

Global Markets: The World Catches Up With Europe

The global wind turbine market is projected to more than double over the next five years. *Crispin Aubrey* looks at where this expansion is occurring and whether new manufacturing bases like China can help even out the imbalance between demand and supply.

Photo: Gilbert Benoit/EWEA

The prospects for global wind energy growth have never looked better. Projections show capacity expanding around the world at an unprecedented rate. New markets are constantly opening up whilst investors are rushing to grab a slice of a booming market. And whilst worsening climate change predictions continue to strongly support a move away from conventional fuels, the soaring price of oil is evidence that a switch makes prudent economic sense as well.

The most recent forecast from the Global Wind Energy Council (GWEC) shows worldwide wind capacity growing at an average cumulative rate of more than 20% over the next five years. By 2012 the total capacity installed will have increased from 100GW now to 240GW.

In terms of electricity supply, GWEC projects that wind will be supplying 3% of global consumption by 2012. This is well on the way to reaching the level of 10% originally calculated in the *Wind Force* series of reports launched in 1999, and seen at the time by some observers as ridiculously optimistic. As GWEC Secretary General Steve Sawyer forecasts in an interview on page 42 of this issue, a contribution of 10-15% towards global demand should be reached by 2020.

GWEC's short-term projections are in line with those of the major market analysts specialising in wind and other clean energy sources. Danish analysts MAKE Consulting are slightly more cautious, with 235GW expected by 2012, whilst US-based Emerging Energy Research anticipates about the same number – 245GW. The latest World Market Update from BTM Consult, however, shows 288GW of capacity potentially installed by 2012, 48GW ahead of GWEC's expectation. By 2017 BTM predicts 690GW, already 6% of world power generation.

Even the generally conservative International Energy Agency now says that, under its most radical scenario, wind could be contributing 17% of global electricity production by 2050.

On the investment front, a recent report prepared by consultants New Energy Finance for the United Nations Environment Programme shows the level of investment in the "clean technology" sector steadily rising from \$150 billion in 2007 to reach an annual \$600 bn by 2020. Wind attracted the most new money last year, the report says – \$50.2 bn – whilst evidence of the technology's buoyancy comes from two recent IPOs (Initial Public Offerings). Floating of Spanish power group Iberdrola, which owns the world's largest wind farm fleet, on the stock market



Beijing traffic and polluted atmosphere

raised \$7.2 bn – the most ever seen in Spain – whilst Chinese turbine manufacturer Goldwind raised \$243 million on the Shenzhen stock exchange – the market's first IPO solely related to renewable energy.

But whilst the appetite to support the wind industry is clearly there – in political terms because of its credentials as a carbon-free energy source and in financial terms because of its excellent investment prospects – the bigger questions are where exactly these new large chunks of capacity are going to be installed, and whether the industry has the manufacturing resources to satisfy this level of demand.

MAKE Consulting points out that shortage of supply means that the delivery time for turbines has more than doubled – from six to twelve months – over the past two years, whilst prices have risen

by more than 30%. Bridging the gap between supply and demand is therefore critical to the industry's continued expansion.

Bullish forecasts

On geographical spread, the GWEC projections show that although Europe will remain a crucial powerhouse for wind, the fastest growth is now occurring elsewhere – at the cultural extremes of the United States of America and the People's Republic of China.

The forecasts for the United States continue to be increasingly bullish. Following the record level of installation during 2007 – more than 5,000 MW – a repeat performance is expected in 2008. Emerging Energy Research reports that over 8,800 MW is under construction this summer; by 2020 it expects a total of 100GW to be reached. "The US wind power market is exploding," EER concludes. "The market will continue to take centre stage in the burgeoning wind power industry for years to come."

Two important positive factors are firstly the expectation that, one way or another, the PTC (Production Tax Credit) payment will be renewed beyond the end of this year, when it is currently due to expire. Secondly, a change of President this November is likely to usher in a change in energy policy, whichever of the two main political parties wins the election. As a result, the US can be expected to finally engage fully with the Kyoto climate change process and to implement more domestic measures to encourage renewables.

On the manufacturing front, on the other hand, there is little evidence that the US will soon be able to produce enough capacity to satisfy more than its domestic and continental demand. Only



The US is expecting another record year: Vestas V-80 1.8 MW turbines at High Winds, California

Photo: Vestas

Price has also recently become an issue as well. Such is the level of demand for coal that it has been cheaper for power station operators to import from Australia than truck or train the black stuff right across such a vast territory. Now the Australians have spotted this and in turn increased their prices.

