	STEP 8	STEP 9	STEP 10	STEP 11	STEP 12	STEP 13	STEP 14
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273
TOTAL JOBS CREATED

ON-SITE CIVIL WORKS

Heavy construction including clearing and grading sites, clearing roads, pouring foundations, and otherwise preparing the site for tower construction and assembly

Occupations include engineers, heavy equipment operators, trade workers and laborers, and managers.



STEP 11

On-site civil works refer to the heavy construction for the project. This includes clearing and grading sites, clearing roads, pouring foundations, and otherwise preparing the site for tower construction and assembly. These activities contribute the bulk of the labor associated with building a wind farm.

A utility-scale wind plant of this size will require, on average, about 21,000 acres of land²⁶ (although this amount can vary considerably), about the size of Manhattan. However, much less land than this would actually be cleared, leaving the remaining property for other uses, such as farming or ranching. On-site civil construction work at a wind farm is required to clear sites for pads, and develop roads to navigate the large land area. Heavy equipment is often used to move soil, facilitate drainage, and build temporary and permanent structures for the construction, operation, and maintenance of the wind farm.

Occupations related to on-site civil works include engineers, heavy equipment operators, trade workers and laborers, and managers. A 250-MW wind farm requires 273 workers.

Company Profile: Mortenson Construction



Mortenson Construction has deep roots in building wind farms. Founded by M.A. Mortenson, Sr. in 1954, the company branched into the renewable energy industry in 1995 and was among the first major construction firms to venture into renewable energy facility construction. As Jerry Grundtner, VP of project development for Mortenson Renewable Energy Division, explained, “We believed there was high potential for growth in what was then a very small market segment with few players in the industry.”

That growth has come to fruition, and today Mortenson employs more than 2,200 workers, including 350 in its renewable energy branch. To date, they have built, or are in the process of building, more than 125 wind projects. On those wind farms Mortenson has erected nearly 8,000 wind turbines, adding over 13,000 MW, enough to power nearly 50,000 homes. Beyond wind, Mortenson’s Renewable Energy Division also works on the construction of solar, emerging renewables, and high-voltage transmission and distribution facilities. While the majority of its projects are in U.S., the firm also works internationally in Canada and China.

Iowa has significantly benefitted from Mortenson’s work, and was the site of the company’s first wind farm. In March 2012, Mortenson began construction on the 103.5-MW Vienna Wind Project in Marshall and Tama counties. When the project is completed, Mortenson will have helped install more than 2,000 MW of wind power capacity in the state, or nearly half of Iowa’s total wind power capacity which provides almost 19 percent of its electricity.

Mortenson has 14 projects currently under construction, in Minnesota, Montana, Nevada, Oklahoma, Texas, and Iowa, among other states, helping to boost the economies of local communities. As Grundtner said, “A given project can generate millions of dollars to the local economy based on new job creation, and construction-related goods and services.”

Community Profiles: Oregon and Illinois



Sherman County, Oregon, has seen huge increases in revenues from local wind farms. Before the wind energy industry came to town, this rural community had few employment opportunities and a small tax base. Since installing a swath of power-producing wind turbines, the county has reaped impressive benefits, including increases in per capita income and the local tax base.

Residents of Livingston County, Illinois, tell a similar story of economic development. There, the wind industry has boosted the local tax base, created new jobs, and provided lease payments to local landowners. Wind developers in Livingston County also pay fees that are dedicated to spurring local economic development and helping the county’s small businesses.

