In Forward Thinking Mode

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Answers for energy.

SIEMENS

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By Jan Kjaersgaard

SIEMENS, DRIVEN BY ITS COMMITMENT TO SUSTAINABILITY, DECIDED TO GAUGE WHICH WAY THE WIND BLOWS. IN THE PROCESS, IT PERCEIVED ENVIRONMENTAL CONCERNS AND ESTABLISHED ITSELF AS A WIND-POWER LEADER.

AS WORLDWIDE ENERGY CON- sumption grows and resources become scarce, climate change increasingly threatens our environment. Renewable energy sources are a key component for building up a sustainable and environmentally friendly energy sector. By 2030, roughly 17 percent of the global power generation is expected to come from renewable energy sources, and approximately half of that will come from wind power. Among renewables, wind power is by far one of the most important energy sources.

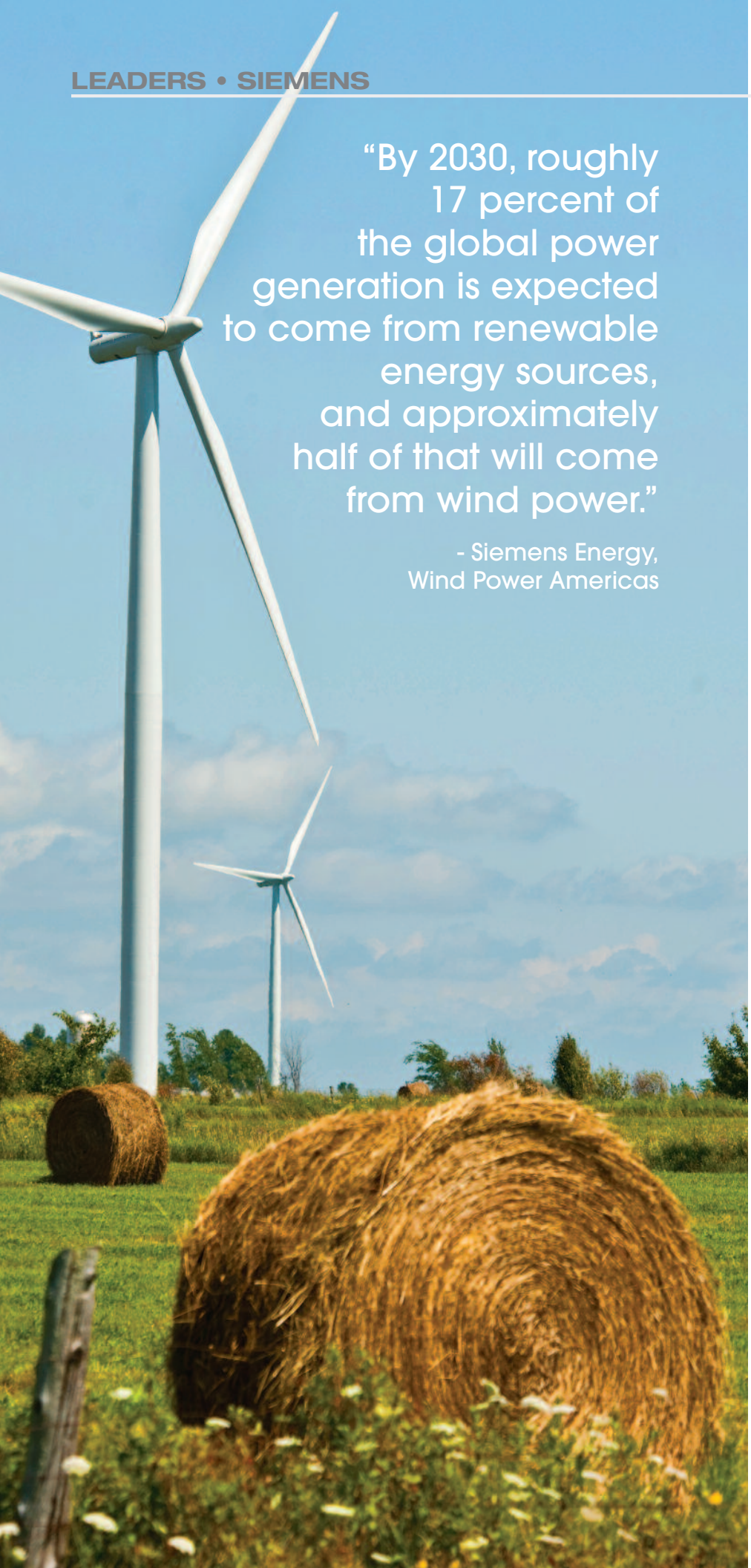
As a result of these megatrends, the wind power industry has experienced rapid growth. According to the Global Wind Energy Council, global annual installed wind capacity has grown from 3,400 MW in 1999 to 37,466 MW in 2009. In 2009, Asia represented the largest installed annual capacity by region, followed by North America and Europe ranking nearly equal with each other. In particular, the United States represented 22 percent of the total cumulative, global installed wind power capacity, Canada 2 percent and all of Latin America at less than 1 percent. As renewable energy continues to be a viable option for energy production, Siemens Energy is poised for growth.

