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LM Glasfiber's global reach positions the company well for market upturns.

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NewsLetter

DECEMBER 2005

The Sweetwater Wind Farm in Texas, USA, has a total capacity of 91.5 MW, and plans are afoot for a further 400 MW of capacity in this area.

LM Glasfiber positioned well to capture the boom in the USA

New wind farms set up in the USA in 2005 will provide a total capacity of 2,500 MW – a record growth of more than 35%. This will bring the total wind energy capacity in the USA to more than 9,200 MW, the equivalent of the electricity used in 2.4 million homes.

This increased wind power capacity is more than welcome for American consumers, who are particularly thirsty for energy. Inadequate supplies of natural gas will result in consumer price rises of 70–100% for electricity and natural gas during the forthcoming winter.

LM Glasfiber is positioned well to capture this boom in demand for energy within the American market. The Sweetwater 2 Wind Farm in Nolan County, Texas, began operations in February 2005, with 61 wind turbines from GE Energy and a total capacity of 91.5 MW. However, plans are already afoot for increasing capacity at Sweetwater right up to 400 MW in the years ahead.

Sweetwater 2 uses LM 37.3 blades manufactured at LM Glasfiber's factory in Grand Forks, North Dakota. This is an example of local production providing customer benefits in the form of lower overall energy costs.

Read more on pages 4–5 ►

"I believe that as this industry matures,
and as the value chain becomes more finely honed,
we will become less susceptible to
the effects of changing political winds"

The wind power industry is currently in the limelight

Paul Anthony, CEO

Renewable energy is on everybody's agenda, and the technology that makes it possible to exploit the power of the wind to provide energy is now maturing and attracting a great deal of attention.

The energy companies with which I have worked over the past 20 years have all expanded their investments in renewable resources, particularly in wind energy over the past 5-10 years.

As one example of the results, American Xcel Energy now provides its Windsource® customers with a direct cash advantage for using renewable energy. Whereas they previously had to pay an average of USD 6 more every month for "green electricity", from November onwards they will now pay USD 10 a month less, as a result of increases in natural gas prices. So even without including the overall cost to society of using fossil fuels, wind-generated electricity is now clearly becoming more economically attractive.

The results of the considerable focus on wind energy are clearly visible in the wind power industry as a whole. Quite simply, demand is outstripping supply. The market has a tradition of fluctuations and is currently confronted with a shift in demand away from the mature markets of Europe, in favour of emerging markets in North America and Asia. Naturally, this represents new challenges for the companies active in this industry.

LM Glasfiber is already well established in these new markets, and is experiencing a significant interest in its specialist skills and products. Our emphasis on local production provides our customers with the ability to rapidly respond to these market opportunities, gaining first mover advantage, as well as fulfilling part of the requirements for local manufacturing. This makes the LM Glasfiber approach a model that helps boost the overall competitiveness of the wind energy sector as a whole. In addition, our specialist competencies play a vital role in continuously improving one of the most important components of any wind turbine and adding to the overall efficiency advantages of wind energy.

I am also pleased to announce that our new plant in Canada is now nearing completion, and over the past year, we have increased our capacity in Asia by 50%, in order to be able to provide our customers with the benefits of local production in some of the most rapidly expanding wind energy markets. I believe that as this industry matures, and as the value chain becomes more finely honed, we will become less susceptible to the effects of changing political winds. Wind power will have proved that it provides an attractive business proposition. LM Glasfiber will continue, with renewed vigour, to assist this goal, providing our customers with rapid response and corporate agility, innovation in our product range, working in partnership to capture market advantage and acting with the highest degree of business integrity to enhance the value of our customers and LM Glasfiber's shareholders alike.

Paul Anthony

Paul Anthony was appointed CEO at LM Glasfiber during October 2005. Over the past 20 years, he has held several top executive positions, including as CEO and executive chairman of the boards for a series of international energy companies. Paul Anthony brings with him considerable insight and know-how relating to the energy industry – most recently, as CEO of Energy Power Resources Ltd., building the company to a position of the largest renewable generating company in the UK.

He has considerable experience in the development and growth of international companies and has previously held senior executive positions such as Executive Vice President of British Gas Group (UK), the founder and CEO of Contact Energy Ltd. (NZ), the largest integrated energy company in Australasia, and senior executive positions with PowerGen International and PowerGen PLC (UK).

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Copenhagen Offshore Wind

Photo: Scanpix

The conference was officially opened by HRH Crown Prince Frederik of Denmark. Søren F. Knudsen, sales and marketing director at LM Glasfiber, is shown here explaining the lightning protection used for the world's largest wind turbine blades to the crown prince.