These profiles are taken from NRDC’s report “At Wind Speed: How the U.S. Wind Industry is Rapidly Growing our Local Economies.” Read it online at <http://www.nrdc.org/energy/wind-powered-communities/>

WIND ENERGY DEVELOPMENT BENEFITS, SHERMAN COUNTY, OR

- Sherman County, Oregon: 1,735 residents
- \$17.5 million in property taxes and fees
- Annual payments of up to \$7,800 per turbine to landowners
- 500 on-site construction jobs
- 80 long-term jobs in operation
- Per capita income increases, from \$18,354 in 2001 to \$52,530 in 2011, to become the highest in the state
- Annual check of \$590 to all residents
- Increased economic activity helps keep small businesses alive
- \$1.8 million grant to school district in 2011 to fund new equipment, classes, and teachers
- Renewable energy technician training program at Columbia Gorge Community College

WIND ENERGY DEVELOPMENT BENEFITS, LIVINGSTON COUNTY, IL

- \$1.2 million in annual payments to landowners (\$8,000 per turbine)
- More than 400 jobs created in construction, 15 long-term jobs in operation
- 12 Illinois companies involved in supply chain
- \$6 million initial fee on wind farm, funds dedicated to spurring economic development in the rural region
- \$3.5 million in annual property taxes
- Increased funding for school district
- Two more large wind farms under construction in the county

202

TOTAL JOBS CREATED

ON-SITE MECHANICAL ASSEMBLY

Assembling all components, erecting towers, and installing nacelles and blades, typically with heavy equipment

Occupations include heavy equipment operators, engineers, trade technicians, inspectors, and clerical staff.

STEP 12



On-site mechanical assembly occurs when all of the components are gathered, towers are erected, and nacelles and blades are installed. This work is typically conducted with heavy equipment such as cranes and is the final mechanical piecing together of equipment. Upon its completion, each wind turbine is physically ready for operation, once all electrical connections are made.

On-site mechanical assembly is mostly conducted at height. Cranes and other supports are used to raise the towers. Technicians assemble each of the delivered components on each pad.

Occupations in this important, nearly final step of the construction process include heavy equipment operators, engineers, trade technicians, inspectors, and clerical staff. For a wind farm with approximately 125 2-MW turbines, on-site mechanical assembly adds 202 jobs.

Reed & Reed, Inc.

Based in Woolwich, Maine, Reed & Reed is a full-service heavy balance of plant (BOP) contractor that has been working in the renewable energy industry for nearly a decade. Reed & Reed’s on-site work includes erecting wind turbine generators. Beyond mechanical capabilities, the company performs civil, structural, and electrical work on wind farms; working to design, procure, and build roads, foundations, collectors, substations, and switchyards. While Reed & Reed got its start in 1928 building bridges, today, its diverse project portfolio, in addition to wind, includes marine terminals, industrial facilities, parking garages, and more.

VP of finance and development John Cooney traces Reed & Reed’s first interest in the wind industry to 2003, when the company began to look into wind farm projects in the early development stage. As Cooney says, “We knew the type of work matched well with our core competencies and resources.” So in 2005, during a lag in new bridge construction, Reed & Reed made the decision to enter the industry, and completed its first project, the 42-MW Mars Hill wind farm the following year. Today, Reed has completed 12 wind projects, in Maine, New Hampshire, Massachusetts, and Vermont, erecting more than 280 turbines to add 554 MW of new capacity to New England’s electrical grid.

Beyond employing over 200 people—130 of whom are currently in the middle of building three different wind projects in three different states—Reed & Reed also notices the economic benefits that its wind farms, representing over \$1 billion in investment capital, can have in remote areas. “These projects currently are the economic life blood of many rural communities ever since the paper industry has essentially left the state,” Cooney says. Since 2005, Reed & Reed’s wind farm work has generated over \$325 million in revenue for the company, transforming the company and many other Maine businesses in its supply chain.



Reed & Reed workers position a wind turbine tower.

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7	STEP 8	STEP 9	STEP 10	STEP 11	STEP 12	STEP 13	STEP 14
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47


TOTAL JOBS CREATED

ON-SITE ELECTRICAL WORK

Developing electrical network and connecting wind turbines to the substation and the electrical grid.

Occupations include engineers, electricians, trade workers, inspectors, and managers.

STEP 13



On-site electrical work is the final phase of the installation project, where the electrical connections are made, the electrical network is developed, and the wind turbines are connected to the substation and the electrical grid. Significant testing and inspection occurs in this phase as well. Typically, this work is conducted on the ground.