In the United States, the increase in wind power and other renewable energy sources are being driven by government incentives and state requirements. Developers are fast emerging on the scene to engage in wind farm development, either to own and operate for the long run, or to sell for profit in the short run. The regulatory environment has been favorable with the enactment of the American Recovery and Reinvestment Act (ARRA) of 2009. Intended to provide stimulus to the American economy in the tides of a recession, the act included provisions for the energy industry. Some of the incentives of the ARRA include an Investment Tax Credit (ITC), Production Tax Credit (PTC) and the U.S. Treasury Cash Grant, unofficially termed "the cash grant." This grant has proven to be a strong short-term incentive and is clearly a market driver for the wind power industry in the United States. Essentially, the U.S. government provides 30 percent reimbursement of qualified costs after the application, or after the project is placed into service, whichever is later. Other ARRA provisions include loan guarantees offered by the Department of Energy and Clean Renewable Energy Bonds to facilitate the financing of projects.

Utilities are facing State's Renewables Portfolio Standards (RPS), legislation requiring that a minimum amount of renewable energy be included in the generation portfolio of electricity resources. Electricity generators need to develop renewable energy projects or purchase renewable energy credits in order to comply with the requirements. Presently,

Strategic Acquisition

In December 2004, Siemens Energy acquired Bonus Energy. Siemens strategically entered the wind power market because of the anticipated exponential growth projections. Bonus was the ideal partner for Siemens, as it held a high reputation for quality and reliability. Siemens' global strength in energy solutions, its market force and vast footprint proved to be a perfect match for fast growth.



"By 2030, roughly 17 percent of the global power generation is expected to come from renewable energy sources, and approximately half of that will come from wind power."

- Siemens Energy, Wind Power Americas

more than 30 states hold RPS policies. According to the U.S. Department of Energy-Energy Efficiency and Renewable Energy, together these states account for well over half of the electricity sales in the United States. Sources that are counted as renewable energy include wind, solar, biomass and geothermal energy, all of which impact the energy industry. A robust national Renewable Energy Standard (RES) should be considered to support longer-term continued action.

International incentive programs are in place, too, as projections for growth in the Americas continues to rise. The Ontario Power Authority has implemented its Feed-in-Tariff and Eco-Energy Credit programs and is instituting its regulations for 50 percent in-country local content. Latin America is expected to grow in the longer term. In particular, European utilities and developers are looking at northeast and southern regions of Brazil for investment opportunities. Recently, Brazil conducted its first wind-only auction where approximately 1.8 GW of wind projects were awarded power purchase agreements. EER reports that Mexico's wind energy market is rallying for growth and offers tremendous wind resources in the areas of Oaxaca and the Baja Peninsula. Chile's growth projections are positive for wind farm development over the next decade, driven by mining companies and a renewable standard portfolio-type requirement. Siemens continuously forecasts in key markets, and is positioned with in-country support to meet the development requirements for these regions.

The Siemens commercially available product portfolio includes 2.3 and 3.6-MW turbines. Offering the SWT-2.3-82VS, SWT-2.3-93, SWT-2.3-101, SWT-3.6-107 and SWT-3.6-120 models, these wind turbines are designed for onshore and offshore application with specific design requirements for various wind speeds and turbulence. Some of the major components include the tower, blades, nacelle and transformer. In December 2009, Siemens announced its first prototype of a newly designed, direct-drive wind turbine installed near Brande on the Jutland peninsula in west Denmark. The new SWT-3.0-101 direct-drive turbine is designed for greater reliability and competitiveness over conventionally geared wind turbines. Eliminating gearboxes reduces further complexity, and as such, provides improved technological performance. Lower generator loss is expected with the utilization of a permanent

Wind Power Pioneer

Henrik Stiesdal, chief technology officer for Siemens Wind Power, is acknowledged as one of the leading founders of modern-day wind turbine technology. As a leading pioneer, he holds 74 inventions and 85 granted patents. Most importantly to Siemens, Stiesdal is intimately engaged in the evolution of Siemens' wind power products and drives the company's excellence in technology development. In foreword mode, Siemens Wind Power now ranks in market share ninth in the world and third in the U.S. region. The company has fast-tracked with more than 50 percent annual growth in sales for the last four years, and it is advancing toward the global goal of ranking as a top-three wind turbine provider by 2012. In 2004, the company employed some 800 people; employment rose to 5,800 in 2010. The global headquarters for Siemens Wind Power is located in Brande, Denmark, while the Americas regional headquarters is located in Orlando, Florida. As a leading, global supplier of wind turbine equipment and services, Siemens Wind Power has installed more than 8,500 turbines worldwide for both onshore and offshore applications.

magnet design. Key to the direct-drive unit is the 50 percent reduction in parts within the overall engineering design. With a higher power rating, the overall machine is lighter in weight when compared with today's design of a 2.3-MW wind turbine.

