

Climate change, the hottest issue.

Climate change is the most serious threat the planet faces and a hot potato in the hands of the world community. Scientific research has indicated that if the Earth's temperature rises by more than 2°C above pre-industrial levels, climate change is likely to become irreversible and have long-term consequences such as rising sea levels, fresh water and food shortages, and extreme weather - heat waves, droughts and flooding - causing physical and economic damage. Since 1850, the global temperature has risen by 0.76°C, and Europe is warming even faster than the global average: temperature has increased by about 1°C.

Global greenhouse gases emissions, the root cause of rising temperatures, increased by 70% between 1970 and 2004. The culprits were the energy supply sector with a 145% increase of emissions, transport with 120% and industry with 65%. In addition, changes in land use resulted a 40% drop in the capacity of forest to capture carbon dioxide emissions? Unless there is a global commitment to reducing greenhouse gas emissions, a further temperature increase of 1.8–4.0°C is forecasted to take place this century while a worst case scenario could result in a 6.4°C temperature increase according to an international panel of scientists convened by the United Nations (UN).

The challenge is global as economies around the world could go into decline as a result of the cost of dealing with a different climate, regardless of their historical greenhouse gas emissions and contribution to climate change. To prevent the world reaching a 2°C increase, which is generally believed to be the tipping point, global emissions will have to be stabilised by around 2020 at the latest and then cut to around half of their 1990 levels by 2050.

The Kyoto Protocol, agreed in 1997, marked the first time that the developed world set a target for the reduction of greenhouse gas emissions: 5.2% for the period between 1990 and 2012. While the 15 European Union (EU) member countries collectively committed to an 8% reduction in their emissions, the United States did not ratify the protocol and is therefore not formally contributing to the objective. Over the past decade, the EU has successfully pursued economic growth and greenhouse gas emission reductions simultaneously. While the EU economy grew between 1990 and 2006, the overall emissions of the 27 member countries fell by 10.8%.

To meet its obligations under the Kyoto Protocol and set an example for other countries in the run up to the UN Conference on Climate Change (COP 15) next December in Copenhagen, the EU has agreed to cut its own greenhouse gas emissions by at least 20% by 2020 regardless of what other countries do. "Climate change is not the only reason but also long-term security of supply, innovation and economic growth," says Hans Jorgen Koch from the Danish Energy Agency.

Nevertheless, the EU considers that industrialised countries should collectively cut their emissions of greenhouse gases to 30% below 1990 levels by 2020. The costs of this action are relatively limited, especially in comparison with the expected cost of damage climate, as annual economic growth would be reduced by less than 0.2%. But "the world cannot tackle climate change unless both the developed world and the developing economies are part of the solution," says Connie Hedegaard, Danish Minister of Climate and Energy. Developing countries, such as China and India, will also need to chip in.

Europe's "20-20-20" targets

Taking serious note of apocalyptic predictions for the future, and the need for a unified approach, Europe wants to lead the fight against climate change. In December 2008, the European Parliament voted to adopt the Climate and Energy Package, which provides a framework for Europe's transformation into a low-carbon economy over the coming decade. The agreement sets legally binding targets to reduce greenhouse gas emissions by 20%, to increase the share of renewables in energy consumption to 20% and to improve energy efficiency by 20%, all by 2020.

European Commission President José Manuel Barroso, a strong supporter of the Climate and Energy Package, firmly stated before the vote that "The transformation of Europe into a low-carbon economy is a way to build a stronger Europe. The costs of climate change, if we don't make adjustments now, can reach up to 20% of GDP annually according to the Stern Review, but we can limit the cost of the Climate and Energy Package to 0.5% of GDP. The EU Climate and Energy Package is part of the

solution both to the climate crisis and to the current economic and financial crisis.”

The adoption of the Climate and Energy Package brings big economic opportunities if the EU exploits its first mover advantage. For example, achieving a 20% share for renewable energy could mean the creation of more than a million jobs in this industry by 2020, a tempting figure especially as Europe enters a severe recession, which will cost thousands of jobs in conventional economic sectors. At the same time it raises energy security across Europe, which is dependent on imports for around 55% of its energy needs, a number that could rise to 70% by 2030. The EU could also save up to €50 billion in oil and gas imports by 2020.

The agreement positions Europe as the first region in the world to commit to such ambitious targets, and is considered to be an important contribution towards a comprehensive international climate agreement to be reached by COP15. For example, from 2013, an emissions cap will be set at EU level and greenhouse gas emissions to be cut to 21% below 2005 levels by 2020, however, the Climate and Energy Package contains a clear offer to commit to a 30% cut in greenhouse gas emissions if a fair and effective deal is reached in Copenhagen. “I can think of no clearer way of showing the world that Europe is prepared to walk the walk, as well as talk the talk,” concluded President Barroso. His perspective was strongly supported by Stavros Dimas, EU Environment Commissioner, “The adoption of the Climate and Energy Package sends a clear signal to our international partners about our determination to address climate change and should convince them to follow our example.”

Times of change for the electricity industry

Central to the successful implementation of such an ambitious EU policy is the European electricity industry. Hans ten Berge, Secretary General of EURELECTRIC, the Association of the European Electricity Industry, confirmed his industry’s support for the 20-20-20 targets outlined in the EU Climate and Energy Package on the condition that market based instruments are used rather than subsidy schemes for renewables. “The electricity industry could become a carbon neutral environment,” he confirmed. “De-carbonization is not a threat for the electricity industry, it is an opportunity that will be challenging to realize.”

Over the past decades, changes in the electricity production sector have been more evolutionary than revolutionary despite new technology introductions. Although coal and hydro power remain important energy sources for electricity generation, they have been joined by nuclear power, oil and gas, and renewable energy over the past decades. The European electricity industry is consistently looking for the most competitive generation sources and firmly believes that the availability of a complete portfolio of de-carbonized generation assets is the critical success factor.

The introduction of a price on CO2 emissions could make it more economically sensible to focus future investment on CO2 free technologies such as nuclear and renewables rather than fossil primary resources. In the long term, nuclear is one of the most economic supply technologies, however, the questions of public acceptance and the long term impact of nuclear waste material are destined to remain. On the other hand, the cost figures for renewables resources are steadily improving, and EURELECTRIC believes that it is certain that renewables will occupy an important place in future electricity supply. “Onshore wind power has already become a competitive energy source, and offshore wind will also become very profitable,” Ten Berge confirmed.

At this moment, renewables are subsidized through feed-in tariffs and the EU counts twenty-seven subsidy systems. But EURELECTRIC is saying that investment in renewables should not be driven by subsidies. “Renewables have a fair chance to compete in a market that should be driven by realistic carbon prices,” explained Ten Berge. “However, if renewables are subsidized and provide securities that are not available for any other generation source then our members will use those feed-in tariffs. Nevertheless, we question whether a twenty year price guarantee is the right way to organize your business.”

While EURELECTRIC forecasts tremendous growth for renewables, wind energy has already taken up Europe’s number one spot in terms of new power capacity. According to statistics released by the European Wind Energy Association, last year 8,454 MW of wind power capacity was installed in Europe, accounting for 43% of all new electricity generating capacity installed and positioning wind power ahead of all other power generating technologies including gas, coal and nuclear power. In

response, Hans ten Berge emphasized that achievement of the wind industry should be placed into context: "Only a complete portfolio of generation assets will drive us to the lowest cost electricity generation that is completely carbon-free at the end of the day."

Due to the global economic crisis, de-carbonization has accelerated in recent months which has resulted in a collapse of the carbon price has fully collapsed. "The question is whether it is worthwhile for the European electricity industry to be a frontrunner rather than a follower in the de-carbonization process. Politically it has been decided that we will move forward, but if only the European electricity industry is making this commitment it would be a waste of money," warned Ten Berge. "If the money spent by the European electricity industry on de-carbonization triggers other countries and industries to join in the future then I think we are doing a good job."