Occupations conducting on-site electrical work include engineers, electricians, trade workers, inspectors, and managers. A 250-MW wind farm requires the services of 47 workers to conduct on-site electrical work.

Company Profile: Vaughn Industries, LLC

Vaughn Industries, LLC is a turnkey electrical contractor, working on everything from high-voltage transmission and distribution line construction to substation construction, commercial and industrial electrical construction, HVAC and mechanical construction, communication and fiber optic installation, along with a metal fabrication shop onsite to assist project needs. Vaughn Industries also is a nationally recognized apprenticeship training facility.

Headquartered in Carey, Ohio, with a central office in Lewis Center, they have a growing presence in renewable energy. In addition to working on wind projects in Ohio, Vaughn has branched into the solar industry as well, completing work on a number of multi-megawatt solar projects in Ohio, North Carolina, and Maryland. “We saw six years ago that the wind market was going to be there,” describes Brian Tschanen, Division Manager at Vaughn Industries. “We’ve moved to work in that space, and are now exploring other opportunities in wind, like maintenance.”

Including tradespeople, Vaughn Industries employs more than 500 people, with 150 workers operating in the renewable energy sector. Their first wind project actually involved installing a wind turbine at their own headquarters, and they subsequently branched out to include utility-scale wind turbines on commercial farms in Ohio. They have recently begun plans for other wind projects in Maine, New Mexico, Indiana, and Ohio, but each is currently on hold due to industry uncertainty about the Production Tax Credit. While waiting for the wind industry to regain its footing, Vaughn Industries completed a 10-MW Wyandot solar project and a 9.8-MW Campbell’s Soup solar project in Ohio, and are currently working on three other solar projects, including a 3.3 MW project in North Carolina, a 6.6 MW project in Maryland, and a 2.2-MW project at Oberlin College.

According to Tschanen, “Working on wind projects, we try to spend as much money on that project locally, in the area. We’ve found that we can bring in funding to those communities, and help boost employment there. During a project, Vaughn has picked up a number of workers from these local communities.” Vaughn Industries is eager to pursue more work in the wind sector, but most of the wind work they are currently tracking is in Canada. “While we don’t foresee a lot of wind projects in the near term due to the PTC,” says Tschanen, “We absolutely will pursue more wind developments in the future.”

27


TOTAL JOBS CREATED

OPERATIONS AND MAINTENANCE

Ongoing operations and maintenance, including inspecting blades and turbines, routine maintenance, and overall management of energy production.

Occupations include technicians, engineers and professional staff

STEP 14



After construction is complete, wind farms require ongoing operations and maintenance. These activities include inspecting blades and turbines, assessing energy production, routine maintenance of systems, and overall management of energy production.

Operations and maintenance activities generally refer to the ongoing work once the wind farm has begun producing power. Though most performance data are monitored with technology, regular inspections and routine maintenance are necessary. With about 10,000 moving parts, there is no shortage of activities to ensure that wind turbines operate at peak performance.

Typical activities in “O&M” are oil changes, blade inspections, torque and bolt checks, seal inspections, and vibration analysis. In addition to these routine checks, O&M workers troubleshoot and repair damaged components. Because damaged parts can prevent the generation of power, speed and proximity are both important to this work.

The occupations related to operations and maintenance vary from technicians to engineers. Like many of the other segments, professional staff, such as accountants, attorneys, and managers, also contribute significant work hours to the operation of the wind farm.

At a 250-MW wind farm, the average firm would employ approximately 27 workers to manage and maintain the facility.

Company Profile: WindGuard North America



In the summer of 2010, Deutsche WindGuard, an elite German wind engineering firm, opened its North American operations in Springfield, Virginia. And in two short years, WindGuard North America, Inc. has made waves in the industry, adding prominent American energy companies to its list of clients.

WindGuard advises developers on wind farm locations, verifies turbine power curve measurements, and performs rigorous technical inspections. The company also provides anemometer calibration services—services that measure wind resources to ensure they are stable and predictable—to wind assessment groups and original equipment manufacturers (OEM), rounding out its engineering services toolbox with five state-of-the-art, wind tunnels.

