

The transport game

How does a wind turbine get from the factory to the project site? Vestas' dedicated logistics staff battle hurricanes, snowstorms and simple old-fashioned bureaucracy to deliver orders on time.

"2005 was a busy year, that's for sure!" says Transport Coordinator Maibritt Kjeldgaard. "Busy" is possibly an understatement, given that she and her colleague Louise Schmidt Nielsen looked after 600,000 cubic metres of freight last year, in the form of more than

8,500 separate items travelling to North America by barge, rail, road and ship. From their base in Randers, Denmark, they make sure that wind turbine parts arrive at their destination ports in the USA and Canada on time and in one piece.

At that point responsibility passes to Vestas Americas, in the form of Mette Heileskov Bülow, Director of Transport and Logistics, and her staff. Working from their office in Portland, Oregon, the Vestas Americas logistics team arrange for turbine parts to be moved from the





Port Houston, Texas, USA



port of entry to the job site, which may be halfway across the continent.

With seven big projects completed during 2005, the North American market is one of Vestas' biggest logistics challenges – but all over the world, Vestas staff are battling uncertain project schedules, customs delays and even the weather to get turbines and spare parts to where they are needed. This is a job that needs resourcefulness, not only to make the best of sometimes limited transport resources but also to develop new ways of moving ever-larger machinery. An aptitude for hard work comes in useful, too.

Meeting at the dockside...

The 600,000 cubic metres that Vestas sent to North America last year included 100,000 cubic metres of steel towers from Vietnam, Korea and Spain. The remainder – 500,000 cubic metres of nacelles, blades and other high-value parts – came from Europe. "That's equivalent to 10,000 standard 40-foot shipping containers, or 415 containers a week," says Maibritt Kjeldgaard, "though of course wind turbines are more complex to handle than 40-foot containers."

In the first of what could be up to half a dozen separate movements, turbine parts leaving the factory are taken to the port from which they will cross the Atlantic. Often this is done by truck, though not just any truck; Vestas has contracts with several transport companies that operate the massive vehicles needed to safely move 70-tonne

nacelles and blades measuring up to 44 metres long.

Nacelles from the Ringkøbing factory, for instance, travel by truck to Århus or Grenå, the two Danish ports Vestas mostly uses for transatlantic freight. Blades for the V80-2.0 MW turbine are moved by barge to Århus from the factory in Naskov, Denmark.

Turbine parts arriving at the docks are placed in a holding area until a ship-load has been assembled. The main items are nacelles, blades, rotor hubs with their covers (spinners) and shipping containers full of smaller parts. "We try to ship complete turbines, so each nacelle is accompanied by three blades, a hub and all the other equipment," Maibritt Kjeldgaard explains. "The only things that travel separately are the towers, because they normally come from outside Europe."

Each ship carries a minimum of around 12 complete turbines, with 28 being Vestas' record to date for a single voyage to the USA. "We have to monitor both our production and the vessel sailing schedules very closely," says Maibritt Kjeldgaard. "Occasionally we have delivered the last component just before the ship has finished loading, so it has been quite tight from time to time."

Almost all the vessels are on what the shipping industry calls "full charter", meaning that Vestas books the whole cargo space. "That way the ship stops only where we want it to, so we have a very good idea of how long the voyage will take," explains Maibritt Kjeldgaard. "The

alternative is a 'part charter', which might involve four or five stops for other cargoes. With our tight schedules, we prefer to avoid that kind of uncertainty. In some cases we have even chartered vessels for the return journey too, to keep delays to a minimum."

...and crossing the pond

Not every cargo ship can be used to carry wind turbines. Turbine nacelles contain a lot of electronics, making them relatively delicate, so they require a vessel fitted with internal decks ("tween decks") rather than holds spanning the full depth of the ship. Also necessary are on-board cranes for loading and unloading, which are a standard feature of tween-deck ships.

