Wind holds key to European super grid

Europes' most persuasive proponent of the super grid and senior scientific adviser to the German government, Dr Gregor Czisch (pictured right), argues that the wind industry must wake up to the potential of this revolutionary technology, and take its rightful place in negotiating a roll-out. James Murray spoke to Dr Czisch for a RealPower exclusive ahead of the BWEA31 conference in Liverpool.

"The wind industry has been almost totally absent from discussion on a European Super Grid," says Czisch over the phone from his office at the University of Kassel. "They have let solar take the initiative and now it is the solar lobby that has the dominant position."

He has a point. After years of research, the views of Czisch and his peers – namely, that if we are to decarbonise Europe's energy supply and meet the EU goal of slashing carbon emissions 80% by 2050 then we will "need a strong super grid that connects the areas of high production with the areas of most demand" – have been broadly accepted in the corridors of power.

The concept of a European-wide super grid stretching across country borders, covering thousands of miles, capable of linking far flung energy sources such as offshore wind turbines and desert-based solar and wind farms with major population centres finally looks set to move from the drawing board into reality. Made technically feasible by the emergence of new High Voltage Direct Current transmission lines that can carry power thousands of kilometres without the losses that would previously have made a super grid economically unviable, the idea is attracting interest from political leaders and blue chip investors.

But, as Czisch observes, it is the still embryonic solar industry, rather than the more mature wind energy sector, that currently stands to gain the most from this groundswell of support for a European super grid.

Earlier this year, German insurance giant Munich Re announced plans for a major new consortium to invest an estimated €400bn in an ambitious plan to harness solar power from sites in North Africa and transmit the energy to Europe. The so-called Desertec project has already secured the backing of the German government and attracted a consortium of 12 blue chip firms, including Siemens, RWE, E.ON and Deutsche Bank to its first meeting last month.

It is easy to understand the appeal of this model. The Destertec group, which now plans to draw up a detailed investment plan for the project within the next three years, reckons it could generate up to 15% of Europe's electricity needs in 2050. Figures from the European Commission's Institute for Energy, meanwhile, go further still suggesting that just 0.3% of the solar energy falling on the Sahara and Middle Eastern deserts could provide all of Europe's energy needs.

But, according to Czisch, this fixation with a primarily solar powered super grid could prove somewhat misguided. He has undertaken a major mathematical study to work out the optimum and most cost-effective design for a European super grid capable of zero carbon energy and high levels of resilience – and solar energy hardly features.

"The base case scenario calculated that at "current" costs solar thermal should represent just 1.6% of the energy mix," he says, adding that evidence from the latest solar thermal projects constructed last year suggests that actual current costs could prove significantly higher than those used in his calculations.

"I am looking forward to the Munich Re meeting," he says ahead of the first meeting of the Desertec group. "But the focus on using solar thermal power is down to a strong lobby that has understood that it could play a role in the super grid. There is nothing necessarily wrong with that, if you want to have solar thermal, that's OK, but you have to realise it will be more costly."

In Czisch's super grid model it is wind and not solar that takes the dominant role. He envisages a grid based on huge amounts of wind energy generated at sites in Northern Europe, Siberia, North Africa and Kazakhstan, and imported to major population centres in Europe. Such an approach, he argues would be both far quicker to build, and cheaper to build.

"If you are looking for the optimal grid you should focus on the best energy resources and that means mainly wind energy," he says. "Wind is more mature and if this is understood it could ensure that the super grid is built much faster – which is hugely important if we want to avoid the most harmful consequences of climate change. We have dozens of gigawatts of wind capacity being added each year compared to just 100s of megawatts of solar and there's a huge price differential. That is why I would really like to see the wind industry more involved in this discussion."

Advocates of Saharan solar farms argue that a European Super Grid based on a wide range of different energy sources, including solar, wind, biomass, hydro, microgeneration technologies and even geothermal plants in Iceland, would prove more reliable than one based on a relatively small number of energy sources.

But Czisch counters that while a mix of different technologies is indeed required, it need not be as wide-ranging or as complex as is widely believed. His model calculates that if the super grid is spread over a large enough area then reliable electricity supply can be delivered using wind farms, with hydroelectric plants and biomass generators providing back up power when necessary.

