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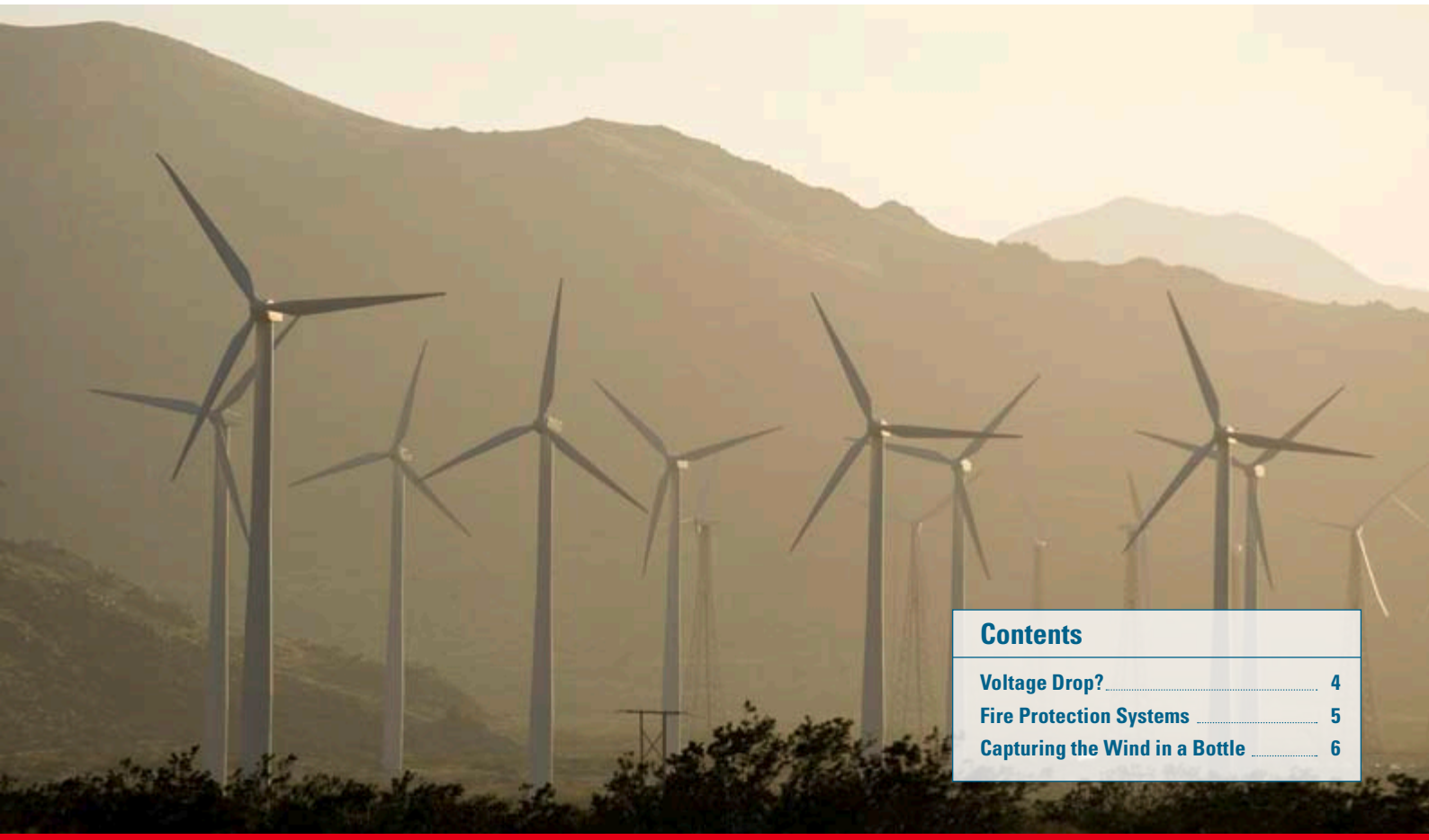
Wind Energy Newsletter for Customers and Business Partners Edition 2/2008



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Hélimax at Windpower 2008 in Houston, Texas: Dynamic Simulation of Utility-Scale Wind Farm Clusters

Dr. Dariush Faghani, Section Head Research & Development at Hélimax. **Date: 3 June 2008, 1.00 – 2.30 p.m. in Ballroom C.**
Please visit Germanischer Lloyd and Hélimax on their joint booth 2213 at Windpower 2008 in Houston, Texas.

