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E.ON NETZ *WIND REPORT 2005* SHOWS UK RENEWABLES POLICY IS MISTAKEN

E.ON Netz GmbH is a major German grid operator serving a population of 20 million people living in 40% of the country's land area. It runs 32,500 km of high-voltage and extra-high voltage power lines, and is responsible for integrating 7,000 MW of wind power, nearly half of all that installed in Germany.

Germany's 16,394 MW of wind power produced 26,000,000 MWh, which is around 4.7% of Germany's gross demand (p. 5), and is operating at a load factor of approximately 0.19 (calculated from figures on p. 5). It should be borne in mind when reading the present summary that the 2010 UK renewable energy target is for 10% of electricity supplied, with the Government's expectation being that three-quarters of this will be from wind. The targets for 2015 and 2020 are 15% and 20% respectively.

The extreme difficulties reported by E.ON Netz have much significance since the company knows more about the practical realities of managing a large wind carpet in a modern grid than any other organisation in the world. E.ON publishes their experience in annual reports, the second of which, the *Wind Report 2005*, has just been issued in English, together with a speech by the CEO of E.ON Netz, Martin Fuchs.[1]

The E.ON reports have created intense interest within the energy sector, and demonstrate conclusively that many national policy expectations for wind energy, particularly those of the UK, are currently unrealistic.

Key Challenges Presented by Wind Energy

E.ON Netz identify three key operational challenges.

- Wind energy cannot replace conventional power stations to any significant degree
- Wind forecasting is inaccurate, and in spite of heavy expenditure on improvements, will remain so.
- Because the wind resource is geographically concentrated very substantial expansion of the grid is required to transport power to stabilise the grid.

All three points are highly relevant to the United Kingdom. We will comment on each in turn.

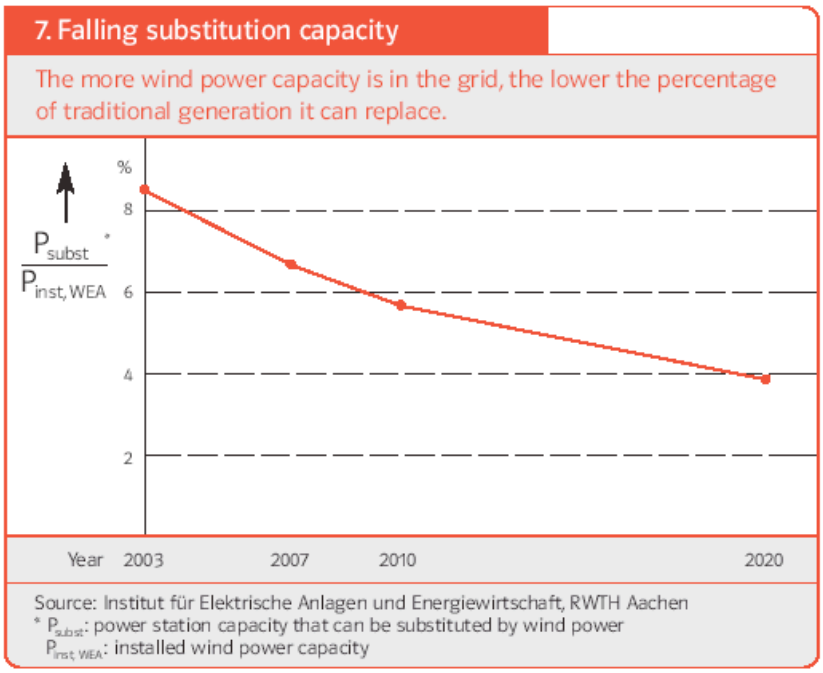
Wind Energy Cannot Replace Conventional Power Stations to Any Significant Degree

E.ON Netz state this matter so clearly that verbatim quotation is appropriate:

[1] Downloadable from http://www.eon-netz.com. Hard copies may also be ordered.

> *In order to guarantee reliable electricity supplies when wind farms produce little or no power, eg. during periods of calm or storm-related shutdowns, traditional power station capacities must be available as a reserve. This means that wind farms can only replace traditional power station capacities to a limited degree.* (p. 9)

The degree to which wind-power can obviate the need for conventional power in the overall portfolio is called its "capacity credit". E.ON reports the results of two independent studies that reveal that at present the Capacity Credit of wind power is 8%. This is so low that it is, in macro planning terms, effectively zero.



Moreover, E.ON shows that this figure will decline as more wind power is added to the system. As E.ON comments:

> *In concrete terms, this means that in 2020, with a forecast wind power capacity of over 48,000 MW (Source; Dena grid study), 2,000 MW of traditional power production can be replaced by these wind farms. (p. 9)*

This is a disastrously poor result, and reveals, finally and conclusively, that wind-power will do nothing to reduce the UK's need for reliable, "firm", generation.

