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The DEWI Report: Windenergy Study 2008

by Eize de Vries

The fourth in a series of respected bi-annual surveys of the international wind energy industry highlights market trends and the latest developments in Germany. Eize de Vries reports from Berlin on WindEnergy Study 2008.

According to the latest WindEnergy Study

According to the latest WindEnergy Study — the series of bi-annual surveys of the international wind energy industry — total wind installations in Germany are expected to be slightly lower in 2008 compared with 2007. This figure includes onshore, offshore and onshore repowering combined but, as an industry novelty, now includes 30 MW of new offshore capacity. One German market assessment graph from WindEnergy Study 2008, reproduced as Figure 1 here, which covers an extended period up to 2030, shows interesting trends involving time-related developments and interactions between new built onshore and offshore, and onshore and offshore repowering.

In the period 2009–2022, German annual installations on average show an upward trend, with offshore initially becoming the key growth driver. However, onshore repowering will gradually gain in importance and reach envisaged peak installation figures during 2021–2023. The latter period is 20 years ahead from the German wind market record years of 2001–2003. Interestingly, these statistics assume that wind turbines erected in the early years of this century are, on average, capable of operating technically and cost-effectively for their full 20-year design life.

The start of offshore wind repowering is predicted for 2021, again with the optimistic assumption that even first-generation offshore wind turbines operating in German waters will last for 12–13 years. By 2012, 3800 MW could be operational offshore and this capacity might possibly grow to 35,100 MW, WindEnergy Study (WES) says. German onshore and offshore combined may reach about 65 GW by 2030 — sufficient to meet 31% of the country's electricity consumption.

Also worth mentioning is that Germany maintained its world market leader position in 2007 with a cumulative total of 22,247 MW installed. However, the USA is expected to take over the top ranking position in 2009 or even before.

International

The assessment findings and main conclusions from the survey were once again derived from a detailed questionnaire sent to international wind industry players. One of the main conclusions is that the global wind industry is upbeat on future wind power development.

The latest prediction is that new wind turbine installations globally will increase each year from about 20 GW in 2007 to 50 GW by 2012 and 107 GW in 2017. This represents more than a five-fold capacity increase within a 10-year period, subdivided into annual global increments of about 20%. The wind industry has entered an exciting exponential growth path and the cumulative world total is expected to reach 288 GW in 2012 and 718 GW by the end of 2017. By comparison, only about 94 GW of capacity was operational in late 2007.

Last year also proved a perhaps decisive turning point with regard to a smaller cumulative annual capacity gain in Europe (48%) compared with a cumulative 52% share for 'the rest of the world'. Another major recent change is that, until 2006, only a few European countries dominated the global wind market. But in 2007 the USA became the largest single wind market, with China leaping to second position. The researchers also concluded that, until 2017, the once dominant and long-established wind market share of Europe will continue to dwindle, particulalrly when set against faster growth in nations representing 'the rest of the world'. China is poised to become the world's largest wind market within a few years.

Offshore development

With regard to offshore wind, an increasing percentage of companies polled for the 2008 study compared with the 2006 study indicated that they already felt the offshore market segment to be important. Others regarded the period 2010–2012 as more likely for a significant offshore market take-off — a view linked to the current strong growth of the more profitable and less risky onshore market.

Looking at available wind turbines in different power ratings, over 50% of respondents considered the 3–5 MW class as 'ready for offshore application'. For the upcoming 5.1–7.5 MW class, over 40% considered 'after 2008' as the likely market-ready period. Finally, more than 70% of the respondents believe that turbine types in the 7.6–10 MW class will not be ready for offshore application before 2012.

Not surprisingly, these opinions follow actual developments. Vestas and Siemens both offer commercial offshore wind turbines in the 3–3.6 MW class, while REpower, Multibrid and BARD Engineering have begun series production of their 5 MW installations. In addition, REpower has announced a 6 MW up-scaling of its 5 MW 5M turbine. Also in a higher power-rating, Clipper Windpower has begun developing a new 7.5 MW turbine. In a different development model, BARD Engineering envisages a stepwise upscaling of its 5 MW VM turbine towards a '7 + X' MW. And while there is talk of even larger turbines up to even 20 MW by 2020, no actual product development projects have yet been announced.