Increasing wind market

New Energy for the New World

More than a quarter of the wind energy capacity newly installed in 2007 was installed in Canada and the US. After a number of setbacks in the past it looks like a long-term success story this time.

It is now the third year that the US has led the international wind market. Last year newly installed capacity increased by 45 per cent, exceeding 5,200 MW. For the international wind industry the US has become the most important market in the world. In terms of total installed capacity the United States is going to overtake Germany, the former "world champion", no later than next year with a total capacity of 22,000 MW. "We are experiencing a new start-up of wind energy," comments Edward Zaelke, former President and consultant of the American Wind Energy Association AWEA, on this development. "The question is whether the boom will last." A rhetorical question which Zaelke answers himself immediately: "This year ►

Photo: © iStockphoto

AMERICA IS A WIND ENERGY COUNTRY

"Westernmills" is the name of the windmills equipped with about 30 rotor blades that conquered mainly the West of the US and Canada in the second half of the 19th century. First they were used for pumping water, but from the 1880s they delivered more and more electrical power as well – up to one kilowatt per mill. By 1940 about six million windmills had been erected, and in 1980 about 100,000 of them were still in service.

The history of modern windmills in North America began in 1941, when a 1.25 MW plant was erected in the State of Vermont. However, only four years later it collapsed due to a rotor failure. Then nothing at all happened for a long time until the oil price shock of the 1970s triggered a true wind energy boom in the US. Huge wind farms with a total capacity of 1,500 MW were built, mainly in the West Coast regions. The rise of nuclear power, falling oil prices and the lack of interest of presidents Reagan and Bush senior brought this boom to a quick end in the early 1980s.

At the beginning of the new millennium the role of wind energy for North American energy supply has grown again. The development has speeded up since 2003, and from 2005 the US wind market has been the largest market in the world.

Historical windmill with 18 rotor blades.

Photo: © Vensys Energy AG

Many wind energy plants in Canada – such as this one in Springhill, Nova Scotia – operate under arctic conditions.

we expect 40 per cent market growth." In the long run AWEA forecasts a 20 per cent average annual market growth. In 2030 the total installed capacity would then reach the 300,000 MW mark.

The course has been set. It is not only individual states promoting wind energy by setting quotas, but also Washington. In early April the US Senate extended the tax credits for power generated from renewables (Production Tax Credit, PTC) until 2009 before it expired. That may seem a short-term measure by European standards, however in America this is almost considered to be a stable framework.

Yet this boom has its downside as well. Today the US wind energy industry cannot master the current growth alone. "America is a large market, and there are niches for your business as well," is what Friedrich Wagner, foreign trade expert of the North Rhine-Westphalian Ministry of Economic Affairs, told representatives of the German wind energy industry at a German-American conference in Cologne. His recommendation for the strategic approach is "Start small, but think big."

The European wind energy industry has been in America a long time. After some initial hesitation the European turbine manufacturers have not just entered the market, but they are also building the first production facilities in the US. Component manufacturers and service companies are also setting up their business. They make use of the serious lack of qualified staff, which is a major obstacle to the development of the American wind energy industry.