That is to say, however much wind power is built, we will still be faced with the need to ensure that we have adequate conventional generation to meet our peak demand unassisted. Thus, the "Wind v. Fossil" or "Wind v. Nuclear" debates are shown to be vacuous. Wind is not an alternative, it is at best a supplement.

This point bears further emphasis: **E.ON's experience shows conclusively that those who expect wind-power to prevent a nuclear rebuild, or reduce the need for gas and coal stations, have been seriously misled.**

REF concludes that the E.ON report supports our arguments and those of others, that we need a radical rethink of contemporary renewables policy. It is now clear that the government's expectations of wind are mistaken, and must be halted. Instead, policy must be altered to favour technologies such as tidal and biomass,

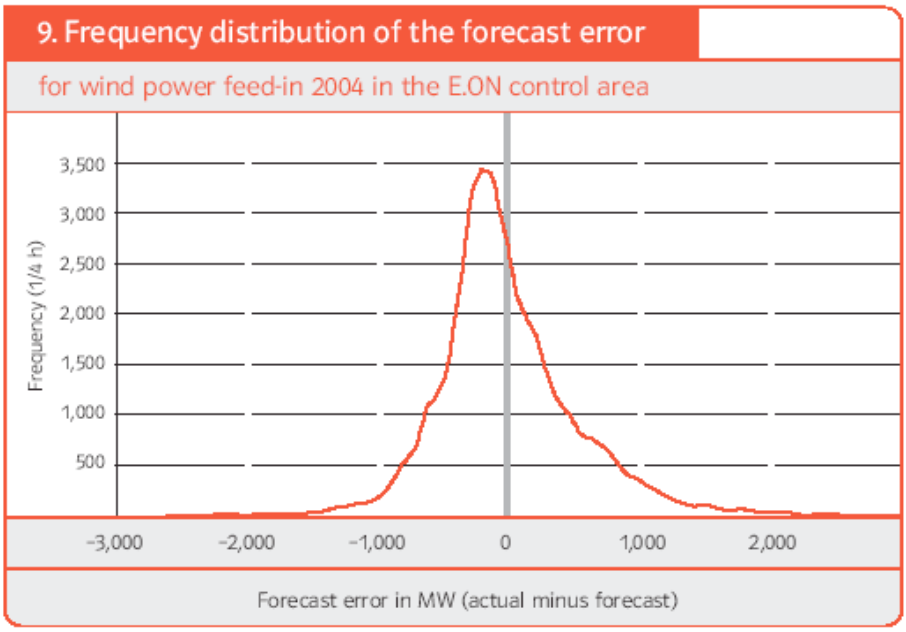
which have higher capacity credits and thus more to offer to the UK's need for stable *power* (energy when and as it is needed). The folly of simplistic "energy" targets for electricity is now evident, and a change of direction is mandatory.

Wind Forecasting is Inaccurate

Because electrical energy cannot be stored commercially on an industrial scale, the grid must be balanced on a second by second basis. Wind input, as Martin Fuchs, CEO of E.ON Netz states in his speech, suffers from various drawbacks to a grid operators:

1. *The wind blows, when it will.*
2. *The wind blows as it will – despite increasingly accurate forecasts, it is difficult to predict its actual strength.*
3. *The wind blows, where it will – and sadly, it does not blow where large quantities of power are required.*

In order to mitigate this unreliability E.ON Netz has invested heavily in wind forecasting. In spite of this, large errors are still common, ranging from 2,532 MW less to 3,999 MW more than predicted, which is equivalent to 36% and 57% of the installed wind capacity. E.ON concludes that "there are natural limits to the quality of the wind power forecast" (p. 11). The error rate in the forecast is illustrated by the following chart:



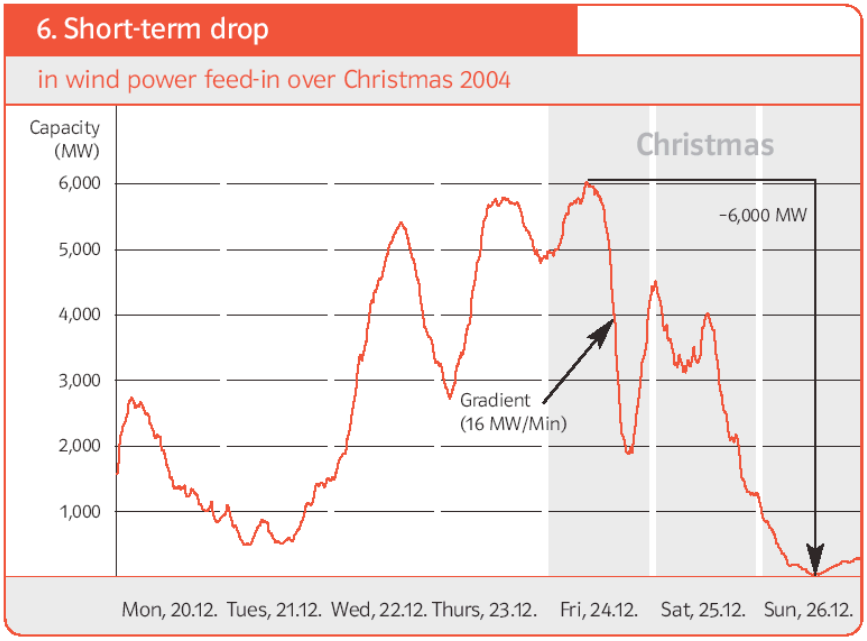
In order to put the scale of error into perspective, it should be borne in mind that a modern coal power station is capable of generating 1,000 MW, and that the UK's national all time peak load is around 59,000 MW. While very large errors are relatively infrequent, the grid operator must be ready for *all* errors. The chart therefore shows that the grid operator must be able to deal with the unexpected absence or presence of large, **nationally significant,** quantities of power, several power stations' worth, on a regular basis during the year. Maintaining such a state of preparedness is costly.

