Offshore wind park Q7 in North Sea off the Dutch coast. Photo: Econcern.

Offshore wind will transform European seas

Offshore wind energy is about to take a giant leap forward. Wind energy currently supplies 3% of EU electricity demand. The European Commission believes that this figure can be raised to 12% by 2020, with one third produced by offshore installations. But questions about the economic feasibility of offshore wind energy remain.

by Annemiek Planting

Sailors crossing the European seas in 2020 will encounter a seascape that, for the first time in human memory, will have been transformed significantly by human hands. Tens of thousands of seventy-metre-high wind turbines will spin their fourty-metre-long rotor blades, delivering pollution-free electricity to some 30 million households across Europe. Yet, although the wind supplies its power for free, energy harvested from the wind will come at a price. Total costs of this offshore wind energy dreamland will add up to roughly €70-80 billion.

Such, at any rate, is the vision presented by the European Wind Energy Association (EWEA) in its recent report, 'Delivering Offshore Wind Power in Europe'. Until now, the offshore wind industry has developed 25 projects in five countries with a total capacity of approximately 1,100 MW.

In 2008 and 2009, a total of 1,455 MW derived from new projects will be delivered in the UK (800 MW), Denmark (200 MW), Sweden (140 MW), the Netherlands (120

MW), France (105 MW), Germany (60 MW) and Belgium (30 MW). As a result of these developments, offshore wind capacity will have more than doubled to reach 2,555 MW by the end of 2009, with about 80% of the market concentrated in Denmark and the United Kingdom.

But this, EWEA says, is only the beginning. By the end of 2010, EWEA expects offshore wind to reach a total installed capacity of 3,000 to 4,000 MW. During the next decade, capacity will continue to increase, reaching 20,000 to 40,000 MW (20 to 40 GW) in 2020. This implies a tremendous leap in offshore wind energy deployment. However, given the current limited distribution of offshore wind power in Europe, historical growth rates, wind potential of each country, projects in the planning phase, industry assessments and the policies and targets of EU member states, EWEA considers this to be a realistic projection.

Wind power specialist Jos Beurskens of the Energy Research Centre of the Netherlands (ECN), a member of the Wind Energy Technology Platform launched by the European Commission in 2006, concurs. 'Having witnessed the development of onshore wind for 26 years, I believe that the EWEA estimates are realistic', he says. 'A good twenty years ago, no one could imagine that by 2007 we would have almost 80 GW onshore capacity installed in Europe. The technical potential of offshore wind power is enormous. According to our calculations, the technical potential of offshore wind farms placed in a row along every European coast line would make it possible to produce 30 to 40% more electricity than needed in the whole of Europe. This is only a technical potential that will never be fully exploited because of practical impediments like balancing problems, but it is an indication of the possibilities sea wind has to offer.'

Though technical potential may exist, exploiting it involves considerable investment. EWEA chief executive officer Christian Kjaer estimates that for the development of 35 GW (35,000 MW) installed capacity, investment costs would reach roughly €70-80 billion.
The big question is, how much government support will be required to achieve this? Germany, as one of the leading offshore wind markets, recently announced a rise in its feed-in tariff for offshore wind energy to €140/MWh over twelve years. A simple calculation shows that German energy consumers are being presented a steep bill for the development of their offshore wind industry. A 100 MW wind farm will cost consumers at least €500 million over twelve years. If all 35 GW were financed in this way, the bill would run up to €175 billion, more than twice the investment costs estimated by EWEA.

Confronted with this calculation, Beurskens is up in arms. 'Merely basing one's arguments on deterministic cost figures seems a bit short-sighted to me. If the great many uncertainties and enormous deviation of these figures are taken into account, in addition to the high risks of developing a new industry, then this tariff seems a reasonable incentive to get the German offshore market going. The Germans have proven very successful in deploying onshore wind, photovoltaics, biomass facilities and energy conservation in buildings.'
Beurskens thinks the German policy is much better than 'the short-sighted mentality of the Dutch government', which has not been very consistent in stimulating the application of new technologies. He says that 'If EU governments manage to offer a stable, clear offshore wind energy policy, the market will provide the required technology for a successful deployment of offshore wind.'