The wind industry to hit Europe with a sweeping blow

The European Union has 3.5% of the world's proven coal reserves, less than 2% of the natural gas, less than 2% of its uranium and no more than 1% of the world's oil, according to the European Commission. With such scarcity of mineral resources and such an energy-intensive society, it won't come as a surprise to anybody that the Old Continent has turned its attention towards an intangible yet powerful source of energy blasting across its geography. Europeans have many names for them depending on whether they originate: Sciroccos, Tramontanas, Mistral or Helms, but all of Europe's winds are equally relentless, powerful and cheap.

"Today, wind energy is a mainstream option, and probably the cheapest way to produce electricity," boasted Professor Arthouros Zervos, who serves both as Chairman of the Global Wind Energy Council (GWEC) and President of the European Wind Energy Association (EWEA). Last March, at the European Wind Energy Conference, he announced that EWEA had increased its 2020 target for installed wind energy capacity in the EU from 180 GW to 230 GW, including 40 GW offshore. Currently, wind power accounts for about 4.2% of the EU's electricity demand, but the 2020 projection will enable wind power to meet 14-18% of EU electricity demand, which equals the electricity needs of about 135 million average EU households.

Andris Piebalgs, EU Energy Commissioner, underscored the rising prominence of the wind industry when he stated that "wind energy can replace a large proportion of the polluting and finite fuels we currently rely on. Those who still think that wind energy will never be more than a "marginal" energy source are, themselves, rapidly being marginalised. It makes good sense to invest in indigenous sources of power which hedge against unpredictable fossil fuel prices and in which Europe has a real competitive advantage."

"EU companies hold 66% of the €35 billion global market for wind power technology, and we should urgently develop, promote and export it to the best of our ability," emphasises Professor Zervos. The European wind industry should aim to be present in as many markets as possible, and it should continue to drive the industry's innovation process. The wind industry has globalised rapidly over the past five years, and the European wind turbine manufacturers will have to follow this trend."

Wind industry is going global

But it is not just Europe capitalising on its fresh gales. The GWEC predicts that in 2013, global wind generating capacity will have reached 332 GW, primarily driven by tremendous growth in China and steady expansion in Europe and North America. During 2013, 56.3 GW of new capacity will be added to the global total, more than double the annual market in 2008. Moreover, wind power is on track to supply 10-12% of global electricity demand by 2020.

The GWEC's Secretary General, Steve Sawyer, believes that China is on its way to overtake Germany and Spain to reach second place in terms of total wind power capacity in 2010. Sawyer highlights that the prospects for future growth in the Chinese market are very good as new installed capacity is expected to nearly double again in 2009. Encouraged by the booming wind power market in China, the Chinese manufacturing industry is becoming increasingly mature, stretching over the whole supply chain. "For the Chinese manufacturers, 99% of their focus now is on the home market, but in the coming 5 years they will certainly be exporting overseas," he predicts.

Sawyer became the first Secretary General of the Global Wind Energy Council in April 2007, after having spent 30 years working for Greenpeace. Following his experience as CEO of both Greenpeace USA and Greenpeace International, for which he served as Head of Delegation to many sessions of the Kyoto Protocol negotiations, Steve Sawyer became an expert advisor to the Chinese government on the formulation of the country's Renewable Energy Law, which entered into force in 2006.

The Global Wind Energy Council, headquartered in Brussels, Belgium, serves as the voice of the global wind energy sector and has the mission to ensure that wind power establishes itself as one of the world's leading energy sources. Its members include the major national, regional and continental associations representing the wind power sector, as well as leading international wind energy companies and institutions. Its corporate membership covers turbine and component manufacturers, project developer, power generation companies, financial institutions and consultancy firms, as well as researchers, academics and associations. GWEC represent all the world's major wind turbine manufacturers and 99% of the world's installed capacity.

Also Professor Zervos, Chairman of GWEC, believes that excellent manufacturers will emerge in China in the coming years. "Perhaps three or four will become formidable competitors in the international marketplace, while other Chinese manufacturers can open new markets in Africa and Latin America where offering the turbine prices will play crucial role in doing business. We have realised that Chinese manufacturers are competing at price levels that are below those of the international manufacturers producing in China. However, if Chinese turbine manufacturers want to enter mature international markets, they will have to compete on both price and quality," he says. This will raise prices, he reflected, but Chinese turbine manufacturers may still end up being cheaper, which could have the positive effect of lowering prices for entire sector.

Born and raised in Denmark

Denmark is undeniably the cradle of the modern wind turbine industry, but in 1975 there was no indication that the country was heading for decades of industry dominance. The main reason for this was that Danish Government stimulated the creation of a market when it passed a law that gave direct subsidies to investment in wind energy in 1979, which was also the year when Vestas started manufacturing wind turbines.

At the time, Birger T. Madsen had been working for Vestas for seven years, and he became the head of the company's first wind turbines production department. "Similar activities were taking place in European countries such as the UK, The Netherlands, and Germany. The difference was that the Danish government created market stimulation and established public R&D projects to develop prototypes of wind turbines. This was the key to our success," he recalls. After fourteen years at Vestas, Mr. Madsen founded BTM Consult feeding the industry with specialist industry analysis and forecasting.

Today, Denmark is the only country in the world to have achieved a penetration of wind energy of 20%, which will be the 2020 renewable energy target for the whole of Europe. Nevertheless, Mr. Madsen emphasizes that Denmark cannot rest on its laurels as the wind industry becomes global. "It is absolutely crucial that we justify why two of the world's leading wind turbine manufacturers, Vestas and Siemens Wind Power, should stay headquartered in Denmark in the years to come," he recognises.

"Unfortunately, the Danish Government has not sufficiently supported the wind power market in recent years," reckons Henrik Stiesdal, Siemens Wind Power's Chief Technology Officer and a pioneer who also entered the Danish wind industry in the 1970s. "Today, the Danish wind industry is facing a challenging situation since its home market has disappeared. Danish turbine manufacturers are no longer able to generate their first volumes in close geographic proximity where they can properly monitor the operation of their new turbines."

Following the demand, Denmark's leading turbine manufacturers, Vestas and Siemens Wind Power, have internationalised their operations. Vestas is widely considered to be the only truly global player in the industry, while Siemens is rapidly developing its international presence by opening manufacturing facilities in the US and China. This leaves the highly developed Danish sub-supplier base with the challenge of chasing their long time customers in the international marketplace. Having been a first

mover for three decades, the Danish wind industry is once again well positioned to set break new ground.

The end of the beginning of technological development.

Modern energy is the term that Vestas prefers to use for wind power in its efforts to put it at the top of the global energy agenda. "Basically, investing in wind power makes sense," starts Ditlev Engel, CEO of Vestas, the world's number 1. "Wind energy is a high-tech, innovative industry that has enormous long-term growth potential in China and around the world. The wind industry has been growing at 25% a year over many years and we continuously strive to enlighten people about the possibilities in the wind sector."

A closer look at Vestas' financial performance and investment plans confirms that wind investing in wind power makes sense. In 2008, Vestas posted a 24% increase in revenue, reaching a €6.0 billion turnover and a €668 million profit. Already the undisputed global market leader, Vestas is expanding capacity at breakneck speed: the company is planning increase its investment in new factories and development centres from €678 million in 2008 to €1.2 billion this year.

Specifically in China, Vestas sees great potential. "It can become a wind energy superpower because of its huge amount of untapped wind energy resources," explains Mr. Engel. "It is also clear that wind energy has massive potential for both energy security and carbon abatement in China, as it can increasingly compete with coal in terms of cost." In 2005, Vestas management decided to move into China. At that time, new installed capacity in the Chinese market represented no more than 311 MW of which Vestas delivered 77 MW. Only four years later, China accounts for Vestas' largest investments outside Denmark, with five factories and 1,800 employees, a number that is forecasted to increase to 3,000 in 2009.

All Vestas suppliers in China are part of a partnership designed to increase product quality and performance. "We strongly feel that helping to build local capabilities in wind energy is vital to building a strong Chinese wind energy sector. Through programs like six sigma, we are helping suppliers to become globally competitive and capable of delivering high quality products to the entire wind power industry," Mr. Engel states. As a result, his company's China-produced turbines currently have more than 80% Chinese content. Vestas had the ambition to develop turbines with 100% Chinese content in the future, and the fact that Zhenshi Group Hengshi Fibreglass Fabrics Co., Ltd., won one of Vestas' "Supplier of the Year" awards in 2008 illustrates the progress that is being made in the Chinese market.