LM Glasfiber presented the LM DiverterStrip lightning protection system at the Copenhagen Offshore Wind 2005 conference and exhibition, opened by HRH Crown Prince Frederik of Denmark.

LM Glasfiber participated in Copenhagen Offshore Wind 2005, held 26–28 October. This conference was arranged in collaboration with the Danish Wind Industry Association, the Danish Energy Authority and the Confederation of Danish Industries. A politically focused seminar arranged by the Danish Energy Authority was held concurrently, and was attended by officials from a number of EU countries. The objective of this seminar was to investigate what can be done in political terms to boost offshore wind energy.

LM Glasfiber presented the latest feature of our lightning protection system – the LM DiverterStrip – at Copenhagen Offshore Wind 2005. This provides significantly better assurance of intercepting lightning strikes associated with particularly demanding operations, for example at offshore sites.

The LM DiverterStrip was also the topic for the technical presentation given by Research Manager John Korsgaard on the last day of the conference.

To download this presentation and an explanatory article, go to our web site and click on Download.

New hires and appointments

Group positions
Torben Vonsild took up a new position on 1 November as Group quality manager. Mr Vonsild has worked with quality management for 12 years, and he is very experienced within the wind turbine industry.

ShortNews

Jorge Raul Alvarez started on 1 November as business development manager. With his 10 years of experience in the industry and considerable familiarity with the international market, Mr Alvarez will develop LM Glasfiber's business relations in the Group's new markets.

Business units
On 1 September, Agustín Lopo González was appointed general manager of LM Glasfiber Southern Europe, based in Madrid, Spain. Mr González previously served as operations manager for the LM Glasfiber factories in Southern Europe.

On 1 October, Martin Couture took up his position as general manager for LM Glasfiber's new factory in Québec, Canada. Mr Couture has worked with glass fibre products in boat production for 10 years.

New web site

In conjunction with the Copenhagen Offshore Wind 2005 conference and exhibition, LM Glasfiber launched its new web site. The new version of www.lmglasfiber.com is the most comprehensive source of information regarding wind turbine blades currently available anywhere on the Internet. In addition to presenting an outline of the blades we currently produce, the site also provides a review of our blade features and information about the areas on which LM Glasfiber research currently focuses. We have also made it possible to download and subscribe to more information, including presentations, articles, brochures and newsletters.

Local production ensures maximum competitiveness

The way that the global market for wind energy is developing requires that manufacturers are in a position to supply wind turbines capable of producing the maximum amount of energy at the lowest possible prices. As a supplier to the wind turbine manufacturers, LM Glasfiber contributes to helping them achieve this via important measures that include local production in what are identified as the growth markets.

LM Glasfiber increased its capacity in Asia by 50% in 2004, and expects a further 60% increase in 2006–7. In North America, we are increasing capacity by 35% in 2006.

"When we talk about blade production, there are three things in particular that are crucial for the customer," says Søren F. Knudsen, sales and marketing director at LM Glasfiber. "These are being able to buy locally produced blades of a consistent quality, being able to pay in local currency, and being able to reduce transport costs and investments in working capital. We deal with all three of these key concerns by undertaking manufacture locally," he adds.

Fluctuating demand

LM Glasfiber currently operates seven factories in five countries in North America, Asia and Europe. This geographical balance in the most important markets for wind energy has changed during the last five years. The focus has shifted from Northern Europe to North America and the Asian growth markets in particular, both of which demand ever-increasing amounts of energy. This can be clearly seen in our business figures, where 70% of our turnover came from Europe in 2000, but 70% now comes from the rest of the world.

Our latest expansion measures include the new factory in Canada, due to start production in January 2006.

Ready for the boom in India

The Indian market for wind energy has grown at an average annual rate of 20% since 1994, when LM Glasfiber set up our first factory there. The Indian government's target is for 10% of the country's total electricity consumption to come from sustainable energy sources by 2012.

Nirmal K. Gupta, general manager of LM Glasfiber in India, says, "Local production is helping to keep down prices – and thereby customers' costs – and this is crucial in a competitive environment. We have exceptional skills in the Asian market, so even though development has so far been relatively slow, we're ready to play an active role when the wind power market experiences a boom in the coming years."

Demand for local production in Canada

LM Glasfiber is the leading manufacturer of wind turbine blades in North America, and we wish to maintain this position. Combined with our existing factory in North Dakota, USA, the new factory in Québec, Canada, will provide an annual production capacity in North America of more than 900 MW.

