

## **The International Wind Power Industry 2008-2012** **Forecast demand strains the supply chain.**

For more than four years the supply chain to the international wind power industry has been subject to constraints in certain key components and materials. It is now considered that the wind turbine industry and its suppliers should be able to meet an annual demand for new installed capacity of **50 GW per year by 2012**, but only if there is **a substantial increase in production capacity** and **quality improvements** in the supply of specific materials.

These are the main findings of a new report, **Supply Chain Assessment 2008-2012**, compiled by specialist Danish consultancy **BTM Consult ApS**.

The assessment concludes that although wind turbine manufacturers are well prepared for high demand - demonstrated by the fact that the industry has been able to cope with >30% annual growth since 2004 - the supply of key components and crucial materials has struggled to keep up with demand. These critical components are **gearboxes**, **large bearings** for gearboxes and the turbine drive train, **forged components** for the main shaft, gears and bearings and **cast iron in the qualities required** by the industry.

Around 200 companies which supply the critical components and materials have been assessed for their current ability to supply and their expected capacity in five years' time. The companies contribute to the industry's supply chain in the US, Europe and Asia. China in particular has recently built up a huge capacity for supplying the wind power industry.

By the end of 2012 the supply chain for wind turbine manufacture is expected to have reached a balance with anticipated demand. This demand is based on the most recent projection in BTM Consult ApS' World Market Update 2007, released in March 2008.

Increasing political awareness of both **security of supply** concerns and the **global warming** issue, alongside consistently high levels of oil prices, have caused a very high demand for wind power equipment in all parts of the world. Wind power has entered the mainstream of electricity generation technologies.

The report **International Wind Energy Development – Supply Chain Assessment 2008-2012, August 2008** will be released **on 22 August**.

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## **Executive summary**

This assessment of the supply chain to the wind power industry is based on recent research in the international market place. Data from more than 200 key suppliers has been sourced and analysed for this report. Our supply sources in Asia (in particular China, India and Korea) have grown significantly since BTM Consult published its first Supply Chain Assessment in December 2006.

It is important to note that the judgment as to whether supply bottlenecks exist or not depends on the demand estimates against which the available manufacturing capacity is matched. For this assessment, the reference demand figures are taken from the forecasts for 2008-2012 in BTM Consult's latest World Market Update 2007. World demand for wind turbines is estimated to be 26,500 MW in 2008 and 50,500 MW by 2012.

The data for this report was collected during spring/summer 2008 and the final editing was completed by 1 August 2008.

The resulting assessment of the wind turbine component supply chain, along with the prospects for short term demand in the industry, has produced the following conclusions:

Overall, the wind industry is expected to increase its demand for installed capacity from today's 20,000 MW/year to around 50,000 MW/year by 2012. This dramatic market expansion entails a major challenge for the industry to increase its supply of components, alongside the requirement for ever larger wind turbines. Currently, the entire supply chain is stretched to its limits to increase production capacity, with the supply situation for most of the key components still more or less under pressure to meet the accelerated rate of growth. It is therefore likely that supply capacity rather than market demand will continue to determine the rate of installation of new wind turbines in the immediate future.

The following specific conclusions have been reached for key components and materials in the supply chain:

### **Blades**

With the vertical integration strategy adopted by most leading wind turbine manufacturers, and more new competitors emerging to cope with increasing global demand, the time when blade production capacity determined the installation rate of new wind turbines is over. The majority of blades (about 85%) are currently either manufactured in-house by turbine companies or delivered by LM Glasfiber. Taking into account the capacity of a further 14 independent suppliers, it is likely that the forecast demand for 26,655 MW of blade capacity in 2008 can be met. With new facilities being developed and already established facilities expanded, global blade production capacity should be enough to cover demand for at least two years ahead. Only two independent producers, however, can so far supply blades for turbines larger than 3 MW, so constraints may still occur in the supply chain over the next few years – especially when the offshore market is expected to take off.

### **Gearboxes**

The global supply capacity of gearboxes is presently enough to cover the demand from the wind industry. Nevertheless, supply information from wind turbine manufacturers indicates that constraints still exist in the gearbox supply chain for various reasons. According to the published development plans of the leading suppliers, there will be no constraints in the gearbox supply chain up to 2012. This assumption is based, however, on the premise that the supply of large gearbox bearings will catch up with demand from the market. Unfortunately, there is no sign that the shortage situation for large bearings can be fully resolved in the next two years. It is therefore inevitable that gearbox supply constraint will continue to be a problem.