Vestas has made the strategic decision to concentrate its R&D activities in Denmark, Singapore, India, the US and the UK. "We have chosen those areas because they are close to the main markets in North America, Europe and Asia," justifies Ditlev Engel. "To access the best brains in the world, we have to be present in the main regions. We know that we need to increase our R&D presence in our biggest markets and that includes China. As we expand our presence in China through building more factories, we also intend to develop our China-based innovation capacity and R&D presence to contribute to the ongoing development of the Chinese wind energy industry and the localisation of Vestas China."

Wind power industry is travelling at high speed across the globe, and yet Ditlev Engel's view is that the wind industry is at the end of the beginning of its technological development. "Unfortunately, people have a tendency to compare the kWh cost of different energy sources without featuring the cost to society and nature," he notes. "Governments around the world are injecting around US\$ 600 billion a year to support the fossil fuel industry. "With 1400 people in R&D, Vestas is the largest R&D centre in this industry, but if you compare this with the R&D capabilities of the established fossil fuel industry we are a very small organisation. One could imagine the impact of putting the same kind of determination and resources behind wind energy and other clean energy sources. There is a clear realisation among scientists that something different must take place. It is not enough to ask governments to put money on the table; this needs to be backed up by research institutes and universities. It will be an ongoing journey because it takes time to educate people to work with this type of energy."

Vestas' focus on China as a key global market has resulted in a strong commitment to sharing its 30 years of industry experience and expertise with China, ranging from counselling on policy to turbine sitting, grid integration, supply chain development, human resource development and technology and

R&D. "It is very important for Vestas that we play a strong role in supporting China's efforts on sustainable development and reducing carbon emissions," Engel stresses. "When such an important player in the world as China is supporting this agenda it means that we can reach global solutions. The solution is in the mirror. We are all responsible for the future of the planet and the health of the environment that we give to our children and grandchildren."

Betting on one's strengths

Like Vestas', Spanish manufacturer Gamesa's success story reinforces the increasingly spread belief that going with the wind is a business both financially and ethically rewarding.

Gamesa had to bet on it to become the world's third largest wind turbine manufacturer with a global market share of around 15%. Gamesa was a multi sector company devoted to aeronautics, services, solar and wind when Guillermo Ulacia, a former executive in the automotive industry, was appointed as CEO in December 2005. Considering the shared vision of the shareholders, board of directors and employees he defined a roadmap to strengthen Gamesa's focus on wind power and set the pace of the transformation process.

"We defined four key action strategies to execute our business case. The first one was to focus on key accounts, meaning key clients and key markets. The second was to build a very competitive supply chain worldwide. The third one was ensuring that we can bring technological breakthroughs to the market, and the final one was spinning-off all activities where we were not on a leading position," remembers Ulacia. "The main issue was determining how to select key clients and how to define our core markets."

Right now, Gamesa has 50% market share in its home market Spain, and its challenge is to become the leader in other markets. Going beyond the European borders, the company was a pioneer in making the decision to enter China where Gamesa sold its first wind turbines in 2001 and became the market leader in 2004. Three years ago, Gamesa selected both China and the US as top priorities and opened factories in both countries.

Guillermo Ulacia's business case proved to be highly successful over the past few years. International markets contributed 61% of Gamesa's total sales of 3,600 MW, and the company set a new record for deliveries in the last quarter of last year. Gamesa's net profit rose by 45% to reach €320 million in 2008 as sales increased by 27% to €3.551 billion.

Gamesa has one of the most integrated supply chains in the wind industry. "We produce gearboxes, blades, nacelles and generators at our manufacturing centre in Tianjin, where we also have an assembly plant for main wind turbine generator components. To optimise our time to market while reducing manufacturing cost we have incorporated the Synchronous Manufacturing System in our Tianjin Manufacturing plant, which is the first time in Gamesa's history that we implement this new production system ... transportation is not a challenge and local content is not an issue for us since components representing 45% of the total cost are manufactured in-house while the remainder is stored on site," boasts Ulacia.

Even if others try to do the same in the future, Gamesa thinks it's in pole position in China vis-à-vis foreign and local manufacturers. "Gamesa is not competing with Chinese suppliers. I think that we should replace the word competition by cooperation. We have worked with many clients in China, and our close relationship with Longyuan Electric Power Group Corporation is a good example of successful cooperation. We are not focussed on Chinese companies closing the gap; our challenge is to keep our competitive advantage through innovations such as the Gamesa G10x turbine with 4.5MW of unitary power, our new product platform of which we recently launched a prototype, as well as innovations in the manufacturing processes. China's commitment to be greener is a clear advantage for all of us."

Successful companies are born smart

Somebody has to think differently. After numerous entrepreneurial ventures, the last one being a textile business, Tulsi Tanti decided that it is best to avoid developed industries with strong competition from established players. The continuous struggle with the availability of energy that

affected the textile industry inspired Mr. Tanti to look at ways to secure his energy supply to create a competitive edge. Shortly after he found that wind energy was the best solution for textile business, and two wind turbines were established, realised that this was the future not only for his textile company but for the whole textile industry, the whole country, and even the whole world.

Fourteen years later, Tulsi Tanti is the Chairman and Managing Director of Suzlon, the world's fifth largest wind turbine manufacturer operating in more than 21 countries. "When we started in 1995, the size of the Indian wind market was 50 MW per year: Banks and financial institutes were unwilling to finance wind projects, and the Government not investing because it felt that wind power was capital intensive and not economically viable. We changed the business model, provided end to end solutions, developed country-specific plans, convinced governments and bankers and in the first year completed a project of 3.5MW: ten small 350 kW machines. We demonstrated that wind power works and today the Indian market represents 1800 MW per year, making it world's third largest market in terms of new installed capacity in 2008, after the US with 8358 MW and the Chinese with 6300 MW, and before Germany coming in behind with 1665 MW," reflected Tulsi Tanti. "In 1995, nobody recognised the potential of the wind industry, but when we introduced our company to the stock market in 2005, we had transformed the industry and our stock was sixty times oversubscribed. We have sent the message to the global economy that this is the future of the energy sector."

In 2003 Suzlon decided to start exploring international markets because it had gained a 50-60% market share in India and there was no more room to expand domestically. "India represented only 10% of the world market, and we wanted a share of the other 90%," proclaimed Mr. Tanti. They first entered the US market, then China and Europe. "In China, we understood the domestic needs and low cost requirements related to having to compete with local Chinese manufacturers. We established a large manufacturing base, transferred our technology, developed local engineering local talent, and established a domestic supply chain. From the beginning we strived to become a truly Chinese company." To penetrate the mature European market it acquired REpower, a German-based frontrunner in large turbines for offshore wind facilities.

Suzlon also acquired Hansen Transmissions, a Belgian specialist in the development of gearboxes that is well positioned in the multi-megawatt segment and has a global market share of 24%. "It is important to point out that Hansen Transmission as a gearbox supplier operates completely independently from majority shareholder Suzlon, and serves companies such as Vestas, Gamesa, and Siemens," noted Ivan Brems, CEO of Hansen Transmissions. "The aim of Hansen, with the support of Suzlon, is to serve all turbine manufacturers requiring gearboxes. We have recognised that both the Indian and the Chinese market are crucial for Hansen." Its entry into India was definitely facilitated by having Suzlon as a majority shareholder, but also in China Hansen Transmissions has been able to benefit from Suzlon's experience. "We see very clearly that China is going to boost our market share," continued Mr. Brems. "There is a learning curve that many of the smaller players in China will have to go through. They will have to make the migration from small kilowatt sized gearboxes into multi-megawatt gearboxes which have to be produced in serial production."

In March 2009, Hansen Transmissions started the assembly and testing of gearboxes at its €200 million integrated manufacturing plant in China, which is expected to have a yearly production capacity of up to 3,000 MW once completed in April 2011. These expansion plans complement Suzlon's approach based on manufacturing every component locally. "We simply add our technological knowledge to the value chain," explained Mr. Tanti. In China, we have companies along the value chain, the Chinese equivalents of Hansen Transmissions and REpower. The products we manufacture in China are made specifically for the Chinese market."