Helping the American wind industry is only part of what WindGuard North America does. At upcoming public seminars and information sessions, the company will advocate for diversifying America’s domestic energy supply. Education is “key to advancing the public support for alternative energies,” says Martin Schmidt-Bremer Jr., WindGuard North America’s Chief Operating Officer, in an interview with NRDC.²⁷

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CONCLUSION: WIND ENERGY WORKS FOR AMERICA

Wind farms of this size and impact have already been built throughout the United States. There are about 120 large-scale wind farms located across the country (including 25 wind projects larger than 250 megawatts and 94 additional utility-scale wind projects between 150 and 250 megawatts). Across America, the benefits of wind energy can reach companies, workers, and communities—provided we build on the growth of the past few years.

However, to do so, the American wind industry (and other renewable energy sectors) needs long-term, stable federal and state energy policies. With the right policies in place, the renewable energy industry can deliver cheaper, more advanced clean energy technologies that grow our economy, clean up on our air and water, and position America strongly as a leader in the global clean energy industry. One first order of business should be for Congress to extend the Production Tax Credit. Set to expire at the end of this year, the PTC has played a significant role in growing our American wind industry. Letting it expire would hurt the progress we have made in expanding clean, renewable wind power and put American companies and as many as 37,000 workers at risk.²⁸ (For other recommendations from NRDC, see NRDC Policy Recommendations on page 31).

CREATING JOBS ACROSS AMERICA

Ultimately, while the rapidly spinning turbines of a wind farm are a powerful demonstration of American can-do spirit and ingenuity, wind energy represents much more than that. As the companies profiled in this report show, creating wind energy builds an entire supply chain of innovative American firms, investors, and entrepreneurs. Along the way, American workers can take part in every aspect of this new value chain: scientists measuring wind, farmers leasing their land, engineers laying out wind farms, steelworkers building towers, construction workers assembling components, electricians connecting turbines to the grid, and many other jobs that are difficult or impossible to outsource. And in wind-energy-connected communities throughout the country, residents can see royalty checks and leasing revenue, local elected officials can use the increased tax revenue for economic development and school improvements, and local job seekers have more options for work.

This country has made powerful strides in the past few years to take advantage of natural, clean, homegrown, renewable energy resources like wind and solar power. It is vital that our government help maintain this momentum. We cannot let this opportunity go to waste.



NRDC POLICY RECOMMENDATIONS: STRENGTHENING ENERGY POLICIES TO TAKE ADVANTAGE OF AMERICAN WIND POWER

NRDC proposes the following policy recommendations to support U.S. renewable power technologies, such as wind, solar, and geothermal energy.

The inclusion of any company within this document is not a statement of support by those companies for any of the opinions or recommendation contained herein.

IMMEDIATE NEEDS

Extend the Production Tax Credit (PTC) to Bring Down Costs and Drive Innovation

For half a century, the federal government has been playing favorites in the energy industry, providing hundreds of billions of dollars in subsidies to nuclear, natural gas, petroleum, and coal technologies. We need to transition away from these dirty energy technologies and instead support a clean energy future. Incentives like the Production Tax Credit help provide a tax credit to wind projects for the clean, renewable power they generate, helping them compete on an unlevel playing field, and allowing our energy sector to develop other clean energy options. The PTC has encouraged innovation and better wind technologies that have led to a 90 percent reduction in the cost of wind power since 1980 and helped propel the strong recent growth in the wind energy sector. Unfortunately, this tax incentive is scheduled to expire at the end of 2012, which would pull the rug out from under domestic wind businesses and cut 37,000 American wind energy jobs.²⁹ An extension of the PTC is crucial to ensuring that workers, companies, and communities can continue to reap the benefits of wind energy.