The company Evelop, a subsidiary of Econcern, one of the largest investors in renewable energy in Europe, is currently building a 120 MW offshore wind park (called Q7) in the North Sea off the Dutch coast. Ernst van Zuijlen, Evelop's managing director offshore wind Europe, says that a feed-in tariff of €140 is far from unreasonable. 'Given the rising turbine prices caused by a booming onshore market, raw material inflation and component shortages, I dare say that in our situation electricity costs will amount to €150 to €200 per MWh (€0.15 to €0.20 per kWh). Both German and Dutch wind farms have to be constructed ever farther off the coast because of conflicting interests with established industries.'

Van Zuijlen expects offshore wind to reach the break-even point by 2020, provided the industry is developed on a large enough scale. 'A less tight market will cause turbine prices to drop. Even more important are price reductions resulting from learning experiences in the fields of installation and operation and maintenance, as well as the economies of scale that larger wind farms and turbines have to offer. As risks diminish, so will financing and insurance costs. As the reliability of new wind farms grows, returns on investment will rise. Meanwhile, energy prices from other energy sources are still increasing.'

> *'As risks diminish, so will financing and insurance costs'*

Windmill parts waiting for assembly. Photo: Econcern

Operational offshore windpark • Planned offshore windpark for 2008/2009. Source: EWEA

Van Zuijlen says that the "unique" financing arrangement of the Q7 project indicates that investors already look at offshore wind energy with growing confidence. 'It is the first time that a loan in this sector will be covered by income from the project itself, instead of shareholder credit. Debt will be repaid using the cash flow generated by the project once it is operational, instead of by the general assets or creditworthiness of investors. This means the debt is "non-recourse" to the project sponsors. This is a clear sign of the growing confidence investors seem to have in the offshore wind industry, and it opens a new window of opportunity for other projects.'

Economists in various countries have been making cost-benefit analyses of offshore wind, coming up with different results. The Danish research center Energy Analysis (EA) predicts offshore wind energy will be competitive within ten years. On behalf of the Danish Association of Energy Companies, EA compared the costs of several electricity generation methods. It looked at fuel costs, operation, maintenance and capital costs, the costs of grid adjustments and environmental impact. The conclusion was that by 2015, power generation from coal, gas, nuclear power, biomass and offshore wind would all have the same cost price at roughly €0.052 per kWh.

> *'The technical potential of offshore wind power in Europe is enormous'*

In Belgium, economist Karen van Capellen from the University of Leuven conducted a cost-benefit analysis (2005) of the planned Thorntonbank farshore wind park with a capacity of 216 to 300 MW. She concluded that offshore wind farms will never become socio-economically viable, mainly because of the necessity of maintaining large amounts of reserve capacity.

An analysis by the Netherlands Bureau for Economic Policy Analysis (CPB) and ECN also showed less positive results. CPB and ECN concluded that offshore wind farms would only increase socio-economic wealth if developed gradually and in combination with a strict EU climate policy. According to researchers, developing the industry could gradually avoid large-scale investments in immature technology, and the impact of volatile emission and fuel costs could be evaluated along the way. Building 6,000 MW of wind parks in the North Sea by 2020 would be economically unfeasible in every scenario, variant and sensitivity analysis applied in this study. In case of a strict EU climate policy and more gradual investments (spread out to 2030), the balance would be only slightly negative. Under the more favourable assumptions of cost decrease over time, higher fuel prices, higher emission prices or lower discount rates, the balance would become slightly positive.