Advancements in Siemens technology include the IntegralBlade®, a patented process that allows for wind turbine blades to be manufactured in one piece using a closed process.

Other innovations in technology include the TCM® Turbine Condition Monitoring system. Since wind farms are located in rather remote areas with unmanned power generating units, reliable remote monitoring is critical. Siemens' TCM conducts precise online vibration measurement and provides real-time condition status. Critical to technical understanding, Siemens has many years of experience and holds a bank of global information based on comparative data between measured vibration and reference masks. The system is currently operating in thousands of wind turbines worldwide. Breakthrough development has lead to the offering of the Siemens Turbine Load Control (TLC) system – a dynamic load control that allows operation of the wind turbine under conditions when it would otherwise have been curtailed, in order to prevent overloading to the entire system. TLC positively impacts annual energy production for developers and owners, unlike other load reduction techniques that were previously offered in the industry.

On the manufacturing front, Siemens Wind Power has announced its new nacelle assembly facility located in Hutchinson, Kan. In anticipation of market growth, Siemens evaluated various locations around the U.S. and strategically determined Reno County. This plant will utilize state-of-the-art lean manufacturing-based processes as it begins to roll out and transport nacelles in late 2010. Already in the Denmark-based plant, the process has managed to reduce the throughput time from 36 to 19 hours for final assembly of every nacelle produced, and the number of workstations from 18 to eight. Some 400 jobs are expected for the welcoming community in Kansas.

As a leading global supplier of wind turbine equipment and services, Siemens seeks ways to lower the cost of wind-generated electricity. Centered in Boulder, Colo. is the Siemens Wind Power Research and Development Center. The company is focusing on technology and innovation to improve aerodynamics and reduced loads with smarter control systems. A team of

researchers is actively looking at ways to increase energy production and improve weather prediction. Siemens and the National Renewable Energy Lab (NREL) entered into a Department of Energy Cooperative Research and Development Agreement to pilot the SWT-2.3-101 turbine, testing for basic wind characteristics, new performance-enhancing features and turbine reliability under severe weather conditions. With $9 million R&D investment over three years, this is the largest wind turbine test program undertaken by a U.S. government and industry collaboration in history. In addition, Siemens entered into a partnership with Lawrence Livermore National Labora-tory to conduct research on wind farm output prediction modeling.

As wind farm development continues to grow so will the need for qualified field service engineers and technicians. Technical service certification and engineering expertise is essential, so educational institutions should monitor the industry's growth, as the need for qualified employees will continue to rise. Public education also plays a key role in the benefits to communities at large, as developers work to bring wind farms to areas with good wind resources.

The Siemens Energy Sector, Renewable Energy Division focuses on wind, solar and hydropower. As part of a comprehensive portfolio, Siemens Energy offers a complete and diverse mix of energy solutions from primary energy generation to full power distribution. Its footprint includes innovative technologies for oil and gas, power generation, transmission and distribution, and renewables. It supplies answers for the utmost in efficiency and productivity along the entire conversion chain.

As the wind continues to blow, Siemens Energy is committed to protecting our environment. Sustainability means acting responsibly to achieve economic, environmental and social progress – cornerstones of its corporate values. In true forward thinking mode, Siemens is deeply committed to sustainability and is spearheading innovation and providing reliability for the future. ●

Jan Kjaersgaard is vice president and general manager, Siemens Energy, Wind Power Americas. Siemens Energy is the world's leading supplier of a complete spectrum of products, services and solutions for the generation, transmission and distribution of power and for the extraction, conversion and transport of oil and gas. In fiscal 2009, revenue from Siemens' Environmental Portfolio totaled approximately EUR23 billion, making Siemens the world's largest supplier of environmentally friendly technologies. Visit www.siemens.com/energy.

Pictured above: IntegralBlade® being transported on a train;
below: rendering of Siemens Wind Power's new nacelle assembly facility located in Hutchinson, Kan.

How Does a Wind Turbine Work?

When the wind strikes the blades and they begin to rotate, the rotor shaft begins to turn. A gearbox located inside the nacelle converts the shaft speed to an accelerated rotation, approximately 1,500 revolutions per minute (RPM). An output shaft transfers the rotational movement to a generator, which is then converted to electricity. Through a series of cables, the electricity flows down the tower to a transformer unit where the voltage is increased and the power is distributed. The collective energy from the wind farm is transmitted to the local utility via electric power lines.

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