In order to encourage wind as a clean, and potentially cheap, energy source the Chinese government has introduced mandatory targets for non-hydro renewables to be achieved by all power producers with a capacity of more than 5GW. The target starts at 3% of operating capacity by 2010, rising to 8% by 2020. At the same time parallel targets have been set specifically for wind power – 5GW of installed capacity by 2010 (recently increased to 10GW), 30GW by 2020.

The last few years have seen an unprecedented rate of expansion in Chinese wind development. Starting seriously in 2005, a major step change occurred last year, with 3,450 MW of new capacity installed, taking the cumulative total close to 6,000 MW. The expectation is that China will install up to a further 5GW this year alone.

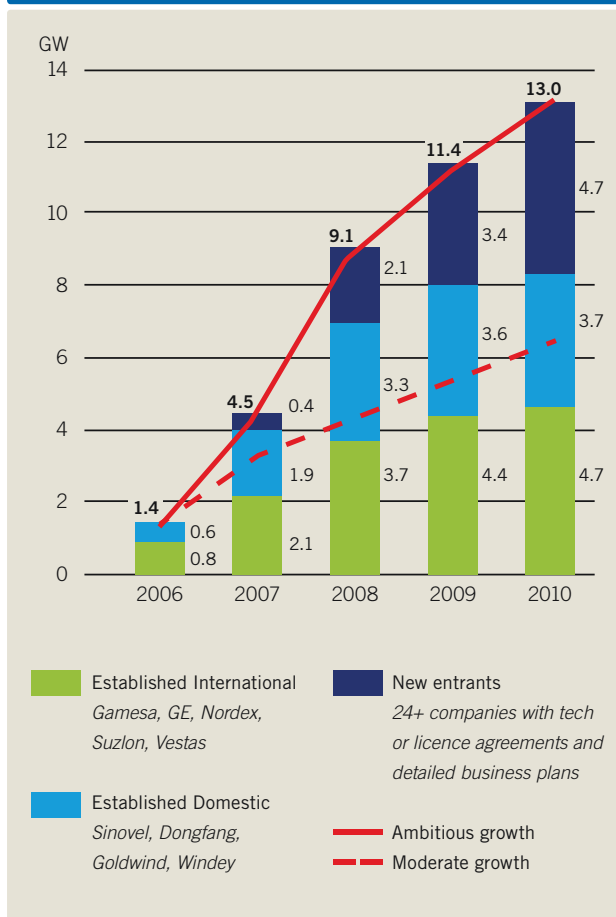
After that, according to the Chinese Wind Energy Association, a similar outcome in both 2009 and 2010 should see a total of almost 22GW installed by the end of the decade. By 2020, a capacity of between 80 and 100GW should be achieved, it projects. “The Chinese industry is now a major factor in any assessment of the global wind market,” says Steve Sawyer. “Everybody has to take it into account.”



Andrew Garrad:

“It’s a totally different situation from the start of the European industry, where often the pioneering companies were relatively small enterprises”

Planned expansion of Chinese wind turbine production



Source: GWEC/Azure International

Manufacturing activity

The result has been an extraordinary boom in Chinese wind turbine manufacturing activity. From a standing start a few years ago about 40 companies are now involved in the manufacture of turbines of 1.5MW capacity and above. They range from purely Chinese companies to a number of joint ventures in conjunction with foreign businesses to foreign turbine manufacturers operating on their own. The latter include Vestas, Gamesa, GE and Suzlon.

Many other companies are involved in producing components such as blades, gearboxes and generators. The Chinese Wind Energy Association estimates that a total of 15,000 people are now employed by the wind industry in China.

Led by the market leaders Goldwind Science and Technology (25% of supply in 2007) and Sinovel Windtech (20% in 2007), most of the Chinese turbine manufacturers have come to a licensing or royalty agreement with Western suppliers in order to kick-start their technology. A few are also working on their own unique designs.