The Canadian factory will have an annual capacity of 240 MW and will supply blades for wind turbines being installed in new wind farms in the Québec area from 2006 to 2013. However, this factory is also ideally sited for deliveries to the USA. "In its invitation for tenders, Hydro-Québec stipulated that 60% of the wind turbines were to be produced locally on the Gaspé Peninsula, where our new factory is located," says Martin Couture, general manager of LM Glasfiber in Canada. "The factory provides jobs for up to 140 employees, most of them unskilled, and a boost to turnover for local sub-suppliers," he adds.

Consistent, competitive production in factories throughout the world demands set procedures and rigorous control –a field in which LM Glasfiber has acquired considerable experience after more than 10 years of international production. However, we must continue to develop at all times, to ensure that this consistent, competitive production can continue on an international scale.

Effective global production

The factory in Gaspé, Canada, will be ready for production by January 2006. Construction of this factory, located in a new industrial area on the outskirts of the town, has taken approximately 6 months.

An important part of LM Glasfiber's success is due to building on well-defined procedures and processes when setting up and operating new factories. This also helps ensure both our own competitiveness and that of our customers.

LM Glasfiber's growth within the global wind energy market places considerable demands on our capabilities in terms of planning, logistics and transferring skills.

The modular factory concept
We have therefore developed a flexible factory concept that ensures the efficient, consistent transfer of skills and technology when production is started up in a new market. This concept is based on setting up all our factories throughout the world using the same layout, and that all production processes and physical units are defined in advance. At the same time, an opportunity for expanding production is built into the solution right from the start, which makes it possible to subsequently extend capacity in a cost-effective way. The factory layout is based on line production, where raw materials enter from one end and finished blades are collected at the opposite end.

"When establishing or expanding production in particular countries, we draw on experts from our existing factories who know everything from factory design, equipment and production processes to quality assurance and control. By doing so, we ensure that every new production facility is based on the knowledge and experience we've gained through our decades of work with blades and composite materials," says Frank V. Nielsen, technical director at LM Glasfiber.

Global purchasing concept
Another important element in LM Glasfiber's local production is local sourcing – using local sub-suppliers. Local sourcing aims at creating sustainable agreements with sub-suppliers that have links to local production, or persuading our existing suppliers to set up locally. The effect has been faster and more reliable supplies, trade in local currency and lower costs of blade production overall.

To ensure quality and a reliable supply chain regarding the raw materials we use in production, we carry out regular audits of our suppliers. They must comply with a number of specific requirements concerning finances, management, the handling of raw materials and the quality of products and processes. These requirements are identical for all our suppliers throughout the world.

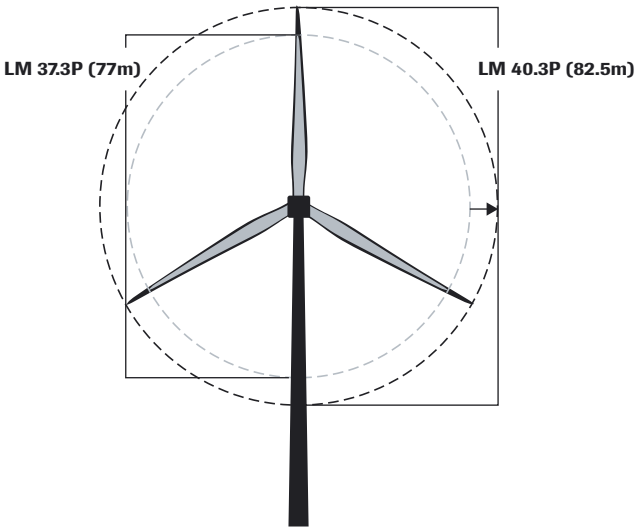
Streamlining via training
People employed in LM Glasfiber production go through a programme of thorough training at the factory concerned. To ensure a consistent level of skills in all our factories, we are in the process of developing a global training programme. Standardising skills makes it possible to ensure that production, in particular, is carried out under identical parameters all over the world, because all the procedures and job descriptions are interpreted the same way. This makes both quality assurance and overall production planning easier. The new programme includes courses that focus on the overall work environment, documentation, production, materials and quality. A global team experienced in both HR and production technology will be responsible for this new training programme.

"We're in full swing writing procedures and developing course material. Local instructors will take part in a conference in Denmark in February 2006. After that, the training programme will be rolled out simultaneously at our factories around the world," says Lennart Juhl, LM Glasfiber's project leader for this important initiative.

Cost of energy
These projects are part of a range of different measures to ensure efficient international production, with the overall objective of contributing to reductions in the price of wind energy. At the same time, boosting efficiency ensures our place as a specialist supplier in the value chain.