The CPB study ran into strong criticism from wind energy proponents who argued that researchers assumed a far too low oil price. But CPB's Annemiek Verrips, the main author of the study, stands by her findings. 'Despite current world oil prices at over $100 a barrel, price developments in the next decades are not expected to make wind energy economically viable in the absence of a climate policy. Although we used lower oil prices for our calculations in 2005, the dollar has decreased significantly in value as well', she says. Nevertheless,

> *'German energy consumers are presented with a steep bill for their offshore wind industry'*

higher oil prices will make a difference, Verrips admits. 'We are currently conducting research into the economic feasibility of all available renewables for the Netherlands, working with current estimates made by IMF and IEA regarding long-term oil prices. Structurally higher oil prices could make offshore wind energy competitive sooner.'

Kjaer argues that when looking at the costs and benefits of offshore wind, comparisons with more conventional generation methods are hardly fair. 'Offshore wind must still compete with existing power stations that have already been depreciated and paid for by tax payers or electricity consumers. Fair enough, we have to continue to reduce the costs of offshore wind power through research and development, technology improvement and economies of scale. I see no harm in providing an incentive for investors – in the offshore wind sector investors are mainly utility companies and a few private parties – for the deployment of offshore wind energy. Investing public money in new power generating technology has been and will be the path to innovation. While the EU should continue to compete for the fossil energy sources that remain on a global scale, Europe needs to address problems like its dependence on politically unstable regions for its energy supplies and issues like climate change and the limited amount of remaining fossil fuels. The only way to limit our dependence on foreign controlled fuels is to develop sufficient alternative energy technologies, while increasing energy efficiency. After initial public investment, offshore wind can contribute to resolving these issues. As far as I am concerned, the question is not if offshore wind can ever be competitive, but when.'

For the moment, the governments of EU member states must decide for themselves how and to what extent they want to invest in offshore wind energy. The European Commission is working on an offshore wind energy action plan that will provide a framework for the member states, but the plan will not be completed until late 2008. ■

Barriers to large-scale deployment of offshore wind

In its 'Offshore Report 2007', EWEA listed numerous "barriers" to large-scale deployment of offshore wind in the EU, such as grid infrastructure needs, logistic and supply chain gaps, site and licensing issues, lack of skilled personnel, shortage of equipment and financing problems.
'Our first priority should be to create both a properly functioning internal electricity market and a sound investment climate by providing a stable political framework, thus reducing financial risks for investors', argues EWEA. 'We need competition at EU level for the internal electricity market to function. We can achieve this by gradually expanding regional cooperation between states geographically close to each other, and with integrated electricity supply systems.'

The European Commission recently announced that it is working on an offshore wind energy action plan, which should be completed by late 2008. 'It is a first step towards establishing a European policy framework', says Kjaer. 'It should at least provide grid reinforcement and interconnection measures, legislation and policy measures including payment mechanisms, environmental measures and R&D measures.'
Kjaer says that national differences in policy hamper offshore wind power development.
A related problem is that EU countries use different types of subsidy schemes. Some countries subsidize renewable energy directly, others use a feed-in tariff to be paid by the distributor to the power producer, yet others require energy suppliers to use a minimum amount of renewable energy in their energy mix. Evelop's Ernst van Zuijlen prefers a feed-in tariff, as used in Germany. 'Although a quota or green certificates system allows for quicker price response to changing circumstances, I am in favour of the German feed-in system', he says. 'When a quota for a period of time or a quantity of power is reached, there is no incentive for renewable power plants to stay competitive with conventional power stations. This means the quota system provides less stability for investors. The feed-in system is transparent, offering a clear return on investment. Germany's successful onshore wind industry illustrates this.'

Van Zuijlen also approves of the offshore grid regulation applied by Germany. 'Connections to the mainland grid should be paid for by grid operators, as is customary with any other gas or coal fired power plant. This stimulates collaboration between project developers in building a sea grid. A similar system is already operational in Denmark, where the connection costs for both the Horns Rev and Nysted wind farms were paid for by the grid operator. As a result, the wind farm operators' costs are reduced by 25 to 30%.'