"Short term fluctuations (in wind energy output) are easy to deal with if you are drawing energy from enough different sites," he explains. "You can also get back up power from hydropower by building strong transmission lines between Scandinavia and the rest of Europe, and biomass plants can also provide quick backup."

The belief that seasonal variations in wind energy would increase the risk of power shortfalls and blackouts during the summer when winds tend to be weaker is also unfounded, according to Czisch.

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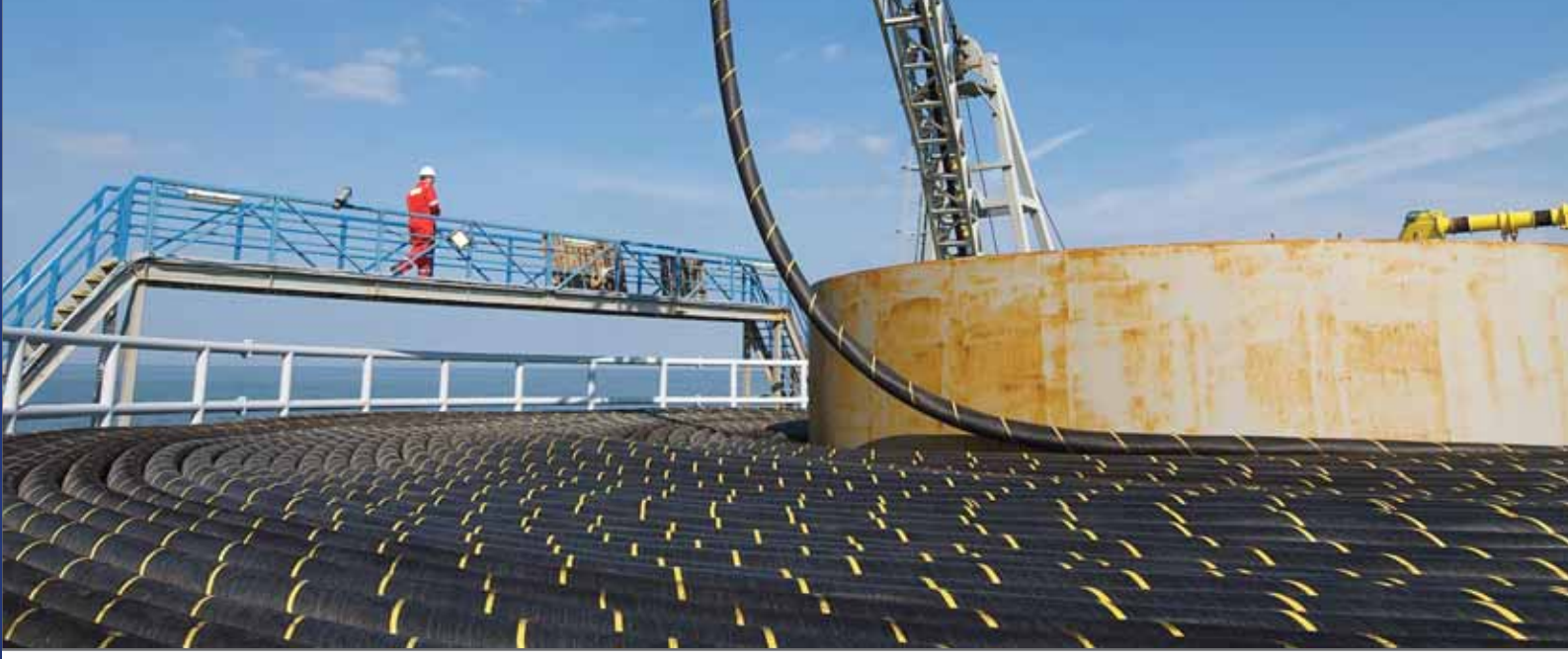

"With a large enough grid you can smooth out the peaks and troughs in supply that you would otherwise get through the seasons," he explains. "For example, in Germany we have about three to four times the wind energy during the winter that we have in the summer, but the level of consumption varies far less. However, with a super grid there are areas in the Sahara where wind energy production would be higher in the summer than in the winter and that would allow us to cope with those fluctuations in German output. We can deal with the seasonal fluctuations if we cover different climatic zones."