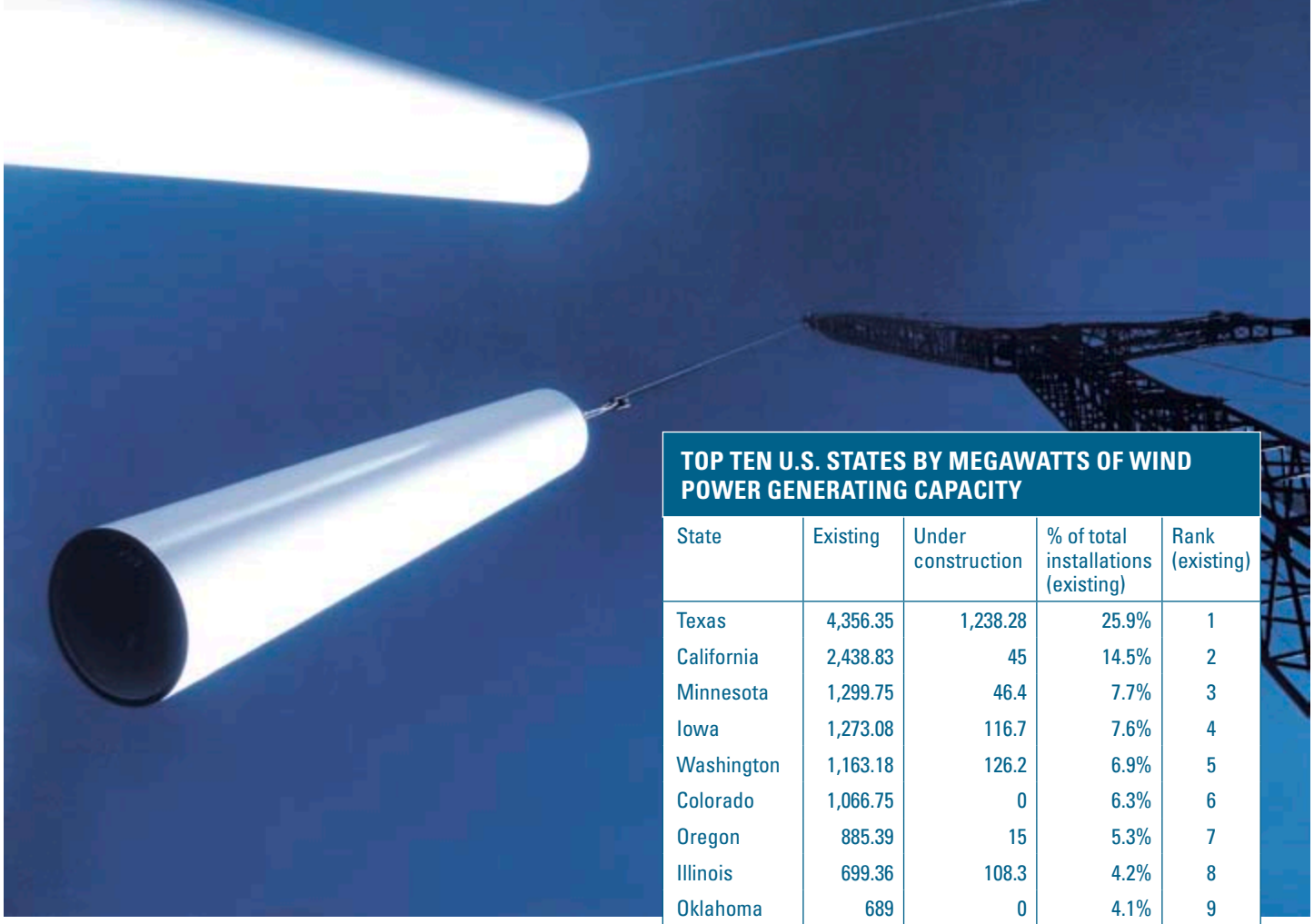
Another barrier which could impede the further growth of wind energy in the US is the insufficient power grid. It is especially the regional imbalance between generation and consumption that presents a challenge. In the plains in the Midwest there is much wind, but only few consumers.

Canada overcomes dent in growth curve

In Canada the development is promising, but far less buoyant than in the US. Currently the country is ranking as number 10 in the world list of market volume for 2007, but it has lagged behind expectations. Following the boom year of 2006 with just under 800 MW of newly installed capacity, the Canadian wind energy industry had hoped that market volume would reach the 1,000 MW mark. But at the end of 2007 the total growth was only 386 MW.