Photo: Getty Images



Hong Kong harbour

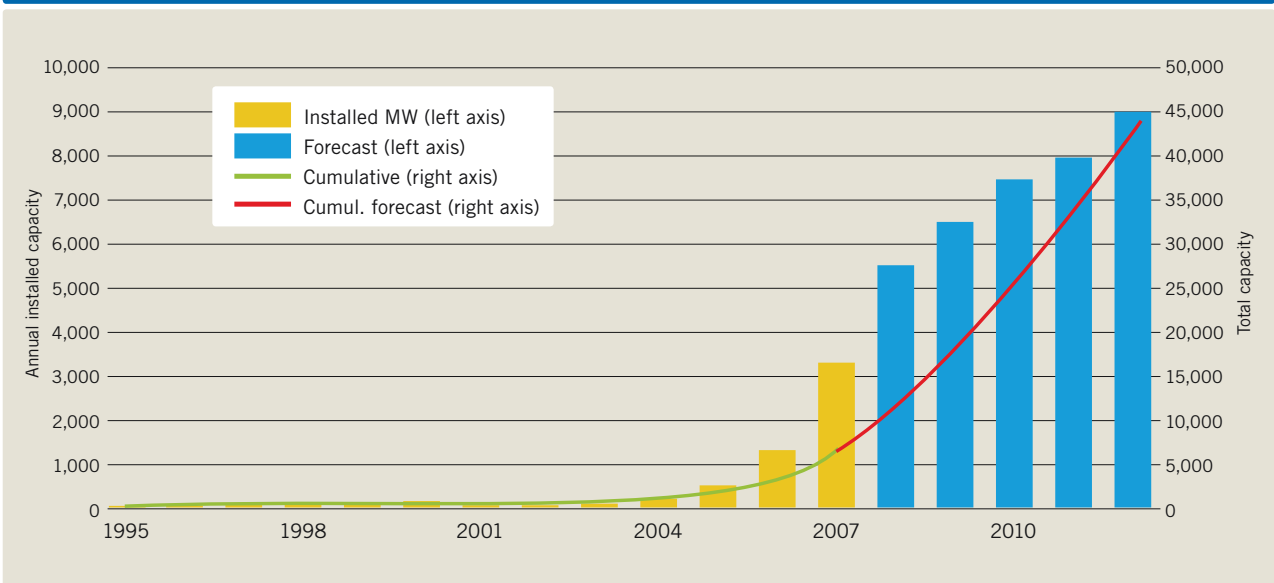
“It’s a totally different situation from the start of the European industry, where often the pioneering companies were relatively small enterprises,” says Andrew Garrad of UK consultancy Garrad Hassan, which has an office in Beijing. “These Chinese companies already have established engineering skills and a large workforce. They are all major manufacturing businesses, often employing hundreds of thousands of people, who have decided to go into the wind business.”

It is also assumed, given the generally lower cost of labour in China, that turbines can be produced more cheaply there than in Europe or the United States. A figure of 25% below Western costs has been quoted in the trade press.

An equally crucial factor for these domestic manufacturers is that, in order to encourage a home-based industry, the Chinese government has decreed that 70% of a turbine’s components must be sourced within China itself and the machine assembled locally. Some turbines are now almost entirely based on Chinese components, although some parts, such as bearings and electrical control systems, continue to be mainly supplied from outside the country.

The domestic manufacturers have not only found it easier to achieve the required level of local sourcing but have been successful at linking up with large state-owned power companies to compete in the series of bidding rounds through which the right to develop wind farms of 50MW capacity and above has been allocated. They have also been prepared to accept a lower price for their output – about 4-5 ¢cents/kWh over 20 years for projects in the last (2007) bidding round – than would be considered an acceptable return for a Western wind developer.

Projected wind capacity in China up to 2012 (in MW)



Source: BTM Consult

Photo: Nordex



Chinese workers at European turbine manufacturer Nordex's production plant

All these factors have resulted in the domestic Chinese manufacturers achieving an increasingly large proportion of the available contracts. In 2007 Chinese companies supplied 55% of the market, up from 41% the year before.

The big question remains as to when Chinese turbine makers will be in a position to export, in the process helping to relieve the worldwide pressure on the supply chain. "The major advantage of manufacturing in China is the Chinese market itself," says

Andrew Garrad. "This promises to be huge and will be mainly supplied by domestic suppliers. Ultimately some of them will export. This includes the European companies, much in the same way as other manufacturing sectors have gone to China to export around the world.