7% more electricity after upgrading blades

It pays to exploit existing platforms to the limit. Scaling up an existing wind turbine rotor has a direct effect on annual production figures and thus the price of electricity produced using wind power. LM Glasfiber recently helped several of our customers to scale up their rotors, and increased the swept area by up to 30%.



Existing wind turbines more competitive
7% increase in rotor diameter. The larger swept area provides the same wind turbine with an annual capacity increase of 7% – a clear improvement in the turbine's competitiveness.

Full utilisation of existing wind turbines means distinctly lower costs because the majority of the wind turbine's parts can be re-used. In addition to lower development costs, this means a firm basis in well-known, proven technology.

7% larger rotor

An example of upgrading a rotor is to be found in one of our latest projects for GE Energy. We developed a 40-metre-long blade for the company's 1.5 MW platform as a supplement to the existing 37.3-metre-long blade. This meant a 14% increase in the rotor area, providing a 7% rise in energy production and maintaining a rated effect of 1.5 MW.

Optimising loads

The challenge associated with developing new wind turbine blades is to keep within the turbine's load calculations, while at the same time ensuring the necessary clearance to the tower to prevent the blades becoming susceptible to damage during operation. When scaling up the blades, weight is an important parameter because less weight reduces the loadings and makes it possible to increase the length of the blades. By pre-bending the blades and fully exploiting the properties of the materials, we have achieved significant weight reductions as well as cost savings. Our most important tool in developing new blade designs is our own LM Blades software suite. "LM Blades makes it possible to carry out a considerable number of calculations for different design variants," says Project Manager Klavs Jespersen, who was responsible for two of the upgrading projects mentioned here. "This means we can fine-tune the relationship between performance and loads. Because we can achieve a solution that is close to perfect under any given conditions, we've been able to make significantly longer blades for our customers' existing turbines," he adds.

LM SuperRoot

Increasing the length of the blades also increases the root moment, i.e. the load on the blade root. "One of the prerequisites for being able to develop blades that are so much longer and also fit an existing platform is the robustness of our root concept – LM SuperRoot. The principle behind this root solution was developed in conjunction with developing the FutureBlade concept. This means the bolts that fasten the blades to the hub can stand more than the traditional root solutions. We can therefore design the blade root so that it can cope with more, without increasing the bolt circle diameter. This means reducing both materials and weight, thus keeping costs to a minimum. Our customers have an opportunity to mount larger blades on their existing turbines without having to make adjustments to the hub, and that makes it both an easy and attractive proposition to increase the turbines' annual production," says Mr Jespersen.

Great interest

These development projects are not one-off occurrences. "Our customers are showing increasing interest in scaling up blades for use on their existing platforms," says Jesper Månsson, head of technical customer support. "There's enormous focus on the financial aspects of wind farms and this means that wind turbines must produce as much electricity as possible and do so as cheaply as possible. And one of the most readily available methods of doing this is to increase production using existing types of turbines," he adds.

Examples of upgrading blades

REpower Systems was able to increase the swept area of an existing turbine by 13%. We developed a 40-metre-long blade to replace the existing one, which was 37.3 metres long. Similarly, Vestas increased the swept area of one of its designs by as much as 30% by replacing a 35-metre-long blade with one that was 40 metres long. In both cases, the manufacturer chose to increase the rated effect of the turbine, thus achieving the full outcome of the increased rotor.

Laser scanning of blades

One of the latest additions to LM Glasfiber's range of test equipment is the blade contour scanner for automating the process of measuring the geometry of the blade profile. This helps improve our quality assurance and product documentation procedures, as well as providing valuable data for developing new types of blades.

The tools we use to produce wind turbine blades are, like the blades themselves, made of organic materials. This means that they can be subject to change over time within the context of intensive serial production, especially when large temperature fluctuations are involved. Such small changes are usually very difficult to detect, and are normally impossible to see with the naked eye. However, the geometry of the blades – their exact shape, in other words – plays a crucial role in determining exactly how much energy they can produce.

To ensure optimal performance, we have been checking blades on a random sample basis for several years. In such checks, different points on the blade were measured and recorded to check that the finished blades met the specifications. This method was accurate, but it was also time-consuming and not entirely foolproof, because checking the blades and typing in the data were carried out manually.

In 2006, the blade contour scanner will become a permanent part of the quality assurance measures used by LM Glasfiber on all blades more than 30 metres in length. The prototype shown here is set up at the LM Glasfiber factory in Hammelev, Denmark.