Use Master Limited Partnerships (MLPs) and Other Policies to Promote Clean Energy Investment

A critical element for building more wind projects is access to low-cost capital that developers need to clear the land, purchase turbines and other equipment, assemble the components, and many other development activities. While more than \$15 billion a year was privately invested in wind farms over the last five years,³⁰ locating financing can still be a challenge. One policy option that could streamline the process by which capital is provided to wind projects, and therefore promote investment, is a Master Limited Partnership (MLP) structure. This financing tool allows companies to reach smaller private investors, who can participate in wind projects through the capital markets. MLPs are already accessible to oil and gas pipelines, and opening them to wind energy is a simple, easy process. Other longer-term financing policy options include loan guarantees that can bring down the cost of debt, and open up new financing alternatives for harder-to-finance projects, or larger financing entities that can be created at the state or federal level.

NEAR-TERM

Set Standards to Further Increase Demand for Renewable Energy

Additionally, other policies can provide stable demand in the long run through market-driven means that further bring down costs and promote innovation. One important policy, in addition to the PTC, is a well-crafted national standard to promote renewable energy like a Renewable Energy Standard (RES) or a Clean Energy Standard (CES) that will create stable market-driven demand, in conjunction with other air pollution legislation. An RES would require that a specified portion of electricity delivered by utilities be generated from renewable energy resources, while a CES would include a broader range of energy resources. In either case, the goal should be to maximize the deployment of clean, renewable energy, while reducing harmful pollution. At present, state Renewable Energy Standards exist in 31 states and have helped cost-effectively boost wind and other renewable energy generation around the country.³¹ Texas, Iowa and Illinois are leaders in wind generation partly due to strong Renewable Energy Standards. While working to pass a federal energy standard with strong environmental guidelines, we should continue to maintain and strengthen existing state energy standards.

Establish Carbon Standards That Level the Playing Field for Renewables

The health and environmental costs of pollution (such as asthma, heart disease, and climate disruption) are not borne by the polluter, nor do they have a price attached to them by the market. A combination of sector-based performance standards and an economy-wide program to cut carbon pollution will reduce this inequity and align with the concept that “the polluter pays.” Funds from a market-based program could be used to help finance the transition to an American clean energy economy.

Facilitate Construction of Well-Sited Transmission Lines

An expansion and modernization plan for the power grid will ensure that wind and other renewable power successfully makes it to the markets that can use it. Policies and regulations can promote the build-out of transmission lines and technologies and protocols that integrate variable wind generation with existing baseload power. These options include timely and reasonably priced transmission planning and cost allocation that will take place through Order 1000 issued by the Federal Energy Regulatory Commission (FERC), as well as operating approaches on the state and regional level to integrate new generation into the electric system and to mitigate the environmental footprint of the overall industry as it grows. Achieving the most cost-effective deployment for renewable energy resources will require building new transmission and distribution infrastructure to access the highest quality resources. Policies to facilitate the planning and siting of high-priority transmission infrastructure and to ensure that costs for interstate lines are allocated broadly to all beneficiaries will help ensure that renewable energy deployment is not constrained behind a bottleneck of grid congestion.

Site Wind Energy to Mitigate Environmental Impacts

A comprehensive programmatic framework for wind energy development on public lands as well as consistent policies to adequately address the range of issues associated with safeguarding wildlife and natural resources can ensure greater certainty for renewable investment. NRDC believes in a smart from the start approach to siting by guiding development to appropriate places—areas with good renewable resources, proximity to existing roads and transmission lines, previously disturbed lands when available, and limited conflicts with important wildlife habitat, wildlands, and other resources and values. Wind project and transmission lines that transport their electricity must be sited and built responsibly to limit harm to sensitive wildlife, wildlands, and cultural resources, while also minimizing conflict that can hinder the deployment of these projects.

"THESE PROJECTS CURRENTLY ARE THE ECONOMIC LIFE BLOOD OF MANY RURAL COMMUNITIES."

John Cooney
VP of Finance and Development,
Reed & Reed



METHODOLOGY

The Natural Resources Defense Council (NRDC) commissioned BW Research Partnership to conduct an analysis of the employment impacts of a newly planned, hypothetical, 250-megawatt (MW) wind farm in the United States, using 125 domestically produced, 2-MW wind turbines. This overall employment analysis is differentiated between each step of development process and includes construction and non-construction jobs.