"At the moment Western companies are able to sell their turbines in China. But there will come a time when they may not be able to because the market is taken by domestic manufacturers. They will then continue to have a presence there but sell elsewhere in the world." How soon this will have a significant impact on the global supply balance is more difficult to judge.

Some Chinese turbine manufacturers have already signed export deals. Earlier this year Mingyang Wind Power Technology agreed to supply 600 of its 1.5 MW turbines to the GreenHunter development company based in the US state of Texas. The first machines are scheduled to be installed in a wind farm in Montana. Other deals are reported for the supply of Chinese turbines to both Turkey and Ireland. The Chinese Wind Energy Association believes that a serious level of turbine exports from China to other countries will start to flow in 2010.

Garrad emphasises that more important than the export of complete turbines will be the point at which Chinese manufacturers can market internationally those critical components, such as bearings, which are currently in short supply. "That's when they'll make a big impact," he says.

The View From the West: International CEOs on China

Victor Abate
GE Energy

"China is absolutely booming. We have a facility in Shenyang producing 300 MW a year and we've been involved in the largest wind farm. But one of the big dimensions we're focusing on is quality. As the industry grows in different parts of world it's essential to keep the momentum going by having good quality standards and production control, as opposed to just building more capacity."

Andreas Nauen
Siemens Wind Power

"Whether you like the way they do it or not, the Chinese make things happen. So we'd better make things happen in Europe or they will surpass us by far. The positive thing is that their producers of shafts and

gearboxes and other parts can contribute to our supply chain bottlenecks. And of course although we Europeans lead the world in the technology at the moment the Chinese will catch up. That will drive competitiveness; in the long term it will drive the cost of turbines down and help our customers."

Ian Mays
Renewable Energy Systems

"Although the suppliers have tried to balance it out, there's been increasing pressure on turbine supply in every part of the world. We're hopeful that in a couple of years time supply will catch up with demand, but there's no guarantee of that. It depends partly on what volumes are starting to come out of China. We could be looking at 750GW of turbines to be required by 2020, which means that the industry will

have to expand by a factor of eight. That's a trillion dollars' worth of investment. It's achievable, but it requires investor confidence and needs political will and leadership to drive the market forward."

Eddie O'Connor
Mainstream Energy

"China is the key to everything. They're adding the equivalent of a new Germany to world demand for electricity every year, but I also see them reversing the amount of carbon consumed in the making of that electricity and probably being able to do that by 2015. So it will be a major engine for change in terms of pollution. But even with Chinese output multiplied by 100 we're not going to see gigantic quantities of those turbines coming out into the West. We have to solve our own problems here by technical innovation."

All quotes from CEO session, European Wind Energy Conference, Brussels, March 2008



Production line in China for Gamesa turbines

Photo: Gamesa

Market issues

There are still some uncertainties about the Chinese market. One is the level of prices agreed by the government for the output from wind farms – low by European standards. Most projects have only become viable by being topped up with a contribution from the Kyoto Protocol's Clean Development Mechanism. The majority of the wind projects agreed so far under the CDM have been in China.

Another issue is about the accuracy of wind regime assessments. Not enough accurate information is available about average wind speeds at particular sites, resulting in the risk that wind farm output will be down on expectations.

Finally there is a question mark over the quality of domestically manufactured turbines emerging from an industry which has had to ramp itself up in such a short timeframe. Most observers seem to accept that mistakes will inevitably be made but that the skill and determination of the Chinese industrial base will overcome these.

“The explosive rate of development has of course put China's wind industry at a high potential risk,” accepts Qin Haiyan, Secretary General of the Chinese Wind Energy Association. “This is because we still have to develop a strong industrial base, including an independent innovation capability.”

“I don't think anybody is really in a position yet to judge the quality of Chinese turbines compared to European models,” says Andrew Garrad. “All the companies are starting from scratch. What is clear is that things can happen in China a lot faster than anywhere else. There's an inherent risk in that, but the upside is that when you've decided to do something it can happen quickly.”

“Personally I think it's very encouraging that the Chinese are producing so much, have huge plans to do very big developments and to create a substantial domestic industry.”

China: Soaring Demand and a Manufacturing Boom

The BTM Consult 2007 World Market Update forecasts that China will have installed 37.3GW by the end of 2012, making it the largest country market in the world after the United States.