Tulsi Tanti believes that neither China can be useful as a manufacturing base for the Indian market, nor can Indian products be successful in the US or European market. "There are completely different product ranges. The basic technology philosophy is the same, but it is very important to have a local manufacturing base in the markets where you are selling your technology. Use the local talent, engage the local business partners, develop the local supply chain and customer networks, and use local banks. Then, you are a part of the local economy, and you can engage with the local government. This will give you sustainable business development."

"I strongly believe that China will be the world's largest wind power market within three years," he continued. "For us, it is extremely important not just to look at China as a market, unless we conquer

the Chinese market, we can never become global player. Our business plan is very clear: develop our technology in the European market, train our staff in the Indian market, and grow our business in China. This allows us to sell German technology at a Chinese price under the Suzlon brand name in China. In 2007, our turbine prices were 15% higher than local Chinese prices. Last year, we were only 10% more expensive, and this year 5%. We aim to be at par by 2010, but without losing the technology and the reliability. China is not just for the market for us, but is the key to becoming more competitive.”

The host of COP15 is showing the way

Connie Hedegaard has been Denmark’s Minister for the Climate and Energy since November 23,2007. Before this appointment she served as Minister for the Environment and Minister for Nordic Cooperation in the Government under Prime Minister Anders Fogh Rasmussen. The Ministry of Climate and Energy was created to place more emphasis on energy, renewable energy and climate initiatives, and enhance international climate diplomacy, in the run up to the United Nations Climate Change Summit that Denmark will host in December 2009. Minister Hedegaard explained how Denmark aspires to show the way towards fossil fuel independence as the world prepares to meet in Copenhagen for COP 15.

Denmark is often presented as a model for the advancement of the climate change agenda, what makes Denmark a unique success story?

Denmark has succeeded in achieving economic growth while being serious about the climate change agenda. Since 1981, Denmark has experienced a 75% increase in GDP and at the same time we have kept the energy consumption almost stable. Moreover, Denmark has outpaced the rest of the world in the expansion of the renewables component in its energy mix over the past decade, but we can go even further. The proportion of renewable energy is to be increased to 20% in 2011 and is expected to reach 30% in 2020, well ahead of the overall EU target of 20%. Our long-term vision is becoming completely independent of fossil fuels, and we are currently assessing which technologies will have to be developed to realize this vision, which choices will have to be made, and what the cost will be.

How can a relatively small country like Denmark with a particular expertise in this field cooperate successfully with a country as large as China? In the sphere of renewables and energy efficiency Denmark has a lot to offer to China, but what can it learn from China?

Only five or ten years ago, European business people anticipated that China would become the manufacturing powerhouse of the world, but that Europe and the United States would add value through research, development and design. I think that people in the United States and Europe are now starting to realise that China is rapidly developing its design, research and development and innovation capabilities. So far, our strongholds have not been threatened by China and our climate change efforts have been largely complementary. Of course, it is interesting that today already around 60% of the world’s wind turbines are manufactured in China and maybe the primary thing that we could learn from China is that this is no time to rest on our laurels despite the success that we have achieved already.

In December 2009, Copenhagen will host the United Nations Climate Change Conference (COP15) where the world will have to agree on the successor of the Kyoto Protocol. Which arguments will Denmark use to push the world leaders to agree?

As we address climate change we are also improving our energy efficiency, energy independence, and energy security, so there are many benefits coming with taking climate change seriously. Just reaching an agreement is not a success; we need to reach a good and ambitious agreement. We will do whatever we can to keep the common denominator where it needs to be, and that requires all the major economies to contribute somehow. Of course, the world cannot tackle climate change unless both the developed world and the developing economies are part of the solution. Countries that are trying to protect the industries of yesterday have misunderstood that the challenge is to reposition them as the industries of tomorrow, and I have absolutely no doubt that China is preparing for this. Besides the country’s climate change concerns, China will increasingly engage in these negotiations to pursue its own interest. It is fantastic that China has succeeded in bringing 300 million people into

the middle class in a very limited scope of time, but to sustain this kind of growth in the future, the country will have to address pollution problems, environmental problems, water problems, climate change problems, and energy efficiency challenges to guarantee the stability of China.

Government regulations driving Denmark's energy revolution

"The Danish Government wants to be at the forefront of the environmental wave and therefore Denmark committed to a 21% reduction of CO₂ emissions by 2012. However, realising this commitment is the responsibility of the energy sector because the Government itself does not reduce emissions," starts Anders Eldrup, who had been working for the Danish Government since the oil crisis in the 1970s until he became CEO of Dong Energy, one of Northern Europe's leading energy companies.

To understand Denmark's green ambitions we have to go back to the first oil crisis in 1973. In those days, more than 95% of Denmark's energy need was met by oil coming from Saudi Arabia and the country had put 'all eggs in one basket'. By 1973 Danish policy makers decided to diversify the energy mix, invest in wind energy and energy saving. Denmark today has a very strong wind industry; the world's leading turbine manufacturers, and the most efficient coal fired power plants in Europe. These developments were paramount as Denmark decided not to pursue nuclear energy.

"We have some success stories that we are really proud of," emphasised Mr. Eldrup. "We will be one of the first companies that can produce second generation bioethanol, we are the first country in Europe to introduce electric cars at a large scale, and we have succeeded in the use of biomass in our power stations, meaning that they are not either gas or coal stations but multi-fuel power stations in which the choice of fuel can be changed according to the pricing." Dong Energy is the world leader in the installation of offshore wind parks. "We have built half of all the offshore wind parks in the world to date, and have a great project pipeline," he continues. Due to the high population density in Europe the use of offshore wind turbines in large wind farms has tremendous growth potential, despite their high price. "We are proud of our power plants, our achievements in biofuels and our offshore parks. All of these successes have been possible because we have been forced by our Government through very strict regulation," he admits.

If tough government regulation has been the driver of Dong Energy's success then the future looks promising. Compared with 1990, Dong Energy's carbon quotas have been reduced by 43%. "This means that either we have to pay high penalties by buying carbon credits, or invest in CDM projects to generate our own carbon credits. Therefore, we have strong interest to participate in projects where we can acquire carbon licenses," underlined Anders Eldrup. "After 2012, carbon quotas will be reduced from 43% to 100%; there will be no free allocations. We have been investing in about 50 projects so far, and maybe we should be even more energetic in this regard since the need for European companies to go for CDM solutions will substantially increase after 2012. This will be good news for developing countries."

The electricity generation sector is based on long-term investments, so the shift towards de-carbonised power generation will be gradual as investment patterns change. "Today, 15% of the power that Dong Energy produces comes from renewables and 85% comes from fossil fuels. Over a number of years we have to reverse this equation, which will represent a dramatic change of the business. Tipping this equation towards renewables is sort of an industrial revolution."

On the road to make Denmark a better place

The main challenge to realise Denmark's vision of becoming completely independent of fossil fuels is the development of storage solutions for wind energy. "Could we use batteries of electrical cars?" asked Minister Hedegaard of Climate and Energy. "Yes, we can!" must have thought Dong Energy when teaming up with Better Place, an American company that is trying to introduce electric cars worldwide with the goal of ending our dependence on oil for transport, while addressing the renewable energy storage challenge at once.

The idea is that storing the excess electricity on windy days or during the night when consumption is low in the batteries of electric cars will enable the country to contend with the unpredictable fluctuation in electricity production. "At the same time, we can make the transport sector, which is our most

polluting sector, run on wind power. We have seen a strong interest among both the general public and the politicians after we announced our electric car initiative. People want electric cars," Eldrup confidently says.