According to the Federal Agency for External Trade (bfai), which watches the wind market in Canada closely, the reasons were delays and uncertainties in the approval procedures. However the most serious problems have been the bottlenecks in the transmission grid which are similar to the US. Canada is a country with an extremely high per capita energy consumption due to the extremely long transmission distances, cold winters and hot summers. Energy consumption, which is already high, keeps growing at an annual

Photo: © Bundesverband WindEnergie e.V.



USA in wind euphoria: Last year the newly installed capacity increased by 45 per cent.

TOP TEN U.S. STATES BY MEGAWATTS OF WIND POWER GENERATING CAPACITY

State	Existing	Under construction	% of total installations (existing)	Rank (existing)
Texas	4,356.35	1,238.28	25.9%	1
California	2,438.83	45	14.5%	2
Minnesota	1,299.75	46.4	7.7%	3
Iowa	1,273.08	116.7	7.6%	4
Washington	1,163.18	126.2	6.9%	5
Colorado	1,066.75	0	6.3%	6
Oregon	885.39	15	5.3%	7
Illinois	699.36	108.3	4.2%	8
Oklahoma	689	0	4.1%	9
New Mexico	495.98	0	2.9%	10

(as of 31 December 2007)

Source: © Global Wind Report 2007

rate of two per cent. So there is fierce competition for free grid capacity. The wind farm operators' demands to be connected sometimes collide with the demands of nuclear power plants that were overhauled in order to compensate for the shutdown of old power plant capacity.

Ambitious expansion goals

In spite of last year's dent in the growth curve industry experts are in no doubt that Canada will in the medium term develop into a hot spot of the worldwide wind power industry. This is supported by the political will of the province governments, almost all of which have formulated long-term ambitious development goals. Take Ontario, for example: there is a plan by the energy authority (OPA) to add 3,000 MW to the existing installed wind power capacity of 460 MW. Robert Hornung, President of the Canadian Wind Energy Association CanWEA, says, "The plan is a vision. OPA has understood that wind energy will play an increasingly important role in the energy mix." ■

WHAT SUPPORT EXISTS FOR RENEWABLE ENERGIES?

USA:
Support mainly relies on two instruments. RPS is the abbreviation for "Renewable Portfolio Standard", the American version of a quota system. So far RPS has been the matter of the states. They oblige the power generation companies to cover a certain percentage of electrical power generation from renewable energies. The percentages vary between states, and in some states there is no RPS at all.
PTC is the Production Tax Credit. It reduces the income tax burden by 2 US cents for every kilowatt hour generated from renewable energies. This spring the federal government in Washington extended the PTC up to the end of 2009.
In addition various tax deductions are possible depending on the tax laws of the according state, and there is investment support for solar energy and fuel cells.

Canada:
Energy policy is a task of the provinces. In certain regions (e.g. Ontario or British Columbia) the feed-in price for wind power reaches the German level. Like the states of the US the Canadian provinces have formulated their individual renewable energy expansion targets. Support from the federal government is rather moderate: since 2001 the Wind Power Production Incentive Program (WPPI) has guaranteed wind energy producers CAD 0.01, and for newer plants CAD 0.008 per kilowatt hour (EUR 0.063 and EUR 0.05, respectively). Currently the budget for this support scheme is CAD 1.5 billion (EUR 1.03 bn).

GL IN NORTH AMERICA

Helimax, a holding company of Germanischer Lloyd headquartered in Montréal, Canada, is an independent consultant and expert company for wind energy (www.helimax.com). Helimax Renewable USA Inc. is working for the American market from its new office in New Berlin, Wisconsin.

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Measurement transducer installed in the WINDTEST equipment.

Medium voltage connection.

Spain

Voltage Drop?

From 2008 Spain is paying a higher price to wind farms that have grid stabilising properties. The requirement is that such wind farms must be able to cover a 500 ms voltage drop and should not be disconnected from the grid in the event of an interruption, but deliver idle current into the grid in order to stabilise. Now Spanish manufacturers are increasingly interested in proving these properties for their farms.