- BTM lists 18 domestic Chinese turbine suppliers producing machines in the capacity range from 600kW up to 2MW. The Chinese Wind Energy Association says there are 40 suppliers in total, expected to produce up to 8,000MW of turbines in 2008.
- Two companies – Goldwind and Sinovel – are already among the ten largest global turbine suppliers. Both have plans to manufacture turbines in the 3-5MW bracket. Sinovel says that its 3MW machine, designed for offshore use, will be ready for mass production in 2009.
- Recent examples of European investment in China include a decision by Nordex to expand its production capacity from 225MW annually to 800MW by 2011 and Siemens' plan to open blade and nacelle facilities by 2010. Spanish project developer Fersa Energias Renovables signed a joint venture agreement this February with the Chinese state-owned Lubei Corporation to develop and construct wind farms in Shandong province. The first phase is a 48MW project but the ultimate intention is to install 10,000MW of capacity over 50 years.
- The rights to develop wind farms greater than 50MW are allocated through a series of competitive tenders which started in 2003. The results of the fifth bidding round were announced earlier this year.
- The potential for wind farms round the coast of China is even larger than on land. The first offshore wind farm (102MW) is scheduled to start construction in the sea off Shanghai in 2009.
- A total of 400 wind measurement masts are being erected around the country to improve the national wind speed assessment record.



Indian market leader: Installing a Suzlon 2 MW turbine and (below) manufacturing Suzlon turbines at Pondicherry

Photo: Suzlon

India and Korea

If China is the most prominent focus outside Europe at the moment for both wind farm development and manufacture, there are other countries in Asia where a similar, if smaller - scale, manufacturing boom is possible. Top of the list is India, where the last three years have already registered a surge in installations. A record 2,000 MW is forecast to be commissioned during 2008, according to BTM Consult, taking the cumulative total to 10,000 MW.

As importantly, the Indian Ministry for New and Renewable Energy recently introduced a new national incentive payment per unit of power generated in addition to the payments agreed by each individual state. This should prove particularly attractive to foreign investors since the incentive is based on production output as opposed to the tax concessions which have so far made investment in wind power a magnet for Indian companies.



Photo: Suzlon

There is also considerable potential for manufacture in South Korea, a country with a strong industrial base and a newly-found interest in wind power. Less than 200 MW has been installed so far, but the government has a target for 2,250 MW to be completed by 2012. Four domestic manufacturers are developing 2-3 MW scale turbines.

Where does this leave Europe? The answer is in very good shape in relation to the global boom. GWEC's assessment shows that by 2012 Europe alone will have pushed above 100GW, with 42% of the world's cumulative capacity. European manufacturers are still the dominant force, with the potential to establish bases or technology transfers in the most promising world markets, not just China and the US. All the main European turbine manufacturers are involved in major expansion plans to cope with soaring demand.

Within Europe, despite the slowdown in Germany, there is a solid cluster of other countries showing dramatic growth rates. EWEA projects that the most dynamic of these will be Spain, France, the UK, Italy, Portugal and the Netherlands. The strongest driver for growth in Europe will be the upcoming European Union Directive on Renewables, setting national mandatory targets to achieve 20% renewable energy in the EU by 2020.

The biggest question mark hangs over what contribution will be made over the next two decades by Europe's offshore projects. The recent announcement by the UK government that it expects up to 33GW of wind capacity (mainly offshore) to contribute to its 2020 target of 15% renewable energy (to meet its EU commitment) was one indication of confidence. But rising turbine prices and other costs still challenge the economics of going out to sea. One intriguing thought is that one day those turbines operating around the UK's coastline might be made in China.

For more information:

www.btm.dk; www.gwec.net; www.make-consulting.com; www.iea.org

Market Analysis: The Turbine Suppliers' View

Spanish manufacturer Gamesa and Indian supplier Suzlon are both active in the Chinese market. *Crispin Aubrey* asked them for their views on key questions about the prospects in China.

What is the attraction of the Chinese market?

Paulo Soares, CEO Suzlon China: This is a very large market with a very high growth rate. We believe that to be a global player we need to be present in China. It is a difficult market, however, with local companies taking the top two spots in market share last year. But we still strongly believe that we can be an important player.

Gamesa: China is a high priority market for Gamesa and the company has been making long term investments there since 2004. These are not only in the creation of an important commercial network and the installation of wind turbines but in the formation of a strong industrial infrastructure to generate employment and wealth.