After convincing Anders Eldrup of the potential of electric cars in Denmark, which will be Better Place's first venture in Europe, the company appointed Jens Moberg as Chief Executive Officer of Better Place Denmark. "Electric cars will have to be able to fully replace conventional cars with something more than a green manifesto, as people will expect the same comfort, safety, performance and the autonomy that the combustion engine cars offer today. The first car that we will offer will be an electric version of the Renault Laguna, which is also a good idea from a customer adoption point of view. People also want unlimited range. We are offering 160 kilometres now, but idea that we are providing allows battery swap. We have a working prototype of a battery changing station in Israel that changes the battery of an electrical car in less than three minutes, which is less time than it takes to refuel your car with gasoline. People who drive less than 160 kilometres a day will every morning have a fully loaded car, which cannot be said for combustion engine vehicles," summarises Moberg.

DONG Energy will be the preferred supplier of renewable energy to power the network of Better Place. "Our goal in investing in Better Place Denmark is to help Denmark reduce its CO2 emissions – fully switching to electric vehicles would enable Denmark to reduce its CO2 emissions by 17% – and increase the consumption of sustainable energy by capturing and leveraging wind power more efficiently," concludes Eldrup. Expect to see the first cars hit the road by 2011.

Innovative companies go green

Combating harmful emissions is the duty of all, but also an opportunity to do business for creative companies from any sector of the economy. As an innovation focussed company, Denmark's Novozymes is constantly looking for new possibilities to apply its enzymes and expanding the enzyme market. The company uses enzymes to improve the development bioethanol, a mature and proven technology which Steen Riisgaard, who serves as President & CEO of Novozymes, tips as the likely winner in the race with competing technologies such as syngas and Fischer-Tropsch to set industry standards for low-carbon fuel technology.

"First generation bio-ethanol can be made from a variety of organic materials including biomass and the traditional feedstocks, starch and sugar crops, such as sugar cane, corn, wheat, barley, rye, sorghum, cassava, or even rice for that matter," explained Riisgaard. "Brazil, a very large player in the bio-ethanol market, develops sugar cane based bio-ethanol which unfortunately does not require enzymes. However, most other countries, such as the US and China, are investing in large scale bio-ethanol production based on breaking starch into sugars for practical purposes. In this type of production, enzymes serve as biological catalysts in the form of proteins that catalyze chemical reactions that enhance the conversion of starch into sugar. Since our specific set of enzymes breaks long chains of sugars in the most effective way, we hold the lion's share in this segment of the global enzymes market."

The next step is second-generation bioethanol, also called cellulosic ethanol, which is based on the use of agricultural waste, cellulosic biomass, for the same process. Long chains of glucose will be broken up by enzymes, just as with starch. However, while nature developed starch as an energy source that could be readily mobilized, cellulose is designed as a structure component that is not easily degradable. Therefore, Novozymes is developing enzymes that can effectively break down cellulose. "Other companies are trying to do the same but we are way ahead of the pack. In 2010 we will be ready to provide the world with the enzyme technology for commercially viable production of second-generation bio-ethanol," predicted Riisgaard. "Not only can second-generation bio-ethanol reduce greenhouse gas emissions by at least 90% when compared to oil-based fuels, it can also create millions of jobs in China and reduce the country's dependence on imported oil." The Chinese government set a target of 15% biofuels by 2020, which Novozymes believes to be achievable especially if China goes for second generation bio-ethanol. The company has teamed up with COFCO, which recently built the best enzymes facilities in the world in Manchuria, to bring second-generation bio-ethanol to the market in China.

Last April, Novozymes and COFCO entered into a new partnership with Sinopec to accelerate the development bio-ethanol from agricultural waste, and together the three partners cover the entire

value chain of bioethanol production and distribution. Steen Riisgaard concluded: "This partnership puts us one step closer to being able to produce commercial quantities of bioethanol from agricultural waste. Second-generation bioethanol production in China holds vast potential for Novozymes as the technology leader, and we expect to be the first company with enzymes ready for large-scale production by 2010."

The greenest energy is the energy that you do not use

While, undoubtedly, technological breakthroughs are a must in the fight against climate change, energy intense societies can not succeed in this ambitious task by simply putting up more and more 21st century windmills or populating vast extensions of land with solar panels. Structural and behavioural changes leading to more energy efficiency play also a key role, or as Niels B. Christiansen, the new President and CEO of Danish company Danfoss, puts it bluntly: "It doesn't help us much to put up a lot of windmills if we keep on wasting energy while using it."

Danfoss was more or less founded as a company with a strong focus on energy efficiency. In 1933, Mads Clausen established Danfoss in Nordborg, a small peninsula in southern Denmark, and that is where this family-owned, privately held company with 23,000 employees globally is still located today. "I think we will keep the headquarters in the area where the family founded the company, which really doesn't influence how global we think," says Christiansen. Today, Danfoss, specialised in the components and controls for district heating systems, operates in three major fields – refrigeration and air conditioning, heating, and motion controls – based on the belief that the greenest and cheapest energy is the energy that you are not using,

The biggest and most visible milestone in the history of Danfoss was the introduction of radiator thermostats in the beginning of the 1970s following the first energy crisis and its devastating effects in Denmark. Given Denmark's geographical location, the country spends a lot of energy on heating in the wintertime and by putting radiator thermostats on all heating radiators people could save between 20% and 30% of their energy consumption. Very quickly legislation to support radiator thermostats was created in Denmark, which was subsequently adopted throughout Europe.

"If we forget about the financial crisis for 30 seconds, developments in the world can be split into three underlying trends: globalization, the climate change problem and rising energy prices. It is likely that these long term trend will continue well into the future. The climate challenge, as well as rising energy prices, translates into the need to be more energy efficient because that is the easiest way to limit CO2 emissions. Politicians should make it very clear that a lot of the solutions and technologies that we need to combat climate change are already available. We don't have to wait for new technologies and innovations, the solutions are there but for different reasons they are not being utilized. The business community must make that visible to governments around the world," Christiansen emphasizes.

A good example of this, he says, is district heating which is a very energy efficient solution. A normal power plant operates at around 40% efficiency. A part of the 40% of the energy is transformed into electricity might be wasted by inefficient air conditioning systems or other applications that do not use energy efficient compressors, but 60% of the energy generated by burning fossil fuels is lost while creating CO2 emissions at the same time. "By connecting the power plant to a district heating system, we can immediately increase the efficiency of the power plant from 40% up to 80-90%, which basically enables you to capture free heating. Since it uses energy that would otherwise have been lost, district heating is being now looked at as a renewable energy. It is important to create a thorough understanding in society that this source of heating is actually freely available by combining power plants and district heating systems," he says, and he volunteers a recommendation: "China, Danfoss' second home market, could gain tremendously from pushing the application of district heating, as well as introducing legislation for the energy efficiency of buildings to ensure that all buildings use radiator thermostats."

JV to deliver direct drive technology in China

While on average of 90% of wind turbines are gear-driven, Dutchman Gerry van der Sluys was charmed, intrigued, and realized the golden opportunity he was given when his company Business Creation acquired the Intellectual Property Rights to all strategic know-how of wind pioneer

Lagerwey's direct drive technology, embodied in ten key employees, following the bankruptcy of the company.

Direct drive wind turbines are a relatively new technology where the turning turbines drive a generator directly, as opposed to the traditional gearbox configuration in which gears connect a low-speed shaft to a high-speed shaft and increase the rotational speeds from about 30 to 60 rotations per minute to about 1,000 to 1,800, which is the rotational speed required by most generators to produce electricity. As a result of the lower maintenance costs, direct drive technology offers a wind energy solution with a lower cost of ownership, therefore generating electricity at more competitive prices.

"We approached the magic of the Lagerwey technology with pragmatic realism and recognized that it would take quite some time until we could successfully commercialize it," explained Van der Sluys. He created Emergya Wind Technologies (EWT) to develop and market the direct drive technology under the DIRECTWIND brand name based on a growth strategy consisting of different phases. "Until last year, we were still in the start-up phase. Today, we find ourselves in the second phase of development which encompasses the sale of a larger volume of turbines. This year will be a critical year, because this is the moment when we have to deliver," stated Van der Sluys.