On any cargo ship, large loads need to be fixed firmly in place. Most vessels are fitted with locking points for standard shipping containers, but large turbine parts have to be secured using different methods. Nacelles, blades and hubs are bolted to specially-designed transport frames made from steel beams, and the frames are then welded to the deck. Hubs and spinners go on the tween decks with the nacelles.

Blades, which are tougher than nacelles and in any case too large for most holds, travel on deck along with the 40-foot containers and any tower sections. Until recently the blades have been stacked in pairs, but new blade frames which can be stacked in threes have allowed ships that could pre-



viously carry only 12 turbines to accommodate an extra two.

The loading time depends on the number of turbines on board; a ship carrying 12 turbines take a day or a day and a half. "We've picked up a good pace," says Maibritt Kjeldgaard. "We use the same terminals in Århus and Grenå each time, and we try to have the same stevedores to load the cargo – that makes the job easier."

"Having said that, it's important that people don't treat our turbines casually, because that's when accidents happen. So we do make sure that many of the loading and unloading operations are supervised by Vestas staff and the freight forwarder. That's the way to make sure everything is handled carefully, and to see if there is anything we could do better next time. Considering that most of our cargo travels without any external protection, we don't get much damage."

From ship to road and rail

Between two and five weeks after the ship sails, the turbines are on the other side of the Atlantic. Now it is time for Vestas logistics veteran Mette Heileskov Bülow and her five-person team to reverse the loading process and get everything to its final destination – which can mean a long journey.

Turbines shipped during 2005 were destined for projects all over North America: Washington and New York states, Texas, Oklahoma, Nebraska, Hawaii, and the Canadian prov-

inces of Manitoba, Saskatchewan and Alberta. Most entered the USA through Houston, Texas, but others began their land journeys at Oswego, a port on the St. Lawrence seaway in New York state, or Vancouver, just across the Columbia River from Vestas' offices in Portland. And as well as towers imported from China, Korea, Vietnam and Denmark, the logistics team had to take in towers made in North America from California, Tennessee, Louisiana, North Dakota, Saskatchewan and Quebec.

In most other parts of the world, Vestas turbines travel overland by road, but North America is unique in that rail transport is an attractive alternative. Since standard railcars are not suitable for wind turbines, Vestas leases a fleet of special railcars – 461 of them in 2005. Vestas has applied for patents on the use of railcars to transport wind turbines.

"Above a certain number of railcars and a certain distance, rail in North America costs only one-seventh as much per kilometre as road," says Mette Heileskov Bülow, "and it's also possible to unload a ship directly onto railcars, which reduces port handling charges. So last year we sent about half our freight by rail, including everything that came in via Houston. We had some big projects in New York and Washington states that were so close to the ports that trucking was the only option; now that those are finished, rail will probably account for 70 percent of our transport this year."

One reason for preferring rail is the complexity of the rules covering

road transport of heavy loads in North America, Mette Heileskov Bülow explains: "There are as many different road regulations as there are states and provinces in North America. In Manitoba, for example, you can't use American trucks, and in California they have completely different requirements from all the other US states."

"In the Pacific North-West they have extreme restrictions on axle weight, so while we would typically deliver a V80 nacelle on a 13-axle trailer, in the state of Washington we need a 19-axle trailer to do the same job. 19-axle trucks are not easy to find, and it's a nightmare just to get them in and out of the port and up the hills. But we've done it."

Permits and hurricanes

Vestas uses two trucking companies to arrange most of the necessary permits as well as haul the loads. Routes are mostly decided by the transport authorities in each state, taking into account that many North American roads do not have the same load-bearing capacity as their European counterparts.

There are negotiations with local communities, too. "Many times landowners and small towns have wanted a say in what we do – for instance, they might not want us to travel through the town between nine and ten o'clock because that's when the people from the retirement home take their daily walk. The trucking companies look after most of this, but sometimes I go



along to meetings in towns along the route, to show them drawings and explain what we're doing," Mette Heileskov Bülow says.