Grid Expansion is Required

Wind resources are not evenly distributed in Germany, with most being concentrated in the northernmost part of the country. Consequently, very substantial grid expansion is required to carry this energy down to the centres of load, and to permit immediate import and export of energy to cope with the rapid fluctuations of wind power. The seriousness of these fluctuations is made clear in Martin Fuchs' speech:

> *On 12 September, wind power supplies covered up to 38% of our grid power requirements at times. This was the highest value achieved during the past year. On 30 September, on the other hand, this figure was down to 0.2 % – the lowest value of the year.*
>
> *Maximum wind power output in our control area was achieved on the morning of 24 December, with an absolute figure of 6,024 MW (compare this with the 2003 maximum power supply of 4,981 MW and the top figure of 3,546 MW for 2002)*
>
> *However, the supply on Christmas Eve 2004 fell to under 2,000 MW within just ten hours. By Boxing Day – on 26 December – the figure had slumped to under 40 MW, a negligible value to all intents and purposes.*

The point is illustrated in the following chart:



Balancing such erratic and uncontrollable flows of energy presents severe challenges, and a very extensive and robust grid infrastructure is essential. By 2020 E.ON Netz estimates that Germany as a whole will require 2,700 km (1,700 miles) of new or reinforced grid, of which 1,900 km (1,200 miles) will need to be on new routes at a cost of 3 billion Euros.

The scale of this expansion is breathtaking, and its relevance to the UK is obvious. NGT has disclosed that most wind power is being proposed in Scotland.[2] This is unsurprising. A recent study by Oxera for the DTI has concluded that even with the very strong subsidy support currently available, which can account for 50% to 70% of a wind-farm's income, wind-farms in medium and low wind areas such as those found in most of the UK, will struggle to be economic. Canny investors are looking towards the NW of the British Isles, and in fact some 17,000 MW of wind, more than is currently installed in the whole of Germany, is currently applying for grid connection in Scotland.[3] The grid expansion needed to support this expansion will cost, according to NGT, some £250,000 per MW. If all 17,000 MW were built this would entail grid enlargement costing over £4 billion in Scotland alone.

It is worth noting that even if Germany succeeds in expanding its grid, it is not clear that this will result in anything more than an export of the problems caused by large fluctuations in wind output. As Martin Fuchs notes, currently:

> *[...] in times of strong winds, the majority of the energy produced between Oldenburg and Rendsburg sloshes southwards in waves. In accordance with the laws of physics, it seeks the path of least resistance, also escaping eastwards and westwards into neighboring European grids. Thus German wind power is increasingly taking Dutch and Polish grids to the limits of their capacity; complaints have already been made in this regard.*

E.ON's practical experience undermines previous theoretical assertions that the UK, with its effectively islanded grid, can economically manage a large wind-component, and indeed raises deeply troubling questions with regard to its feasibility.

CONCLUSION

The E.ON Netz wind report is required reading for those wishing to determine whether the UK government's current wind policy is prudent.

The inescapable conclusion to be drawn from the German experience is that the unsophisticated nature of the UK's Renewables Obligation is driving us towards an irrational over-commitment to an unreliable and extremely expensive energy source **with an extremely large and deep environmental footprint**. A rethink of both the conventional and renewable energy policy is obligatory. It is now well-known that the Energy White Paper of 2003 neglected to ensure gas inflow and has exposed the UK to severely constrained supplies this winter. This was avoidable, but by taking its eye off the ball at a crucial moment, the government has created a needless crisis. Failure to respond to the evidence now coming out of Germany with regard to wind would be a corresponding dereliction of duty, leading to fundamental problems in the UK electricity system.

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[2] Lewis Dale (Regulatory Strategy Manager, NGT), 'The Energy White Paper - Will it Deliver?', IEE seminar, 19 May 2005, at the Royal Society.

[3] Lewis Dale, 'The Energy White Paper - Will it Deliver?'.