Foreseeing the success of the adventure, the Chinese Academy of Launch Technology (CALT), entered into a joint venture with EWT in June 2008. "We can develop a territory faster by working with a strong joint venture partner," explained Gerry van der Sluys. The joint venture aims to install over 1000 MW of EWT wind turbine capacity in China over the next five years based on the current DIRECTWIND 750 and 900 series as well as a 2 MW turbine that is currently under development. "We took quite some time to look for a suitable partner in the Chinese market, and we selected CALT because of its experience in the wind industry, its solid experience in engineering and manufacturing and because it is a financially very strong partner. Our joint ambitions create a win-win situation."

EWT has gradually expanded its installed base and further developed the direct drive technology by improving and standardizing the 750 kW design and developing and certifying the 900 kW model for on-shore turbines, called the DIRECTWIND 750 and 900 series. To enter the more mainstream market and gain overall market share we are also developing a 2MW turbine that will become available in 2010. The company sources components from different places around the world. Bulky items such as generators or blades are normally manufactured and sourced locally, whereas other items are sourced from suppliers that have the most appropriate products. "This also allows for a certain extent of localization of our turbines. For example, we deliver a cold weather version of our turbine for Inner Mongolia in China, while we can also supply a wind turbine optimized for installation in the Sahara desert. The configuration of our turbines is designed to tolerate the use of different suppliers, but, of course, it is never an uncontrolled difference that could affect the quality of our product," Van der Sluys emphasized.

Depending on the development of the global economy and EWT's ability to keep its new product introductions on schedule, the company has developed different growth scenarios for the coming five years. "Our ambition is to reach €1 billion turnover within this period of time," forecasted Gerry van der Sluys. "However, we always have believed in values that go beyond revenue generation and shareholder value. We want to be a successful manufacturer that satisfies all stakeholders, and are not under pressure to generate this level of revenues by a certain date."

Freedom to convert the business

The boom in green alternatives to oil and gas has positioned power generation systems for the renewable energy sector as a core area of application for forward-thinking power engineering companies. "It was quite logical and natural for Converteam to enter the wind industry because wind turbines are based on rotating machines," notes Pierre Bastid, President and CEO of French Converteam. "Five years ago, when we were part of Alstom, there was absolutely no business in the wind industry. We entered this industry three to four years ago, and today it is our main activity within the energy sector, which represents around 20% of our total order intake. In only four years, Converteam has become a major supplier to the wind industry with more than 5.0GWs of low voltage and medium voltage power conversion systems delivered annually, and a continuously expanding product including converters, direct-drive generators, power electronics, inverters, collectors,

infrastructure to transport electricity to the grid, as well as high temperature superconductivity technology that is currently under development,” Bastid boasts.

When Bastid joined French energy and transport infrastructure specialist Alstom in February 2004 he recognised the potential of Alstom Power Conversion, a €500 million business that played a relatively small role within Alstom’s multi-billion euro portfolio. “Large groups are generally not very good at managing small and complex businesses, and as a result Alstom Power Conversion was not living up to its full potential and was eventually the subject of a spin-off,” Bastid says. As the own name of the new company suggests, Bastid “converted” the business; He brought in people from other industries looking to amalgamate the organisational skills and professionalism required to run large organisations with the flexibility and agility of small companies. Then, he set off on a mission to transform Converteam into the world leader in power-conversion engineering.

Converteam defines itself as a specialist in power conversion, which 90% of the time involves large rotating machines such as electric motors or generators. The company has centred its mission-critical solutions to convert electrical energy into mechanical performance and vice versa, around three core components: rotating machines, variable-speed drives, and process automation and controls. Historically, Converteam had focussed on core markets in marine, oil and gas, energy and industry.

Ironically, in the process of generating energy, even green one, a lot of energy is lost. Each of the steps leading from the transformation of mechanical energy into electricity up to its transportation into the grid, creates an opportunity for electricity losses, explains Bastid. As wind farm developers strive to minimize the cost of energy in order to optimize the return on investment of the wind farm, Converteam takes a systematic approach; “Our job is to try to minimise the electricity losses, maximise the yield and maximise the return on the investment.”

Converteam believes that the wind industry is still in its inception and that there’s plenty of opportunity out there, namely in China. The nature of its business encouraged the company to target emerging markets while also anticipating changes in the technology used by the major players in mature markets. “While strengthening our position in Europe, Converteam has taken a leading position in the wind-generation market in China,” Pierre Bastid underscored. His company has won major contracts with DongFang and a number of other large Chinese wind turbine makers in the past years and has the objective of selling more wind converters in China than anywhere else in the world.

The perfect offshore wind turbine is up for grabs

To own or not to own; that is the question, when it comes to patenting an invention. As Converteam understands the role of ownership when designing the perfect offshore wind turbine, the company has developed, in addition to its cooperation with leading players such as DongFang and Siemens Wind Power, a privileged relationship with Dutch wind turbine manufacturer, which is positioned to introduce the next generation of offshore wind turbines. As a significant shareholder, Converteam shares Darwind’s believe that offshore will play an important role in the future of wind power generation. Darwind strives to become a major global supplier in the offshore wind by designing the absolute wind turbine for offshore conditions. “We would never enter the onshore market. It is the main market for the world’s leading turbine manufacturers, and there are already more than fifty Chinese newcomers in this market segment, so the market is very saturated. We are focussed on the new market,” explained Vincent Van den Brekel, founder and Managing Director of Darwind.

He built Darwind from scratch after he realized that existing offshore wind turbines were simply marine versions of onshore turbines. Darwind’s design is based on a 5 MW offshore turbine with direct drive technology, permanent magnets, a single main bearing, innovative blades, a fully sealed nacelle and an integrated management control system. The direct drive technology that was invented in the 1980s by Henk Lagerwey, the founding father of the Dutch wind industry, is at the core of Darwind’s technology platform.

When Van den Brekel wrote Darwind’s business plan three years ago, it was focussed on Europe, because there were no offshore projects in the rest of the world. In the meantime, the wind industry has rapidly globalized, and Darwind has expanded its geographic orientation. “Our main focus is the UK, which is destined to become the largest offshore market in Europe. But in the future, we expect

serious developments in China, South Korea, United States and Brazil,” confirmed Van den Brekel. We will focus on places where it happens, because we need to be there.

Even before it has installed its first offshore turbine, or turned its first profit, the future of Darwind is already highly dependent on who will be its owner in the coming years. “In order to become one of the leading companies in the offshore market, we need to ramp up quickly,” recognized Van den Brekel. “By 2014, we are planning to install 200 turbines annually, and the intention is to reach 235 by 2016. In order to achieve this growth we have to become part of a major industrial company. Siemens entered the wind industry by acquiring Bonus, GE bought Enron, and Vestas took over MG Micon. All of these companies were start-ups that were acquired by large industrial groups because the wind industry is an attractive industry. Perhaps Goldwind wants to buy us because they are also focused on the offshore market. We are not only focussed on what our target market and technology development, but also on which shareholder would best position us to become a global player.”

An early mover in the China's offshore wind market

“Bonus installed the first real wind farm in China, completed for the fortieth anniversary of the establishment of the People's Republic on October 1, 1989. Before that, the company had already put up individual wind turbines in China as far back as 1986,” boasted Henrik Stiesdal, Chief Technology Officer of Denmark's Siemens Wind, who spent the majority of his career at Bonus. “While Bonus had been active in China for decades, it was essentially a regional company when it was acquired by Siemens in 2004.”

Bonus turned out to be the ideal fit at the right time, so when it became Siemens Wind Power it embarked on a rapid international growth strategy. “The transformation from a regional company to a global company takes time,” noted Andreas Nauen, CEO of Siemens Wind Power. Under his leadership, Siemens Wind Power decided to enter new markets such as the US, and to re-enter markets such as China where they had been inactive for several years. “When you are in the sixth position in the world then the question is how to get into the top three,” he stated. “Of course, the answer was and is through organic growth.” The wind business today represents around 10-15% of Siemens' €19 billion environmental portfolio.

The offshore market is destined to play a central role in the growth ambitions of Siemens Wind Power. The company pioneered the offshore installation of wind turbines with the world's first offshore wind farm at Vindeby, Denmark, installed in 1991. Since then Siemens Wind Power has become the market leader in the offshore wind market with a track record of notable projects including Nysted Havmøllepark, Burbo Offshore Wind Farm and the world's largest offshore wind farm under construction, Greater Gabbard. Moreover, DONG Energy and Siemens recently entered into the world's largest offshore wind turbine agreement under which Siemens is to supply up to 500 3.6MW wind turbines to DONG Energy's coming offshore wind farms in Northern Europe.