Additionally, this report identifies American companies that could participate at every one of the 14 steps of the wind farm. A select number of these companies are profiled at the step of wind farm development with which they are primarily associated. No endorsement of these businesses by NRDC is implied by inclusion in this report.

To overcome corporate concerns about releasing proprietary information for specific supply chains, we have used comprehensive analysis and multiple surveys of the U.S. wind industry to develop the full value chain for an illustrative 250-MW wind farm that could be located in any state that has wind resources.

To accurately ascertain the employment impacts of such a wind farm, 137 firms were contacted regarding their labor market intensities. Following an outline of activities developed by the National Renewable Energy Laboratory, this analysis focuses on 14 distinct segments of the value chain.

Companies were asked which of the fourteen categories of building a wind farm (site prep to component manufacturing to on-site construction, etc.), and were then asked to ascertain total jobs created if firms were hired to contribute goods and services for a newly planned 100 MW wind farm, total labor hours associated with the work required to contribute goods and services for a newly planned, 100MW wind farm; (and for manufacturers only) how many labor hours are associated with the manufacture of a standard (2.0 MW) wind turbine.

Only U.S. firms were surveyed for the purposes of this study. Labor market intensities may be different in other nations.

Sample sizes within each category are small but responses were highly clustered, meaning that employers’ responses within each category did not deviate significantly from the means. This suggests higher confidence in the data. BW Research calculated the average responses to specific questions (conducting outlier analyses as required) to understand a range of employment impacts for each segment of the value chain.

For manufacturing firms, this report uses a combined mean to calculate the overall impacts of manufacturing firms to capture supportive employment in addition to the labor hours connected to the assembly of products. Finally, the analysis uses NREL’s JEDI wind model to extrapolate from a 100-MW wind farm to a 250-MW wind farm, using a factor of 2.02. NREL’s JEDI wind model calculates 2.02 times more jobs for a 250 MW wind farm than a 100 MW wind farm. This report is a summary of the employment impacts of a domestically sourced, 250-MW wind farm in the United States.

This report does not involve an existing project, but rather an “illustrative” project developed through interviews with 137 companies, literature reviews, and analysis of existing data. The companies featured in this report are simply examples of the type of companies that would work on any similarly sized wind project.

We chose a 250-MW project to illustrate the level of economic development and jobs that could come from deployment of a large, utility-scale wind farm. This scale of project would provide enough electricity to power over 75,000 homes. A large number of wind farms of varying sizes (from a few megawatts to many hundreds) are in various stages of development at all times, with various project databases calculate tens of thousands of megawatts of potential wind power in project development.

Ultimately, the full development of a clean energy economy will require a broad portfolio of renewable energy and efficiency options. Utility-scale wind projects of this size are one component of that portfolio.

Finally, this analysis is not intended to provide a proxy for current U.S. wind industry employment. Neither can it be extrapolated to determine total U.S. wind industry employment, especially indirect or induced jobs. This study focuses solely on the benefits of one individual wind farm. Different industry wide job survey analysis is necessary to understand and quantify the economic benefits of the industry as a whole. By only focusing on one wind farm, this study undercounts total wind employment – many U.S. wind companies export goods and services to other countries which create more employment. The wind industry also employs many workers that are not directly related to wind farms and so not included in our methodology, such as workers in education and training, the utility sector, transmission, government and outreach roles.

METHODOLOGY, CONTINUED

Additionally, our figures may potentially be more conservative, particularly in manufacturing, because we focused on the major contributors to a wind farm and may not have captured every component manufacturer through the value chain. For example, there are no jobs from aluminum smelting and refining or steelworks in our study. As a result, we could be undercounting some manufacturing jobs for certain sub-components or raw materials. Manufacturing firms run the gamut on size and breadth. Some firms produce nearly all components and others are highly specialized. Within each of these types, there are various labor efficiencies. This study takes a fairly conservative approach in quantifying labor impacts to prevent over- or double-counting.

ENDNOTES

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