Czisch's model also suggests that cutting edge smart grid technologies will not necessarily be required to make the super grid work. "There are solutions that show you do not need very complicated grid planning," he says. "There would need to be some co-ordination to get the right voltage standard to limit losses from the additional converters that would be otherwise necessary, but that is not actually very complicated."

The recently launched European Renewables Grid Initiative may be lobbying for a so-called super-smart grid, capable of not only linking remote wind and solar farms, but also drawing energy from millions of microgeneration devices, but Czisch is sceptical of the term. "I don't use the word super smart grid, as the smart part is not necessarily needed," he says, arguing that a grid based on micro-generation devices such as rooftop solar panels and small scale wind turbines or micro gas turbines would prove much less efficient then one built around large scale renewable energy technologies.

"There's nothing wrong with this 'small is beautiful idea' where you can get all these small applications working together and feeding energy into the grid," he says. "But if you have lots of small sources of energy, like home biomass systems, then you have to realise you will lose a lot of the efficiency... You just have to compare the efficiency of a micro gas turbine with a large combined cycle gas power station to know this."

Of course, even if the wind industry gets its act together and convinces policy makers that it offers a better alternative to African solar farms and microgeneration technologies, the price tag for a genuine super grid will remain daunting. It is estimated that the Desertec project would cost €400bn and, while a super grid that is more reliant on wind would in theory be more cost-effective than one based on solar, it will not come cheap.

However, Czisch is extremely reluctant to get into a game of 'guess the price tag', guessing, accurately no doubt, that any multi-billion euro headline figure will be employed by critics to attack the viability of his super grid model.

"It is difficult to put absolute cost figures on the super grid as people do not know what the total costs of the electricity system will add up to in 20 years' time across 60 different countries," he explains. "If we say an absolute figure we end up with a huge figure that scares people." Of course, many of the headline figures attributed to the Desertec project have been published, but Czisch maintains that they are not very helpful to further general understanding of the project.

According to Czisch, a better way of presenting the cost of the super grid proposal is in terms of the resulting electricity price. He points out that the cost of electricity based on his conservative base case scenario optimisation is 4.65 €ct/kWh at the point where it is fed into the conventional local AC transmission system. This includes production and transmission over the HVDC super grid and is significantly cheaper than current electricity sold at the EEX. The super grid would represent just 11% of the total costs in this decarbonised energy supply with transmission lines accounting for 5%, converters 2% and transmission losses representing 4% of the total cost.

The problem is that 'a huge figure that scares people' is just the kind of sum to alarm governments and investors, particularly given the current economic backdrop. But Czisch is adamant that the potential costs are manageable when you place them in a wider context. "What I will say is that if you compare the investment needed for this totally renewable electricity supply to the capital investments that are made across our societies it is a very low digit percentage," he says.

Moreover, while never underplaying the size of the challenge, Czisch is convinced that the whole undertaking will not be as daunting as the naysayers believe. "We are not talking about replacing the entire grid, we are envisaging a super grid that runs above the existing grid," he explains. "The existing grid to take the energy to homes and offices will still be there – you just overlay the super grid. It's just like building highways that connect to normal roads."

DR GREGOR CZISCH

Dr. Gregor Czisch is a fully qualified agriculturist who studied physics at Munich Technical University.

He wrote his PhD in electrical engineering on scenarios for a future electricity supply with renewable energies and since 1987 he has worked on various topics in the energy-related field at Munich TU, the DLR Stuttgart, the Fraunhofer ISE in Freiburg, and the Max Planck Institute for Plasma Physics (IPP) in Garching.

During his work in the R&D division Information and Energy Economy at the Institute for Solar Energy Supply Techniques (ISET) and at the Institute for Electrical Energy Technology/Rational Energy Conversion at the University of Kassel, he undertook a PhD with the title "Scenarios for a Future Electricity Supply – Cost-Optimized Approaches to Supplying Europe and its Neighbours with Electricity from Renewable Energies", for which he was awarded the distinction summa cum laude.

He has subsequently taken up a role as a consultant to the Scientific Advisory Council on Environmental Change of the German Federal Government (WBGU) and has appeared as an expert to hearings at various ministries and parliaments in Germany and other countries.