Is your main interest in supplying the Chinese domestic market or in using China as a base for supplying other markets, especially with the attraction of low labour costs?

Suzlon: Unlike many other companies, Suzlon is not in China for the labour cost advantage or to use China as a springboard for export. We are here because we believe this is an important market for our company from a global perspective. Having our manufacturing base in India already provides us with a basis for export to Australia and the US, and means we benefit from potentially lower labour costs.

Gamesa: With three of the five main Asian wind farm promoters as clients, our main interest currently is in supplying the Chinese market. We are sure that our product catalogue, with its characteristics of robustness, reliability and adaptability, will allow us to be well-positioned for projected installations in the Asian market, and to also export components and/or whole machines to the rest of the world. Nevertheless, this is a possibility to be considered in the future.

What is your company's current and proposed level of investment in China?

Suzlon: We have about 1,200 employees in China. We have a manufacturing facility in Tianjin, with about 250,000 m², where we manufacture blades, nacelle covers and nose cones, genera-

tors, power and control panels and assemble the nacelles. In Beijing we have our sales/project management and OMS operations. Suzlon has invested US\$60 million in its facilities, which started operation in April 2007.

Gamesa: With more than €40 million invested and around 1,000 employees, Gamesa currently has four production facilities in China: one for nacelle assembly (inaugurated in September 2006), one manufacturing blades for Gamesa G5X-850 kW turbines (January 2007) and the other two (recently inaugurated) manufacturing gearboxes and generators for the 850 kW turbines. These facilities are in Tianjin, on the east coast of China, 130 km from Beijing and logistically in an excellent location.

How much capacity have you produced so far in China, of what turbine models, and what is the company's projection of future capacity output?

Suzlon: We delivered 206 MW in 2007. Our main products are the S64 1.25 MW Class II, S66 1.25 MW Class III and S82 1.50 MW Class III turbines, both in low version and standard temperature versions. Last year nearly all our deliveries were of the S64 1.25 MW Class II, with one wind farm with S66 1.25 MW Class III machines. Our factory has a capacity for 600 MW and our intention is to fully utilise this.

Gamesa: The Gamesa G5X-850 kW is presently the turbine most in demand. We expect the G8X-2.0 MW platform to be introduced in the market in the next few years. Gamesa's annual production capacity in China is nearly 700 MW.

Is it a problem that Chinese component suppliers cannot yet guarantee reliable quality?

Suzlon: As is the case in any young industry there is a learning process during which quality problems will occur, especially in key components such as gearboxes. Suzlon anyway follows strict quality requirements, and no key component is localised to a Chinese supplier before we are absolutely assured of the product quality. Furthermore, changes in key components which lead to turbine re-certification are dependent on international standards and a lengthy verification process.



Gamesa: The company relies on an integrated effort in the design, manufacture, operation and maintenance of its wind turbines. In-house development of the critical wind turbine components, from gearbox to blades, ensures excellence in the design and the highest quality standards. Gamesa's more than 12,000 MW installed around the world attests to the excellent yields of its turbines. This exemplary performance is made possible through complete control of the product's technology and its key components.

What are the other main challenges of operating in China?

Suzlon: People, people, people! In an industry which is growing so fast, and at the same time competing for resources with other growing industries, qualified personnel are at a premium. The power business in China is very strong, and wind, despite its growth, is still small compared to thermal power and hydropower.

Gamesa: The Chinese wind power market is dominated by large promoter companies with interests in conventional energy production as well as shareholdings in the provincial power companies in the majority of the regions where wind power is being installed. Although private developers have not traditionally existed, some organisations have begun to plan a strategy which takes into account a possible liberalisation of the market. There is also the challenging requirement by the Chinese government that all foreign manufacturers have to achieve a minimum level of 70% domestic content to be able to enter the market.

Will China eventually be able to make a major contribution towards solving the global supply shortfall in turbines?

Suzlon: Not in the short term, but eventually in the long run. It will depend on the Chinese suppliers stepping up their efforts to comply with international standards and also having broader management skills to deal with the requirements of the international market.

Gamesa: We have been developing a Chinese component supply chain for more than three years, transferring technology to suppliers as well as quality management to ensure both sustainable and high quality components. Chinese companies will benefit from Gamesa's input and eventually be able to operate worldwide.