Vestas Mediterranean commissioned WINDTEST, a Germanischer Lloyd subsidiary, to conduct voltage drop measurements on the three Vestas turbines. The certification of the V90-1.8 and the V90-3 MW were obtained in December. And the V52 certification around middle January. The test of the V90 1.8 covers all the wind turbines of 2 MW (V90 2MW and V80 2MW) and the V90 3 MW were ready before the end of the year.

For over six years the WINDTEST experts have made measurements on wind turbines to document their behaviour in the event of a grid failure. For that purpose test apparatus installed in the medium voltage circuitry generates the fault. The test apparatus can generate a voltage drop with the required amplitude over the necessary time without affecting the grid too much. The apparatus, consisting of two sea containers with the according measuring equipment, was designed by FGH, a power supply research company. Measurements are taken at three measuring points in the container. Usually further signals in the low voltage circuitry and signals such as wind speed, rpm, torque, etc. are also recorded.
WINDTEST offers voltage drop measurements either as a package in line with the applicable guidelines and standards, or as individual measurements almost everywhere in the world. In addition the wind experts provide support in planning the measurements, taking the according grid connection guidelines into account. WINDTEST also offers measurements to optimise wind farms independently from guidelines and standards. ▪

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New Technical Note for Fire Protection Systems

Active fire protection is increasingly becoming the focus of attention for the wind industry. The design of new wind turbines and especially those for installation offshore, requires a high level of safety, and the protection of the wind turbine against interruptions in operation and even total loss.

The comprehensive "Technical Note for Fire Protection Systems of Wind Turbines" puts manufacturers, owners, operators, investors and insurers in the position of being able to minimize their risks and initiate corrective measures at an early stage. The technical note covers fire protection systems and the requirements for manufacturing companies. Safety concepts are considered as much as tests, periodic inspections and condition monitoring. Fire protection systems for wind turbines can detect and ensure the fast automatic extinguishing of a fire and achieve a minimisation of damage and hours of operation. In the technical note, unified requirements for effective and reliable fire protection systems for wind turbines and their certification are stated. In addition, methods for the certification of fire protection systems are introduced. It describes what kind of documents for a certification have to be presented.

Although fire in a wind turbine has serious consequences, active firefighting systems are not very widespread. Up until recently, fire protection was not a topic of discussion – but that has changed. The increase in hub heights up to between 80 and 160 metres have made effective fire fighting from the outside all but impossible. The discussion on active fire protection is likely to increase with the rising number of offshore installations. After all, the follow-on costs of fire damage at sea are much higher than on shore. Various insurance companies have already announced that they will offer reduced fire-risk premiums for turbines that have an automatic fire protection system.

In summer 2006, GL and the German Insurance Association (GDV) decided to cooperate and work out a concept for technical notes on fire protection systems for wind turbines. There was an active coordination phase by the members of GL's Expert Committee for Wind Energy (FA) and the GDV project group wind turbine. There were many meetings and coordinations between GL and GDV.

After the first project phase two technical notes have been worked out, differing in relevant aspects. The GL technical note describes unified requirements for effective and reliable fire protection systems for wind turbines and their certification. Methods for the certification of fire protection systems are introduced as well as what kind of documents for a certification have to be presented. The owner or operator of a wind turbines receives information on what kind of documents that are relevant for the certification have to handed in. The technical note from GDV describes the general conditions for the fire protection systems from an insurer's point of view.

In GL's technical note there are extensive descriptions on the certification process. Within the scope of quality management system check, the manufacturer shall prove that he fulfils the requirements according to ISO 9001 regarding construction and manufacturing. A fire protection draught has to be provided in vote with all partners. It shall be stated which safety class according to VdS 3523, table 2 "examples of the safety classes" should be reached. After finishing the certification of the fire protection system, a type certificate is created including information on the period of validity and possibility of re-certification. The period of validity for a type certificate for a fire protection system covers two years. ■

If you would like to receive a copy of the new technical note for fire protection systems, please contact:

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Photo: © REpower Systems

Capturing the Wind in a Bottle

Wind energy is not an entirely dependable source of power. This fact is constantly used as ammunition by the renewable energy sceptics. After all, a modern industrial society needs reliable sources of energy: only with the aid of conventional power stations can the gaps arising during lulls in the wind be closed properly.

