Embracing the future of wind manufacturing

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Throughout Europe, the requirement for larger capacity wind farms is growing dramatically. Total consumer energy demand has risen, and political commitment from governments is accelerating the transition toward renewable energy across the continent.

To highlight some of these commitments across Europe, Germany has vowed to increase the proportion of renewable energy in total electricity consumption to 65 per cent by 2030. Denmark has committed to reduce 70% of CO_2 emissions by 2030, compared to 1990, and to produce electricity solely from renewable energy by 2028. Oil and gas extraction will end completely by 2050.

Wind manufacturers have begun to build significantly larger turbines than ever before to meet this demand. This year will see Vestas erect an incredibly impressive prototype, a 15-megawatt (MW) wind turbine that once operational will be powerful enough to provide electricity to roughly 13,000 British homes.

Siemens Gamesa has plans to install a prototype of a 14MW offshore turbine that can be boosted to supply 15MW and have suggested that a single turn of this 14MW turbine would power a Tesla Model 3 for 218 miles.

Building taller, more powerful turbines presents significant challenges throughout the value stream. With every additional MW of power output, the machining, assembly, lifting, transportation, and installation of these behemoth turbines become an order of magnitude more challenging to accomplish safely.

Facing the future: orbital milling of larger turbine blades

Safely constructing wind towers would not be possible without a critical step in the turbine blade manufacturing process: orbital milling.

When wind turbine rotor blades are manufactured, the mould can create small, half joint steps on the surface where the blade is connected to the generator. When bolting the two together during tower construction, joint integrity depends on achieving a flatness tolerance to make a secure connection. Otherwise, the rotor blade could vibrate and affect performance, or, in a worst-case scenario, the blade's constructed integrity could be impaired.

The recent breakthroughs that finally allow turbines to produce power in the range of 14-15MW have increased these challenges, and blades of more than 5m wide will become increasingly common.

Often, the engineering team behind the rotor blade will set the flatness tolerance in conjunction with the generator manufacturer. The team will then work with vendors like Enerpac to help them achieve the accuracy needed.

Because of this size, many wind turbine manufacturers have found these tolerances challenging to achieve with existing tools. But thanks to new technology, Enerpac has developed its latest orbital milling machines, and the job can now be completed quickly, safely, and accurately.

Orbital milling machines are designed to deliver fast material removal and achieve high accuracy across large flange diameters. The machines use a rotating table. They are affixed to the end of the rotor blade and hooked up to a hydraulic power pack with hoses. The combined orbital milling machine and the hydraulic base are set within the commissioning period to achieve the specified machining tolerances. The combined assembly will repeat and reach the required tolerances blade after the blade; the process for an average size rotor blade takes just 30 minutes.

In addition to speed, orbital milling machines also improve health and safety because the debris produced can be better controlled. Compared to a grinding head that generates a lot of dust and other hot material moving at a fast velocity, a milling machine creates metal chips that can be contained with an optional vacuum system. Additionally, the rigid, independent bases on orbital milling machines provide ultimate safety, ensuring maximum performance each and every time they are used.

Another benefit is manoeuvrability. The large size of turbine blades makes them hard to move around a factory. Rather than depending on the facility crane to bring the rotor blades to a machine to be worked on one by one, an orbital milling machine can be moved around the factory to each rotor blade. Some units come equipped with an installation trolley that holds the machine along with the hydraulic power pack and optional vacuum, giving workers greater flexibility to move from blade to blade throughout the manufacturing plant.

Today's orbital milling machines are both simple and easy to use. Traditionally, an operator would rely mainly on their instinct,

listening and feeling for vibration to gauge progress. Orbital Milling Machines from Enerpac deliver fast material removal and precision flatness tolerances across large diameters. The two types within the Enerpac range are OM-Series Orbital Milling Machines and WP-Series Orbital Milling Machines.

Enerpac WP-Series Orbital Milling machines are currently working on producing turbine blades that are 5.5 meters in diameter at the root end. Right now, these Enerpac machines are quickly and precisely machining enormous blades, impressing operators with their capabilities, and already beginning to carve out an impeccable track record.

Development is already underway on the next generation of WP-Series Orbital Milling machines with advanced features such as data logging, clash detection and Integrated hydraulic power units. Such information-based machines can provide early warnings, like notifying the operator when the cutters wear or alerting them if there is any movement that is unacceptable.

Moving to address the challenges

The logistical implications of moving and handling these much larger turbine blades around the production floor have also become much more complex. On many production sites, traditional and historic solutions may have outlived their usefulness. Factor in the transition from the manufacturing space to the installation site, and it's clear tools and machinery should perform in a way that is flexible enough to be used seamlessly in all areas of production, assembly, and transportation.

For example, the Enerpac Self-Locking Cube Jack (SCJ-Series) is an incremental lifting system with automated mechanical locking. The compact size and portability of Self-Locking Cube Jacks with steel cribbing blocks

offer a powerful solution for numerous lifting applications, such as blade positioning or for vehicle loading and unloading.

Besides lifting, moving heavy wind turbine components horizontally across the production floor can also be challenging. Enerpac has solutions in this area, too. A low-height skidding system will jack up and slide heavy loads over a pre-constructed track, fitting into tight spaces while still offering a high load capacity to carry significant wind components.

If more precise control is needed, Electric Trolly Systems like the ETR-Series provide an alternative method over traditional skidding practices and increased benefits. Handheld wireless control systems mean load movements are more stable due to the continuous movement, controlled travel speed and acceleration/deceleration.

Increased capacity hydraulic gantries are another safe, efficient way to lift and position heavy wind components where traditional cranes will not fit, and permanent overhead structures for job cranes are not an option. When used with rail systems, hydraulic gantries like this also provide a greater capacity for moving and placing heavy loads. Hydraulic gantries are a cost-effective solution for many lifting and rigging applications.

Enerpac hydraulic gantries have several unique features to ensure optimum stability and safety: self-contained hydraulics and electrics, self-propelled wheels or tank rollers, and the Intelli-Lift wireless control system. Intelli-Lift provides the operator with information about the stroke, lift and load per unit, and it automatically corrects any unsynchronised motion of the individual units.

With lifting and horizontal displacement taken care of, wind manufacturers are left with one final piece of the puzzle. Rotation. Hydraulic turntables provide the safest solution for rotating heavy loads during, before or after a lifting and skidding operation.

Linking all of these elements together make load handling in the most demanding manufacturing situations simple, safe and efficient.

Get equipped to embrace the future of wind manufacturing

Few people would argue the role wind energy plays in making the world a better place. Yet, few outside of the industry understand the complexity involved in transporting and installing productive, cost-efficient, safe, and reliable wind turbines worldwide.

Enerpac is supporting the wind industry by providing the tools and solutions to meet today's demands and conquer tomorrow's challenges. Enerpac is encouraging OEMs to continue their investment in trusted, high-quality equipment today to ensure they are ready to build towards a more sustainable future.

If you would like to learn more or have a discussion on how we can work together and 'embrace the future of wind', please get in touch with us at:

www.enerpac.com/en-gb/wind or
www.enerpac.com/en-gb/e/contact