Wind markets

As in 2004 and 2006, respondents to the 2008 survey lowered their ranking of the importance of the German market. The US market is now the number one favourite; the wind market in France is viewed as less important and, not surprisingly, China is seen as clearly on the rise.

The question on future important markets produced a rather different outcome. Respondents to the 2008 survey viewed China (1), Germany (2) and the USA (3) as the three most important future wind markets. These top three countries were followed some way behind by France, the UK and India. Details of worldwide installed capacity are shown in both figure 2 and table 1 on pages 100 and 102 respectively.

Meanwhile, when it comes to opening up new international markets and co-operation preferences, there is a declining interest in establishing joint ventures while interest in opening up foreign subsidiaries is growing. One likely explanation for this shift in co-operation model preferences are the hard lessons learned from past experiences. In particular, suppliers now realize that their valuable 'know-how' should not be given away easily. Opening up a subsidiary as an alternative co-operation model to a joint venture is viewed as less risky with regard to preventing 'know-how' leakage.

Limited grid capacity

Wind power generation is characterized by its stochastic nature, whereby supply and demand, in small grid systems in particular, mostly do not match. The combination of wind power with a second complementary power generation and/or direct/indirect storage technology therefore has, in principle, considerable potential. Wind–diesel, wind–water desalination and wind power in combination with hydrogen production are all potential options that have been high on the international renewable energy agenda for several years.

Of the three options in the questionnaire, wind–diesel was viewed as already important. However, its relative importance is expected to decline after this year for a prolonged period until 2020 and then pick up again steeply. At present, wind–diesel applications are mainly concentrated at isolated islands and similar situations with limited grid capacity. Other promising potential applications include places with inadequate transport logistics. One example is land-locked African countries where each barrel of fuel easily doubles in value the moment it is offloaded at a harbour and transported by road to its final destination.

Wind–water desalination is expected to take-off from 2010, while respondents indicated this will happen for wind–hydrogen systems after 2012. Some potentially attractive markets for wind–diesel and wind–water desalination technologies are (small) islands in the Mediterranean — often characterized by a favourable wind climate as well as a shortage of potable water. Only a few wind turbine suppliers offer commercial wind–diesel and wind-water desalination systems, with Enercon being the only 'top five' supplier currently active in this segment offering advanced in-house developed integrated system technologies.

The positive short-term view on wind–hydrogen is slightly surprising as there are only a few operational projects worldwide, plus much uncertainty with regard to market potential and other variables over the next few years. Experts appear increasingly of the opinion that a superior solution to wind–hydrogen is to use wind turbines to supply grid electricity during the day and to charge electric car batteries during the night hours with surplus energy. These electric cars thereby serve as a large decentralized back-up energy storage base. The idea itself is not new. Six or seven years ago, for example, Aloys Wobben of Enercon

presented similar calculations with a focus on future German energy supply.

A recent Dutch newspaper article under the (translated) heading 'Hydrogen economy remains perhaps a sweet dream' compares two future options. It quotes total transport efficiency figures of a fuel cell vehicle fed with hydrogen compared with a functionally similar electric vehicle powered by electricity. The main conclusion is that a vehicle consisting of fuel cell/hydrogen fuel technology will accomplish a maximum total efficiency of 5–27% compared with 63–81% for an all-electric alternative. The latter assumes that the electricity required is produced from renewable energy sources. According to the article, the availability of new generation lithium–iron phosphate batteries — characterized by a much better energy storage capacity per unit mass — is a strong point in favour of electric cars. In addition, an electricity distribution and transport infrastructure is already in place in developed countries, while such a network is all absent for hydrogen.

Value-added

Among several other prominent speakers at the Berlin event was Thorsten Herdan, managing director of VDMA Power Systems (Verband Deutscher Maschinen-und Anlagenbau; German Engineering Federation). In line with a series of observations on future wind turbine development, Herdan commented that when optimized wind turbines produce more clean energy per MW installed, owners/operators in turn are likely to be prepared to pay more for these installations!

A second issue he raised was the German wind industry's impressive 40% share of the global market in terms of value-added during 2006. But he expects this percentage may well drop to 33% by 2012. Herdan commented: 'Our prognosis is that current wind turbine and component production capacities will stay in Germany, but new manufacturing capacity is likely to be built in geographical locations close to these new growth markets.'