Fully automatic scanning

In addition to now providing more reliable scanning, the specially developed blade contour scanner makes it possible to scan all the blades during the final quality assurance check, because scanning can now be done very rapidly.

By collecting data on a continuous basis, we are able to respond immediately and with great confidence if the geometry of a blade deviates from the specifications at any point. Our plan is to include the collected data in the documentation supplied with the blade, thus providing full traceability for our customers, the wind turbine owner and our R&D department. In other words, we will be able to document the exact geometry of each individual blade.

"Blade contour scanner technology is unique in many respects," says Jørgen D. Vestergaard, team leader at LM Glasfiber. "Geometrical measuring is currently a procedure that is largely carried out manually, and is not yet an integrated part of serial production," he continues. "We're now taking the first step in that direction, however. The scanning is done with the aid of cameras that register the exact coordinates for where the laser beams hit the blade surface. Specially developed software stores and analyses this information. The method has just been evaluated and verified by both in-house experts and external specialists. We therefore have full assurance for the validity of the data we pass on to our customers," concludes Mr Vestergaard.

3-D scanning

An important part of the blade contour scanner is the software. This enables our technical staff to see the blade geometry in 3-D, and turn and rotate the finished blade in relation to the theoretical design parameters and blade specifications, enabling an analysis of the minutest deviation.

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Keeping blades off radar screens

Wind farms and radar systems can be a dangerous cocktail. When wind farms are set up near airports or radar installations, there is a risk that the towers and moving blades can resemble aircraft on the radar screens operated by both civil and military aviation authorities.

Methods for dealing with this problem involve setting up an additional radar installation that can cover the area on the other side of the wind farm. This makes it possible to combine the signals from two radar systems on one screen. It is also possible to install a virtual barrier in the system. This modifies the radar's scanning area and renders the wind turbines invisible to the radar beam. A third method involves so-called stealth technology – using specially developed materials that prevent detection by radar to make the wind turbine blades and tower.

However, simpler and more effective alternatives are also available. BAE Systems – the British aerospace and defence company – has developed software that is currently the best solution to this problem. Implementing this program into existing radar systems, along with the use of additional hardware, avoids expensive changes to wind turbine technology or investments in additional radar systems.

This program is called Advanced Digital Tracker (ADT). It can eliminate unwanted signals caused by wind farms and other large structures, without affecting the signals the system actually needs to operate as required. ADT can be adapted to suit local topographical conditions and the position and layout of the individual wind farm. The ADT system was developed by BAE Systems working in close collaboration with the British Wind Energy Association and different government organisations.

For more information, go to www.bwea.com.

Special software can eliminate false positives caused by wind turbines from appearing on radar screens.

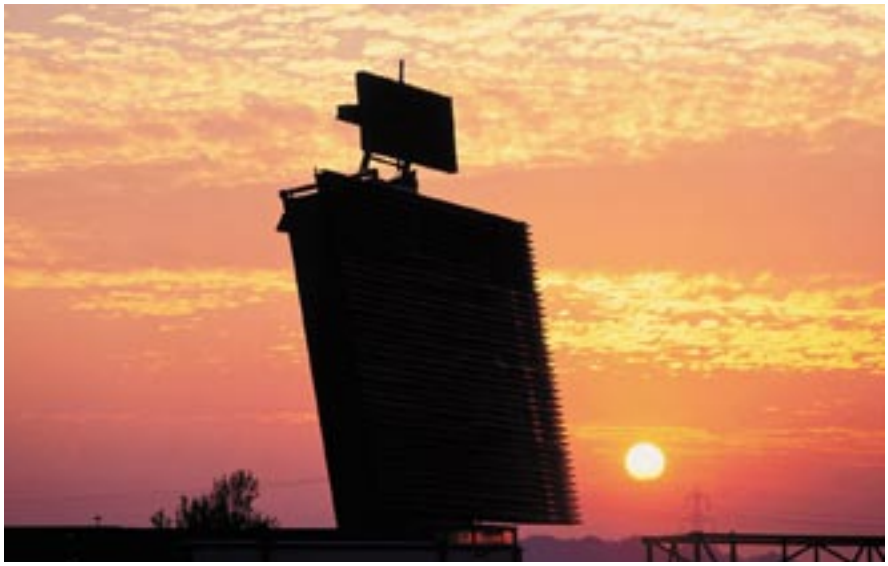

Photo: BAE Systems

Did you know that …
if you increase the swept rotor area by 20% and maintain the turbine's rated effect, you will achieve an annual production increase of 10%? However, if you also increase the turbine's rated effect, energy production will increase in proportion with the larger swept rotor area.

Did**You**Know