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Wind energy on the go

The focus this month is on transport, as MARCO VAN DAAL continues his series of articles on wind energy

When on steep hills or mountainous roads, blade adapters can be used to change the position of the rotor blade

A series of articles about wind energy and wind turbine components would be incomplete without addressing the transport aspects. Before lifting the wind generator components; the nacelle, the hub, the various tower sections and the blades, they all have to be transported to the jobsite.

As the wind generator components are becoming bigger, the challenges for the transport contractor are also becoming bigger. Blades used to be between 18 and 24 metres long and could be transported on extendible trailers. Now, however, blades can be up to 80 m long and require some serious engineering and logistics involvement. The Vestas V164, for example, is an 8 MW wind generator with 80 m long blades. Not all blades, however, are this long and some can even be transported in pairs.

When the blades become too long to be transported from origin to destination, or the surrounding infrastructure simply does not allow for such a long load, alternative transport methods are available. Various hydraulic platform trailer manufacturers have developed a wind blade adapter. Rather than placing the blade flat on a trailer, the blade is now fitted into an adapter, similar to the way the blade is fitted on to the hub during erection.

During transportation, the blade can be kept horizontal as if it were transported on an extendible trailer. When corners are getting tight or obstructions are in the way, the blade can be tilted up some 25 degrees. This allows the tip of the blade, or the tail swing of the transport combination, to move over street furniture, or trees, or buildings.

When an adapter is placed at the end of a transporter, it is possible that a counterweight is required to warrant transporter stability. This, however, depends on the weight and centre of gravity (CoG) of the individual blade.

Transporting towers

The challenge with transporting tower sections is twofold. They are long, although generally not as long as the blades and, for the tall towers, the diameter (read height) can become an issue during transport. Diameters of 4.5 to 6.5 m are not uncommon and with the height of the trailer or transporter the overall transport height reaches close to 7.5 or 8 m. This can become problematic when transporting on the public road.

Fortunately, manufacturers recognised the opportunity and need for specialized equipment to transport tower sections. Tower sections vary in diameter depending on the height of the entire tower. In addition, each section tapers, meaning that the diameter on each end is different. The >

Figure 1b

Figure 1a

ABOUT THE AUTHOR

Marco van Daal has been in the heavy lift and transport industry since 1993. He started at Mammoet Transport from the Netherlands and later with Fagioli PSC from Italy, both leading companies in the industry. His 20-year plus experience extends to five continents and more than 55 countries. It resulted in a book *The Art of Heavy Transport*, available at: www.khl-infostore.com/books Van Daal has a real passion for sharing knowledge and experience and holds seminars around the world.

tower adapter can cope with all of these variables, and more. Transporting a tower section with a tower adapter is similar to transporting with turntables or bolsters. The front and rear transporter can pivot under the adapter support point. The tower adapter allows the tower to be kept close to the ground as it hangs in between the front and rear transporter; this reduces the overall transport height to the largest tower diameter plus the bolted rim of the adapter. The tower section can also be raised; the tower adapter allows pivoting of the adapter arms by means of a hydraulic cylinder. See Figures 1a and 1b.

The tower adapters come with two more advantages. First, no crane is required for the loading of the tower section. When they are properly laid out the truck with adapter can simply back-up against the tower section and the securing by means of bolted connection and, or, hydraulic clamping can be done. Secondly, once the tower section is delivered to site, the front and rear adapter can be connected and returned to the loading facility as one transport combination. There is no need for a second truck to return the rear transporter. See Figure 2.


Figure 2

Overcoming issues

Nacelles, specially the bigger ones, have three drawbacks. They are oversized, heavy and awkward shapes. The oversize aspect can create a situation where, when the nacelle is positioned on a trailer, the overall height becomes too much for the route. Similar to the tower sections, the solution is to hang the nacelle between a front and rear transporter and keep it as close to the ground as possible. The awkward shape of the nacelle, which is different for each manufacturer and often for each model, makes a nacelle adapter a tricky design.

This is worked out between the manufacturer of the nacelle and of the transporters by a template design that fits on the one side to the tower adapter and on the other side fits the nacelle. The adapters are designed for a certain maximum weight and, as the tower sections are generally lighter in weight than the nacelle, not all nacelles can be transported in this manner. See Figure 3. In addition, a crane is unnecessary for loading the nacelle and both transporters can be pulled back to the loading facility by one truck.

The transport starting point is often similar to other heavy and oversized cargo and is usually a port facility or a factory. At some point, the transport leaves the public road and continues on a temporary road that is solely constructed for the purpose of mobilising the wind generator components and for the crane to lift the components. A well compacted dirt road may be just fine for the job but it is important to understand what forces are imposed on these roads.

Transport equipment manufacturers have designed some clever adapters and features as described above to aid project execution. Crane manufacturers have also come up with new solutions. We all know that crawler cranes are a common sight on wind turbine erection jobs due to the ease of moving them from one lift pad to the next while (nearly) fully assembled. One of the drawbacks of crawler cranes is the wide tracks; 12 to 15 m is common for the large capacity crawler machines used for wind turbine jobs. As a result, the approach road to the lift pad needs to be this wide as well. Knowing that the transport of the wind generator components often requires less than half of this width it becomes apparent that a narrow gauge track crane would be cost effective for the civil works. See Figure 4.

One can imagine, however, that when a crane's stability base is reduced from 12 to 6 m, the stability of the crane becomes questionable. For this reason, when transporting a crane in narrow gauge track configuration, outriggers are used to guarantee the crane's stability.

These outriggers, however, are off the ground or only slightly touching the ground. They bear no load during the transport unless the crane starts leaning. Leaning can occur due to an uneven or out of level road surface, slight settlement on one side of the road and weather conditions such as rain, wind etc. This is an unwanted situation as leaning will have to be countered by 'pushing' the crane back using the outrigger stroke.

Secondly, when the crane starts leaning, the pressure underneath the track on the side of the lean rapidly reaches extreme values and it can easily take 70 to 80 % of the total weight of the crane. As a result, the road needs to be able to withstand these pressures and should not cave in or sink.

When this happens the outrigger will not be of much help. It can push the crane back but a void will appear under the track. Narrow gauge track cranes are cost-effective and useful, as long as they are used with caution. ■


Figure 3


Figure 4