Flywheel energy storage system from Enercon.

Photo: © Jan Oelker

For years now, scientists have been working on diverse concepts for reliably storing the energy harvested from wind turbines. Thus far, compressedair and pumped storage as well as the use of gigantic battery depots have been considered. There now appears to be a trend towards compressed air energy storage (CAES) as a "power warehouse". About two years ago, the utility company Energie Baden-Württemberg (EnBW) started the planning phase for an EU-funded project involving a compressed air storage facility in Lower Saxony.

Whenever their electricity is not required immediately in the grid, some large power stations feed their energy to pumping stations, which push water up to storage dams situated on a higher level. When the energy is needed again, the water is allowed to flow back down, driving hydroelectric turbines in the process. Since such facilities are usually located in mountainous areas, they are poorly suited for storing the energy produced by, for example, offshore parks or wind turbines close to the coast. By contrast, a CAES plant makes use of the energy packed in compressed air. A compressor is used to create the high-energy air and then squirrel it away in an underground salt cavern, for instance. The whole air reservoir is closed off by a valve, which can then be opened during periods of peak demand to let the air drive a turbine. Such plants may seem far-fetched, but they already exist: in the US State of Alabama and also in Huntorf, Lower Saxony. There, the first compressed air energy storage plant in the world was set up in 1978 to collect the electricity produced during the night by the Unterweser nuclear power station, in the form of air at a pressure of 70 bar, and then transform it back to electricity during the day to serve the peak loads.

Unfortunately, such plants are quite wasteful – the Huntorf facility offers an efficiency of just about 42 per cent. When the air is compressed, the compressors must be cooled considerably by burning fossil fuels; when the air passes through the turbines, they have to be heated, otherwise they would immediately ice up, owing to the high pressure drop. The special feature of the new EnBW plant is that the engineers intend to apply "adiabatic state changes" in developing a method to boost the efficiency to 70 per cent. In concrete terms, the aim is to buffer the heat generated by the compression process so that it can be utilised during the expansion phase for preheating the cavern air to the turbine inlet level. In addition to the components normally required to build a compressed air energy storage plant – compressor, cavern and turbine – the adiabatic system also needs a heat storage tank. This is a decisive factor in achieving the higher efficiency, because it means the plant can function without the additional combustion of fossil fuels. Admittedly, this scenario – with a capacity of 100 to 250 megawatts – is really still "up in the air": at present, the search for a site with an acceptable cavern as mass storage vessel for the compressed air is still continuing. In principle, it is possible to store compressed air in a wide variety of geological layers, but the most reliable and cost-effective formations are believed to be salt domes, in which the desired storage volume is created by solution mining.

Germany's second-largest supplier of energy, RWE, also believes that air is the answer. At the end of last year, RWE and the US group General Electric signed a declaration of intent for the development of a compressed air energy storage plant. The focus of their research activities will be on the design of a heat storage unit, the development of the air turbine, and the identification of suitable locations for storing the compressed air. A feasibility study for the construction of a demonstration plant is to be compiled by the end the year, and the aim is to have the plant up and running by 2012.

