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# Can the European Electricity Grids cope with more Windfarms?

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*The EU Directive 2001/77/EC on the promotion of Renewable Energy expects wind power in Europe to increase from 41MW in 2005 to nearly 67MW in 2008, and increase still more by 2015. But a recent study<sup>1</sup> by the European Transmission System Operators (ETSO), the operators of the five main European grid systems serving 28 countries, draws attention to the technical and financial problems which may arise from such expansion and from the attempts to integrate the output from windfarms into the various national Grids. The study makes recommendations to try to solve these problems. Many of the new windfarms will be in Germany but some will be in Spain, Portugal and Great Britain.*

The idea of generating electricity from the wind is superficially attractive. The fuel is free, windmills use established technology, they are not difficult to make and they can be built quickly so that a Government minister can see something happen during the time he is in office. But the practical reality is very different. ETSO's *European Wind*

*Integration Study* identifies a number of major problems in developing wind electricity if it is intended to make a useful contribution to both our National Grid and to the European electricity system. There are technical solutions to these problems but they increase the costs of what is already an expensive form of generation.

A general problem with large windmills is that they generate electricity only when there is a strong wind blowing and these occasions are unpredictable and intermittent. Also they do not necessarily occur when there is a demand for the electricity. The average electrical output is small. In the UK the annual output from all

the windmills contributes less than 1% to the national electricity demand of 375Twh per year and they provide no sufficiently predictable power on which the operators of the National Grid can rely. They are also expensive and not economically competitive; without the government subsidy provided by the Renewables Obligation it is unlikely that anyone would build them: "The subsidy for wind power until 2020 will be some £30 billion due to the freedom of multiple departmental committees to reach consensus conclusions in a policy vacuum with no effective ministerial leadership."<sup>2</sup>

The technical problems which ETSO consider arise from trying to integrate wind energy into the electricity grid and affect all the European grid systems. For instance, many wind farms built on sites with high average wind speeds are remote from the main load centres so that new overhead lines are necessary to transport the surplus electricity to the regions where it is consumed. And it is necessary to provide back-up generation, with its own requirements for grid reinforcement, to balance the variable contributions from wind power.

Lengthening the transmission lines increases the line losses (in Germany the active grid losses are doubled by large amounts of wind power) and leads to a higher load factor which consumes more reactive power. An increase in reactive power generation at high voltage will need to be installed before 2008 to meet the EU's development plan.

ETSO consider that the cost of these new investments and extra work should be met by the developers of the wind farms. If these costs have to be met by the system operator the costs become part of the tariff paid by the customer and there is no incentive for the windfarm developer to reduce the cost of integration with the grid.

Another problem ETSO looked at was the effect of an unpredictable gale which could generate a large surplus of wind power and cause a temporary power surge through neighbouring grids. Such surges, together with the sudden increase and decrease in output as the wind speed rises and falls, could reduce the stability and security of the grid and affect trading capacities.

A recent paper<sup>3</sup> by Hugh Sharman illustrated this problem in western Denmark.

The situation is likely to get worse as more wind farms are built. By 2008 it has been estimated that proposals for large amounts of wind power will cause bottlenecks in the internal and cross border transmission lines in Northern Europe. Single circuit outages due to a disturbance on the grid could cause internal overloads on the remaining lines of up to 180% in Germany, the Czech Republic, Poland, Belgium and the Netherlands.

The security of the grid can be put at risk by the way the windfarms are connected to it. Conventional power stations do not disconnect from the grid even after a grid failure but many of the windfarms so far built disconnect themselves even in the event of a minor brief voltage dip. This can lead to serious power failures on the system. ETSO recommend manufacturers should ensure that their machines are designed to support system stability even in the event of a fault.

ETSO also considered the economic impact of wind energy. System operators are required to give priority to renewable electricity such as local sources of wind energy, but by doing so they will cut out some cost-effective generation from conventional plant.

To solve these problems ETSO make a series of recommendations. They recommend that a Europe-wide

rational allocation of renewable energy sources should be established with a more even spread of windfarms to avoid concentrations of output and to make use of the most efficient sites, and they recommend the priority rules for the transmission of electricity from renewable sources should be re-examined. Licensing approvals for both renewable sites and grid infrastructure should go hand in hand to avoid delaying the expansion of the grid. Also, wind farm developers should be responsible for correcting the imbalances their output creates on the system and for ensuring they do not adversely affect the stability of the grid in the event of voltage or frequency drops.

The EU Directive demonstrates that the EU is rightly seeking to find new sources of energy to reduce Europe's dependence on imported oil and gas, but it is surprising that it has focused so much attention on wind energy when better alternatives are available. The better alternatives would include the promotion of heat pumps for local space heating and energy from waste plants for the generation of electricity and heat from municipal waste. Energy from waste plants can be built near towns and cities, which are both the source of waste and the demand centres for the energy produced. This would solve both an energy problem and an environmental problem by recycling into energy wastes which would otherwise have to go to landfill. And on the large scale the EU should be promoting a Europe-wide plan for a new generation of nuclear power stations which would solve the problem of providing reliable carbon-free electricity to meet the base load.

#### REFERENCES

- <sup>1</sup> "European Wind Integration Study. Towards a Successful Integration of Wind Power into European Electricity Grids" European Transmission System Operators, Final Report, 15 January 2007
- <sup>2</sup> Lord Tombs, House of Lords debate 23 June 2005, Hansard 1787
- <sup>3</sup> Hugh Sharman, "Why wind power works for Denmark" Civil Engineering, Vol 158 May 2005