Nauen believes that his company has to offer something in China that is different from what the forty or fifty competitors can offer at the moment. “Vestas and Gamesa were early movers in the Chinese onshore market, we are determined to become an early mover in the country's offshore market. By applying our 18 years of offshore experience in China we can establish a clear leadership position,” anticipated Nauen. “We have the knowledge and the right product.”

Offshore wind; how to carve a niche in the open seas

Another Danish company has become a leading provider of consulting services for offshore wind projects. Ramboll entered the wind industry in 1986 ‘by accident’, and based on its experience in the oil and gas industry specialised in the development of new foundation ideas for offshore wind turbines before the offshore wind industry took off. According to BTM Consult, offshore wind represented 1% of the world market in 2007, and will grow to 4.5% to 5% of the market in five years. This means that offshore wind will remain a niche market, which will therefore not benefit from the economies of scale enjoyed by smaller turbines.

The cost of foundations of 5 MW or 6 MW turbines, which are currently becoming the offshore standard, will be crucial for the success of the offshore market. Minimising the required number and unit cost of foundations for offshore projects creates a clear advantage, and by relying on its in-house

software Ramboll is able to do just that. “We design and customise each foundation in every offshore wind farm, and this really does cut costs for a project,” confirmed Søren Juel Petersen, Managing Director of Ramboll Wind. “Dedicating 80% of our activities to structural design, we believe that the biggest mistake that companies can make is basing the design of offshore foundations on onshore best practices. Designing foundations for offshore purposes requires different ways of thinking.” Given the scale of offshore wind farm development, and the fact that wind and environmental conditions are different for every location, standardisation is not the low cost solution in this case.

Ramboll is not counting on the development China’s tremendous offshore wind potential in the coming years. “Offshore is still our niche market and this explains why we’re not more active in China yet,” concluded Mr. Petersen. “Perhaps one day we will open an office in China to support the development of the Chinese offshore market.”

The root of the matter

Not many of us may yet have had the opportunity to see an offshore wind park at first hand. But, close your eyes and picture this: rows of towers up to 120 metres tall, with 60 metres-long blades sticking out in the middle of a sea storm. May sound futuristic but this is one of the realities of today’s wind power industry. Making sure that these super heavy structures can not only stand but also maximize the effects of constant high-speed winds is a challenge which begins at the very bottom, for the wind turbines need to be extremely well rooted.

“The foundation of offshore wind turbines is often a monopile drilled or hammered into the sea bed. Each monopile is overlapped by a transition piece upon which the wind turbine is installed, and developing a sound connection of the two elements is both crucial and challenging,” says Finn Thor Hansen, CEO of Densit, a manufacturer of cement-based construction materials based in the north of Denmark’s Jutland Province. Of course, he immediately offers his company’s own solution: “Due to its extreme properties Ducorit grout has emerged as the most reliable and cost effective connection between the monopile and the transition piece, providing both strength and flexibility in design. The process is carried out by filling the annulus between the transition piece and the pile with pumpable Ducorit, a cement-based special grout that can be pumped through flexible hoses for application both above and below sea level using standard processing equipment,” he details. It takes just 24 hours, he goes on to explain, for the mix to develop 50% of its strength, which is sufficient to mount the rest of the wind turbine.

The development of the Densit ultra high strength cement based materials in the 1960's was unique, and patent applications for the Densit technology were filed in all major industrial countries in the world. Ducorit is based on 25 years of technological development based on the Densit technology, as well as the company’s experience in the strengthening of offshore structures in the oil and gas industry.

“We really saw that there was tremendous opportunity to become an efficient and competitive foundation concept provider for offshore wind turbines, and today the wind industry makes up about 25% of our business,” emphasized Mr Hansen. “Since 2000, we have grouted transition pieces to driven monopiles at 18 offshore wind farms, and concept has become the offshore industry’s preferred solution, covering more than 70% of the installed capacity today.”

“The offering of engineering and installation service in combination with the grout gives us a unique positioning in the industry as our competitors are focussed on one of these two components,” added Densit’s CEO. “We handle all phases of offshore foundation projects, from engineering and planning, supply of grouting material and installation, to test sampling and documentation.”

Densit has recently started to target the onshore wind industry as well, which accounts for over 98% of the combined market. Alternative solutions like a rock socketed-monopile foundation, where steel piles are grouted into a socket drilled into the rock, have also proved extremely effective with Ducorit. “Based on our successful experiences with grout connections offshore, Densit has developed a Ducorit grout solution which connects onshore wind turbines directly into gravity foundations,” confirmed Finn Thor Hansen. “As the wind industry gradually expands offshore, we will bring innovation to the onshore market.”

The first Sino-Danish first joint venture is in “control”

kk-electronic started to consider China as an important market in 2006. "Siemens Wind Power, our biggest customer, asked us to help them building their business in China. When we were travelling around China many local companies approached us and expressed their interest in working with kk-electronic. At the time, we were growing 40% per year and it was essential to focus on our existing customers," explains Tommy Gundelund Jespersen, CEO of kk-electronic. "Therefore, I made the decision not to enter China alone but rather through a joint venture, and we were the first Danish company that decided to go for this model," he continues.

After travelling to China 16 times over the course of a year and a half, kk-electronic establish a joint venture with CSIC Chongqing Qianwei Instrument & Metering Factory. This joint venture, under the name kk-Qianwei, is China's first dedicated company for developing and manufacturing control systems for wind turbines. CSIC Chongqing Qianwei Instrument & Metering Factory is a state owned company with 180,000 employees that already has ten years experience in working with a European joint venture partner manufacturing gas meters. "Haizhuang, one of the companies of CSIC Qianwei, is manufacturing 850 kW and 2 MW wind turbines," explained kk-electronics' CEO. "The 50-50 joint venture company will supply control systems to Haizhuang but is also allowed to work as sub-suppliers for other turbine manufactures which gives us an excellent positioning. kk-electronic see the partnership with CSIC-Qianwei as a great opportunity to establish a base for the emerging and lucrative Chinese market." kk-electronic has a strong focus on technologies and solutions, while its partner CSIC-Qianwei has a detailed market insight and manufacturing capabilities. The joint venture started by opening a 130.000 sq meter factory in Chongqing and hiring 100 employees, a number that is forecasted to increase dramatically.

Gundelund Jespersen made the shift to kk-electronic and the wind industry, after a career in Bang & Olufsen, FiberVisions, and LEGO. Created in 1981 kk-electronic gradually moved from simple to complex control systems with built-in remote monitoring and reporting. The first thing that really caught Gundelund Jespersen's attention was the entrepreneurship that can be found in this industry. "When I was appointed as CEO of kk-electronic, in 2004, the wind industry was still a relatively young and undeveloped industry that had to be industrialised and then globalised," he reflected. "This company, with 200 employees, was developing a new control system for every project. The lack of standardisation and structured processes really caught my mind."

The quality issue was a second surprise. "Then the whole industry's approach to quality was out of focus, there were problems with many components while the market demanded increasingly efficient turbines. The industry was continuously upscaling to bigger turbines while in my mind it never took the time to optimise existing turbines," added Mr. Jespersen "That is what we are seeing in China at the moment, where companies have very ambitious plans but they might run into problems if there is no increased focus on quality and optimisation of existing turbines."

"Our overall long-term focus will be on the offshore wind market, because kk-electronic is one of the only control system supplier that is experienced in offshore control systems," Mr. Jespersen proclaimed. "Technology-wise we are ahead of both the Chinese and international offshore control system suppliers, a competitive edge that is strengthened by the fact that we are simultaneously a Chinese company serving the Chinese market and a Danish company satisfying its European customers in China."