In the meantime, other concepts are also being considered, and even the long-derided idea of storing energy in batteries is making a comeback. At its technology centre in Nottingham, the EON Group is currently working on a huge battery offering the capacity of 1 MWh in a housing the size of four truck containers. By contrast, the ENERTRAG company of Dauerthal in Northern Brandenburg declares that only the conversion of wind energy into hydrogen will allow the long-term storage of large quantities of energy at low cost. In the Uckermark area, 100 kilometres from Berlin and not far from the Polish border, the company is currently operating a power station in which 230 MW of wind energy and 20

MW of biogas electricity are being fed into its own high-voltage grid. This energy mix in the feeder network forms the basis for an innovative hybrid power complex – with capital expenditure of 19 million euros – scheduled to come online near the town of Prenzlau in 2009. Here the goal is to produce hydrogen by means of three wind turbines with an output of 400 kilowatts, using an electrolyser. This unit is coupled with a 400 kilowatt biogas plant and an above-ground storage facility. A sophisticated control system installed locally decides whether the plant should generate electricity or hydrogen. Hydrogen is an energy carrier that is relatively easy to produce from wind-based electricity: by applying the electrolysis method, efficiency levels of 70 to 85 per cent can be attained. The hydrogen produced in this way has an energy content of about 100 kWh per cubic metre at a pressure of 30 bar. According to ENERTRAG, this is one hundred times greater than the same volume of compressed air. What is more, hydrogen is easily transported through pipelines; large quantities of hydrogen, mixed with methane, can also be stored in caverns. The experts are convinced that, in a few years' time, the demand for hydrogen will grow enormously through its use for transportation. If the automotive industry really does commence series production of hydrogen-powered cars, as is slated for 2009, hybrid power stations will be able to supply this emerging market with a pollutant-free substitute for petrol and diesel.

Another surprising and innovative storage concept is the "Dispatchable Wind Power Systems", presented at the HusumWind 2007 exhibition by the US company General Compression: instead of a generator, four compressors are located in the nacelle of the wind turbine. These are used to convert the wind energy directly into compressed air. With the aid of an underground pipe network and a power station of expanders and generators, the plans are to generate and store between four and twelve energy hours a day.

The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) in Berlin is also pushing things forward: a feasibility study has been ordered from Clausthal University of Technology to investigate the possibilities for integrating large quantities of offshore wind electricity into the grid. A completely new approach is reflected by the combination of compressed air storage units and electricity generation using lean gas from reserves in the North Sea. The main thrust of this research programme is to drive technical progress along the entire process chain – from electricity generation through transport and right up to the consumer – to optimise the power supply in accounting for the growing proportions of renewable energy sources. No double about it: in view of the ambitious targets set by the Federal Government for the expansion of renewable energy, the provision of adequate storage technologies is one of the research objectives with the highest priority. ■

BARD

Pioneer Jack-up Barge

Lithuania, cloudy skies, zero degrees. Yet visitors, both local and international, turned out in large numbers to witness the keel-laying ceremony for the BARD installation ship "Wind Lift I" at PC Western Shipbuilding Yard in Klaipeda. 102 metres in length and 36 metres in width, the jack-up barge, a special lifting platform, will be able to jack itself up out of the water on four legs, each of them 71 metres tall. The barge is ideally suited for the logistic challenges involved in the construction of large offshore wind turbines. "Wind Lift I" is the first jack-up barge BARD Engineering GmbH is having custom-built for erecting offshore wind turbines.

Two lucky charms

"Wind Lift I" is designed to install foundations as well as complete wind power plants, including towers, nacelles and rotors – and all of it with ease. The special ship will be certified according to construction rules and guidelines of Germanischer Lloyd. The first vessel of its kind, "Wind Lift I" is scheduled to enter service next year. Viaceslavas Cumakov, project leader with PC Western Shipyard, and Anton Baraev presided over the keel-laying ceremony. They attached a one-euro coin and a one-lita coin to a steel plate that will be welded onto the craft later on (see photo). ■

Klaipeda. Keel-laying ceremony for "Wind Lift I".