And then there's the weather. "Hurricane Katrina, at the end of August 2005, didn't cause us any damage, but a delivery of towers from Louisiana was delayed by a week – obviously the authorities had better things to do than issue transport permits for wind turbines," says Mette Heileskov Bülow. "Then in September the port of Houston was closed because it looked as if the eye of Hurricane Rita would pass through the city. We had a lot of tower sections in the port, so we were a little nervous, but luckily for us the hurricane changed course."

A tornado in Canada caused the loss of both working time and cargo when a 40-foot container on the job site was flung 500 metres through the air. The train, which was five kilometres away, escaped damage. "Then we had severe snowstorms in upstate New York which left equipment stranded for several days. And we have had some weather issues transporting towers on the Great Lakes. People from outside North America don't realise how big these lakes are – by European standards it's like the ocean!"

Teamwork and communications

From the start it was obvious that 2005 was going to be a challenging year. "In 2003 and 2004 we had projects involving up to about 80 V80s, which we handled over two

Supersize statistics

In 2005 Vestas shipped to North America 8,500 separate items, making up 600,000 cubic metres of freight, at a rate equivalent to 415 standard 40-foot shipping containers a week. This required 137 shipping berths by full-charter vessels all over the world.

Within the USA and Canada all this cargo, plus locally-produced towers, travelled on a fleet of 461 railcars and 360 trucks and special trailers. Five barges moved towers on the Great Lakes between Green Bay, WI, and Oswego, NY.

And the result of all this hard work? By the end of the year North America had 475 more Vestas wind turbines than it had 12 months previously.

to three months," says Maibritt Kjeldgaard. "But in 2005 we shipped 80 V80s in one week. 2005 has really been extraordinary."

"We took it one step at a time, because there's not really any other way to do it," says Mette Heileskov Bülow. "When you look at all these projects you can do one of two things: give up, or start planning. We started planning, we didn't give up, and if a problem appeared – a hurricane, say – we just worked out a way to go around it."

With so many variables and a nine-hour time difference between Vestas offices on each side of the Atlantic, clear communication was essential. "Regular conference calls and meetings kept everything on track," says Mette Heileskov Bülow.



Anders Sørensen
President, Vestas Offshore

New business unit for the offshore sector: Experience to benefit customers

Vestas is the most experienced player in the world when it comes to offshore wind energy, and customers should benefit from the experience the company has built up in this area. So says Anders Sørensen, who took up the position of President of Vestas Offshore – the new Vestas business unit – at the beginning of the year.

"Vestas has tried and tested more solutions than anyone else in the field of offshore wind energy, and it is no secret that our experience has come at a price. Now it is time to put our investment to work so that both Vestas and our customers benefit from our experience. In fact, I consider it Vestas' duty to lead the way in developing the offshore sector. With Vestas Offshore, we have the framework we need to do just that," says Anders Sørensen.

From its head office in Randers, Denmark, the new business unit is to handle all Vestas' offshore projects, no matter where in the world they may be located. This will make the unit a highly specialised function that can concentrate exclusively on the special challenges linked to developing, manufacturing, transporting, installing and maintaining offshore turbines.

"At Vestas Offshore, we gather together the people who know most about offshore wind energy and give them the opportunity to focus on what they do best. All the staff in this function are here because they burn for offshore projects, and this will really generate results," explains Anders Sørensen.

"We are now in a position to collect know-how at a level that was not possible previously, and as a result, we have firmer foundations for improving our technology and processes. At the same time, we now have a department with ownership of the products and of the development of the offshore sector in general. At the end of the day, this will surely translate into optimal results for our customers."

However, the new President of Vestas Offshore is quick to stress that specialisation in itself is not enough to ensure good results.

"We want to build up a closer, long-term dialogue with our customers so that we can work together in an atmosphere of openness and honesty to pinpoint the very best solutions," concludes Anders Sørensen.