### **Electric generators**

Generator designs in current use will continue to be available in sufficient quantities. With new supply capacity emerging in China, with the leading suppliers increasing their production facilities around the world and with in-house capacity continually increasing, there are no signs of a shortage. Demand for more advanced and/or tailored applications may change this situation. Such concepts will, however, be designed in partnerships between generator suppliers and wind turbine manufacturers.

### **Large bearings**

According to our research, just 30 - 40% of potential suppliers can offer large bearings for generators, gearboxes and rotor shafts. The result is supply constraints for gearboxes and main shaft bearings in the wind industry. Another bottleneck is the supply of pitch movement bearings, which appears to be the most critical constraint on market growth. Although leading suppliers SKF and Schaeffler are stretching their limits to expand production capacities and new entrants are emerging, the shortage is unlikely to be completely resolved within the next two years. This is because the supply situation is very sensitive to demand in terms of size and only a few companies can deliver bearings for the largest turbines. An important constraint for the bearings industry is the limited availability of high quality alloys used for the bearings' rings.

### **Power converters**

Apart from in-house production capacity, the power converter market is characterised by a number of large European companies who together meet most of the demand from the wind industry. With new facilities being established around the world by the leading suppliers and new entrants, there is no sign that power converter supply will constrain the growth of wind turbine manufacture. According to information from both the supply and demand sides, the current situation is that there is massive pressure for increased converter supply, but the suppliers are confident that they can meet this.

### **Power transformers**

According to information from the leading global power transformer suppliers, and several Chinese companies, there is no pressure on the suppliers to meet dramatically increased demand from the wind power market. For established power transformer manufacturers, supplying the wind power market is just part of their overall business.

### **Castings**

Thanks to newly emerging capacity from Asia, in particular China, current global supplies can just about meet the demand for castings from the wind industry. However, this situation could still be under pressure if no additional capacity is introduced in the near future. In addition, as with large bearings, the supply situation for large castings is also very sensitive to demand in terms of sizes. Only four European foundries are currently capable of supplying good quality large casting components for multi-MW wind turbines. For many foundries, heavy parts, such as hubs and the mainframe, present a major challenge, not only because of weight but because the "thick walls" in such structures make their manufacture difficult.

### **Forgings**

Apparently the supply situation of forged items to the wind industry in the near term is better than that for castings in terms of global production capacity, mainly because of the significant contribution of capacity from South Korea. Even so, the fact that the geographical distribution of forging capacity is extremely uneven and only a few companies can supply main shafts larger than 3 MW still makes the supply situation under strain. A better global balance of product distribution and setting up new capacity in Europe and the US are imperative for forging supply at present. Furthermore, the supply of special "roller forged" items of a high enough quality for bearing/pitching rings may be a constraint, in particular for bearing manufacturers.

<p>Note: The supply of key components or key materials is quantified in terms of MWs of turbine capacity and "tons of material" respectively. The basic supply data appears as an estimated gross potential, which in our analysis is reduced by factors including size limitations, quality limitations, uneven geographical distribution etc. Constraints at the bottom of the supply chain have an impact upwards, for instance lack of high quality steel alloys affects forged material, which affects bearings, which affects gearboxes and so on. All these issues are treated in detail in the report's relevant sections, component by component.</p>
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Illustration: Status of the supply chain in 2008 and 2012

**Supply constraints 2008 to 2012 - Key components and materials**

**2008 Demand (Est.): 26,565 MW**



**Supply constraints 2009-2011:**

**Supply status during 2008 to 2011**

**Demand** according to BTM-C Forecast (WMU2007):

2009: **32,295 MW**

2010: **39,455 MW**

2011: **44,835 MW**

**Supply of Key Components:**

- Blades will generally be able to meet current demand, but larger blades (>3 MW turbines) are still in short supply.
- Gearbox capacity will be sufficient during 2008 but the future situation depends on the supply of large bearings.
- Electric generators, power converters and transformers will not suffer a lack of capacity.
- Large bearings for gearboxes and main shafts and blade pitching bearings are the main bottlenecks in the supply chain.
- Casting capacity will be sufficient during 2008. However, constraints will increase towards 2012 if no new additional capacity is commissioned.
- Global forging production capacity will be sufficient during 2008-12. Even so, the fact that the geographical distribution of capacity is extremely uneven and only a few companies can supply main shafts larger than 3 MW still makes the supply situation under strain.

**2012 Demand (Est.): 50,785 MW**