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HELIMAX

Expertise in Wind Turbine Icing

At the 110-MW Baie-des-Sables wind farm in Quebec's Gaspé Peninsula, Helimax has recently successfully completed the installation of a test bench for the observation and measurement of icing and freezing rain phenomena. The project was implemented in partnership with Cartier Énergie Éolienne and the École de Technologie Supérieure. Installed on a meteorological tower in proximity to one of Baie-des-Sables's 73 GE 1.5sle turbines, the test bench designed to collect data over two complete winters will provide an invaluable database to help refine methodologies for detecting icing phenomena and to quantify the impact of such occurrences on wind turbine energy performance. The wind farm's output is continuously monitored using a numeric model developed by Helimax's meteorologists and engineers. The data collected will be entered into this model in order to better model wind farm operational conditions. Based on a detailed study, the test bench consists of several classic and heated anemometers and wind vanes as well as temperature, pressure and relative humidity sensors. It also includes more specialised sensors to detect and measure ice accumulation, precipitation and solar radiation, as well as an ultrasonic 2D anemometer. ■

Certification

GL will Certify First Sinovel Wind Turbine

Tong Tong, Sinovel Vice Manager of R&D Center, and Christian Nath, Global Business Manager Wind Energy at GL, signing the contract in Hamburg.

According to the report from the Energy Information Administration (EIA), China's energy consumption will rise to 4,500 TWh per year in 2015. In order to satisfy the demand for energy, China is opening up new energy resources: wind energy in particular is of growing importance. Sinovel, a leading Chinese wind turbine manufacturer, has now developed its own 3MW wind turbine – to be GL certified.

Germanischer Lloyd is in charge of certifying the complete design of the 3MW wind turbine "SL 3000", which will be available as onshore and offshore versions. The experts will carry out the wind turbine design assessment according to their own and international rules and directives. The process comprises the assessment of all installation components including tower, rotor blades, mechanical as well as electrical components and safety system. ■

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Certification

Tightening Factor

Since the beginnings of wind power technology, the tightening factor on large-diameter bolted joints has emerged as a critical factor. It is an indication of the repeating accuracy of the tightening method. To ensure safe operation of the wind turbine, the heavy loads acting, for example, on the rotor hub require optimal tightening accuracy on the large rotor blade boltings. At the European Wind Energy Conference in Brussels in March 2008, Germanischer Lloyd's Mike Wöbbeking presented Guido Consogno, responsible for technical sales at Swiss manufacturer P&S Tensioning Systems Ltd., with a certificate for the CY-series SUPERBOLT® Multi-Jackbolt Tensioners (MJT). Better accuracy. Germanischer Lloyd oversaw tests on size M36 and M48 CY-series fasteners. The test results show that the repeating accuracy for the MJT is better than for conventional tightening methods such as torque-controlled or hydraulic tightening. A tightening factor of 1.2 may be used for dimensioning bolted connections. MJTs represent an advanced bolting technology, warranting safe operation and meeting stringent criteria. Bolts of any size may be tightened with a hand torque wrench only. The boltings are free of torsion and in pure tension. ■

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North Sea

Planned Transformer Platform

400 MW transformer offshore platform.

Heerema Vlissingen recently signed an engineering, procurement and construction ("EPC") contract with ABB in Sweden for the design, procurement and fabrication of a 400 MW transformer offshore platform in the German sector of the North Sea. The platform will be part of the world's largest offshore wind farm located 130 kilometres off the German coast. The NordE.ON 1 transformer platform will be connected to the most remote wind farm in the world and consisting of 80 wind turbines generating 400 MW in total.

Heerema will design and fabricate the transformer platform and the jacket, on which the innovative and environmentally friendly HVDC Light (high-voltage direct current) transmission technology concept of ABB will be installed. Also the procurement and the hook-up of offshore activities are part of the contract. Germanischer Lloyd is contracted to certify the structure of the platform according to their and international rules.

The topside, weighing 2,500 tons, will have a length of 55 metres and a width of 35 metres. The jacket will be 60 meters high with a weight of 1,500 tons. Fabrication started in March 2008 and is scheduled for completion in April 2009. The offshore wind farm is planned to be operational in September 2009. ■

DATES

24–26 June 2008
WWEC 2008 Community Power
Kingston, Canada

24–26 June 2008
Wind Power Asia
Beijing, China

9–13 September 2008
Husum WindEnergy
Husum, Germany

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