The wind industry is just getting started

Mankind has used the power of wind for centuries. Farmers have used windmills to pump water or grind grains and now, in its most modern form, their rotating blades are being used for generating electricity with presumably lesser environmental effects. Today, 20% of all energy in Denmark comes from wind power, 13% in Spain and 8% in Germany. Wind power has just passed 1% of global electricity production, so the world is where Europe was 7 years ago. "This should send a strong message about the global growth that we are expecting in the coming years. Why shouldn't we be able to repeat what we have achieved in Europe and in other countries? The European model is really good and the wind industry is just getting started," says the CEO of the European Wind Energy Association (EWEA), Christian Kjaer.

Germany, Spain and Denmark had traditionally been the largest wind power markets in Europe.

During the 1980s and 1990s, Europe's wind industry was dependant on a few markets and therefore highly exposed to the boom and bust cycles associated with the introduction and termination of governmental subsidy schemes for wind power. Now, the industry is much more geographically spread, and, in the coming years, EWEA expects the majority of growth to be coming from outside Europe, particularly from China, India and North America.

"European wind turbine manufacturers have since captured two-thirds of the global markets, and some of the rapidly growing Chinese manufacturers are using European technology," boasts Kjaer "China presents an opportunity for the European wind industry to confirm that wind power is capable of delivering large amounts of installed capacity within a short time. At the moment, the Chinese market is growing so fast that there is going to be enough market in China for everyone and the challenge is ramping up capacity there."

"There has been a very close relationship between the European Wind Energy Association, the Chinese Wind Energy Association, and Chinese politicians over the last five years," states Kjaer. He argues that China can take Europe as an example of what can be done in a relatively short time." It took 20 years before wind power represented 1% of the European electricity mix by 2001, but only 7 years later we had reached 4%. Wind power will supply 5% of Europe's electricity in 2010 – the market share of wind power in electricity generation is currently increasing by 0.5% per year and growth continues to accelerate – and will reach at least 12% by 2020."

EWEA wants Europe to be the continent of wind power, and hopes that the vast Chinese landscape will find in modern wind turbines an inspiration as well as a practical solution to the unresolved equation pitting economic development versus environmental protection.

One-stop shop for the global wind industry

As leading turbine manufacturers internationalise their production, the burgeoning European sub-suppliers are being confronted with the challenge of preserving their status as preferred partners in the face of stiff overseas competition. The choices are to physically follow their customers wherever they might go or to stay put in their well-known quarters and learn to manage the new situation by remote control, through complex logistic strategies. "The biggest challenge is how to bring some of the sub-suppliers' production and competences into a global landscape. The question is whether sub-suppliers can gain easier access to the global market through cooperating or by facing all the challenges individually," says Jan Hylleberg, Managing Director of the Danish Wind Industry Association.

The Danish Wind Industry Association has 194 members, of which 120 are within one hour's driving distance from the city of Silkeborg, including global leaders such as Vestas, Siemens Wind Power, Suzlon, Gamesa and Nordex. The typical company in the Danish wind industry has between 10 and 50 employees, and sub-suppliers employ two-thirds of the total workforce in the Danish wind industry. "Our very experienced Danish customers fit easily into the burgeoning Chinese market," noted Peter Nyegaard Jensen. He founded Wind Cluster in January 2008 to support Danish manufacturers and sub-suppliers reach these new opportunities in China. "We realise that retaining our market leader requires not only world-class technology and top quality but also constant improvements in logistics, service, global presence and competitiveness. There are obviously many challenges facing European suppliers and sub-suppliers who want to work with the Chinese manufacturers, as well as Chinese companies looking to operate in the international marketplace, but Wind Cluster provides an answer," he boasts.

With offices in Silkeborg in Denmark as well as in Beijing, and plans to establish a presence in the US and India in 2009, Wind Cluster markets and sells electronics and electromechanical products and services to the global wind industry and offers sub-suppliers global sales channels and a presence on all markets. "Wind Cluster will gather small and medium-sized companies with unique products and services as well as growth potential, and facilitate synergy effects in innovation, process competence, and global production," explains Jensen. "We will take responsibility in the global sales and marketing, presenting products of the participating cluster companies and relevant agencies as one strong entity in the wind industry."

"We also manage the logistics supply chain, and can help SMEs to kick-start production and sourcing from countries that offer a cost advantage. This is a unique opportunity for small and medium sized

sub-suppliers to become a vital part of our partnership,” notes Jensen. “Similarly, when Chinese manufacturers want to order several different components from Europe, we can organise this and ship the components together in one package to China. In short, we can help these companies to establish their supply chain and find them the right sub-suppliers.”

Of course, big players in China like Dong Fang, Sinovel and Goldwind already have well-established supply chains, but there are many newcomers which still are logistically limited,” recognises Jensen. “This saves these companies who don’t have much experience in Europe a lot of hassle. We facilitate production, and that is what makes our company interesting even for large manufacturers.”

As a one-stop shop for the global wind industry, Wind Cluster strives to achieve status as the wind turbine manufacturers’ natural supplier of choice for electronics and electromechanical products and services. “We want the production engineers and purchasers of wind turbine manufacturers who are looking for certain components to think first of Wind Cluster,” concludes Jensen. “Moreover, by playing a central role in the globalisation of sub-suppliers Wind Cluster and its partners are serving as a catalyst for the maturing of the Danish wind industry.”

Danish management philosophy bonds with Chinese culture

“As the turbine manufacturers moved from Europe to China, we needed to move with them,” Claus Nielsen of Betech Seals admits. Founded in 1922, Betech Seals is one of the market’s leading suppliers of gaskets, seals, mouldings, bellows, vibration dampers, and sheet metal working. The company is part of Addtech Transmission AB, which in turn is part of the Swedish listed company Addtech AB. In the beginning of 2007, Betech Seals entered China by opening Codan Tech Qingdao, which operates as the Asian sourcing centre of sales, production and procurement for Betech Seals in China.

“A large part of the group consists of trading companies, but Betech Seals and Codan Tech are a little bit special because they have a high proportion of in-house manufactured products in their portfolio,” Claus Nielsen states proudly. He serves as President of Addtech’s Polymeric Solutions business unit, as well as Chairman of both Codan Tech China and Codan Tech Denmark. Codan Tech and Betech Seals have complementary business strategies. The former is more focussed on the rubber moulded parts niche while the latter has a wider range of polymeric products and as a full line supplier can serve a wider market.

Claus Nielsen identified two incentives to move into China. On the one hand, the opportunity to benefit from moving established production from Denmark to China to cut cost for distribution and sales in Europe. On the other hand, it enabled the company to serve large customers like Vestas, GE Wind and Gamesa requiring parts that are manufactured in China too meet the 70% local content requirement. “Through Codan Tech Qingdao we are now able to serve them with local products. At the same time, our experience can also support Chinese wind turbine manufacturers in their ambition to develop high quality, reliable wind turbines,” he says.

Betech Seals has successfully transferred part of production to Qingdao, where it applies the same technical skill level and quality standards as Denmark but benefits from more competitive pricing. “We combine Danish management style and Chinese culture, and have excellent foreign and Chinese employees,” states Peng Hui, who has been appointed as General Manager of Codan Tech Qingdao. “This creates a strong foundation to the company for exploring new China market and abroad market.”

The wind industry illustrates the diversity of Betech Seals’ product range. Betech Seals does not supply system solutions, but it offers a diverse range of specific mechanical components that are distributed all over the wind power generator. “We supply parts for the nacelle, the seals that are used around the shaft, vibration dampeners, metal parts that align the gearbox, components for the tower as well as the gaskets for the transition piece,” notes Nielsen.

In some economic sectors European manufacturers are producing products according to different quality standards for the Chinese and European markets. “Fortunately, we have not seen this lowering of standards in the wind industry. Components for wind turbines have been developed over a long time, so it is not easy to find a Chinese source that offers critical components of similar quality, especially in polymeric products where the use of different additives makes a big difference.

Nevertheless, our challenge is to make our offer competitive to ensure that our customers will not choose a local Chinese supplier,” recognises Claus Nielsen. “While Betech Seals pursues both customisation and standardisation within its product offering, its value proposition, both in Denmark and China, is based on the logistic and technical packages. “If products are easily substitutable there will always be a pressure on prices, therefore we distinguish ourselves through our complete product range of high quality products that enables customers to streamline their supply chain.”