Another interesting statistic is the amount of land required for installing a given wind turbine capacity. According to Herdan, 70 GW of wind power require only 1% of total German land space.

Of the cumulative 44 GW wind capacity projected for 2017, 32,500 MW is land-based and 11,500 MW offshore. In terms of productivity, Herdan noted the huge differences between the 3500–4000 full-load hours achieved with offshore turbines set against about 2000 hours on average for land-based wind installations in Germany. He said: 'We expect a continuing optimizing trend whereby future wind turbines on land as well as offshore produce substantially more megawatt hours (MWh) per MW. In terms of costs, wind is already closing the gap with conventional power generation depending on fuels like coal. This will be even more the case when operators will in future be charged a penalty for releasing carbon dioxide into the atmosphere. And today no solutions are available yet for commercial capture and storage of the greenhouse gas.'

What Herdan did not mention is that, according to experts, commercial carbon dioxide storage is not expected to be viable before 2020 at the earliest. In addition, the storage process itself will result in at least a 13–20% drop in the overall efficiency of a coal-fired power station. The efficiency of a state-of-the-art coal-fired plant without storage is currently 44–46%.

MW to MWh

Another guest speaker was Hermann Albers, president of the powerful German wind energy association Bundesverband Wind Energie (BWE). He pointed out a recent prognosis suggesting that, by the end of 2008, the price of a barrel of crude oil may have risen to €200 or more. In his view, further fossil fuel price rises are likely but, as a second but more positive major trend, the costs of wind power generation will come down. Driven by the success of the German renewable energy policy and the EEG support mechanism (Erneuerbare-Energien-Gesetz or Renewable Energy Sources Act), Albers estimated that Germany has saved a total of around €4 billion on fossil fuel imports.

Raising a second issue, Albers urged a shift in focus away from speaking and thinking in terms of MW towards MWh, saying: 'As a major trend in Germany, rotor diameters are getting relatively bigger on the latest turbines being erected. One positive effect is that these new turbines operating at less windy inland locations on average achieve full-load hour performance comparable with yields per MW at windy costal locations ten years ago.' In practical terms, this is expected to boost the current average of about 2000–3000 full load hours in future, he explained.

And as all countries face the potential threat of climate change and the real effects of rising fuel prices, Albers stressed the need for more and more rapidly deployed counter-measures. One of these practical and highly effective measures, he suggested, is putting wind turbines on much higher towers: 'Not so long ago

during the 1990s, hub heights between 60–70 metres were state-of-the-art. When parties involved with the permitting and realization of land-based wind projects can accept the relevance of hub heights in excess of 100 metres, potential energy yield gains and environmental benefits are both substantial. Raising hub height from 70 to 110 metres on average results in about 40% extra clean energy yield, or roughly 1% per extra metre of tower addition. When applied to (future) repowering projects, a tripling of energy yield can be achieved by only doubling installed capacity on a MW basis.'

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figure 2. Installed capacity per year (world)

A Vestas V82 1.5 MW machine at Pollenfeld, Germany vestas

Windenergy study 2008

The results of the fourth WindEnergy Study were presented in Berlin in June 2008 by Husum WindEnergy, a newly formed German wind fair umbrella organization, and the German Wind Energy Institute (DEWI). These wind market surveys have been carried out by DEWI every two years since 2002. The assessment series has established a reputation for the accuracy and reliability of its predictions. WindEnergy Study 2008 covers wind energy market prospects and trends for the period up to 2017.

The name 'Husum WindEnergy' refers directly to the world-famous bi-annual international wind industry fair held many times in the small German North Sea town of Husum. The next fair is this September but with a new partner, Hamburg Messe. The latest WindEnergy Study assessment was not only presented under the umbrella of a new organization, but also the location had moved from the German port of Hamburg to its capital.

DEWI's R&D leader, Bernd Neddermann, presented a summary of the main findings and conclusions at the study's launch in Berlin.

To order a copy of WindEnergy Study 2008 (WES2008) visit the Husum WindEnergy website (www.hamburg-messe.de/windenergy/we_en/start_main.php).

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