

THE IMPACT OF WIND GENERATION ON NORTH-WEST EUROPEAN ELECTRICITY MARKETS

A major new Pöyry multi-client study

Pöyry Energy Consulting is launching a major multi-client study to examine the implications the rapid growth in intermittent generation will have on the wholesale energy markets of North-West Europe.

The combination of variable wind and other inflexible low carbon generation which are implied by the EU's proposed renewable targets for 2020 and beyond will create significant levels of uncertainty over market outcomes. Our previous studies, covering GB and Ireland, and Northern Europe, have shown that large volumes of renewable (especially wind) generation disrupt the status quo; typically, market prices become more volatile, leading to a risky operating environment to which inflexible low carbon generation is unsuited. In many markets, we have observed that load factors of thermal plant reduce sharply, and returns on investment may be concentrated in a smaller number of hours.

It is essential for market participants, TSO's, regulators, and governmental bodies to understand the behaviour of markets with large amounts of variable renewable generation so that strategic, investment and policy decisions can be made based on a full understanding of possible market behaviour.

Background

European governments have agreed that 20% of the EU's final energy consumption should be from renewable sources by 2020, implying that renewable sources will potentially need to account for **over 30%** of electricity generation.

The variability of wind as a generation source has major implications for the operation of the system in North-West Europe. This applies to patterns of price, operating profiles of existing generation and commercial implications on new build generation of different types

There will be significant build of wind farms in North-West Europe due to high average wind speeds

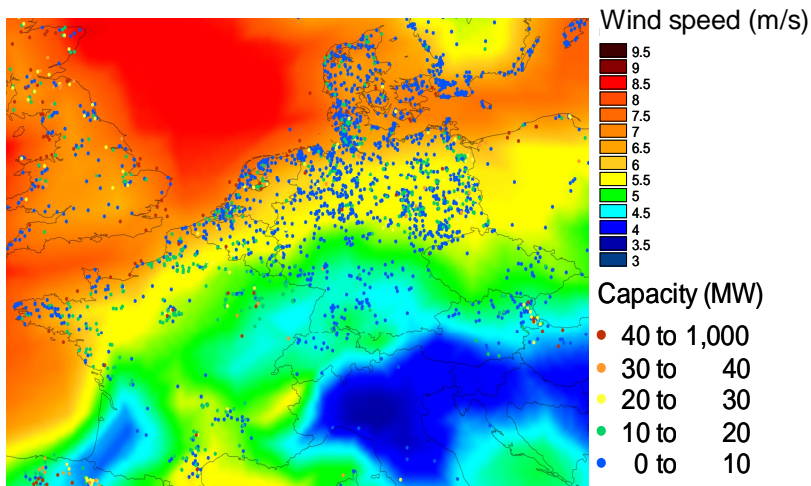


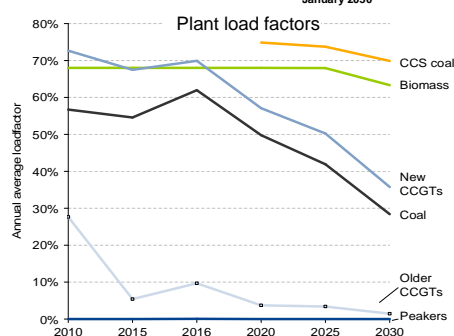
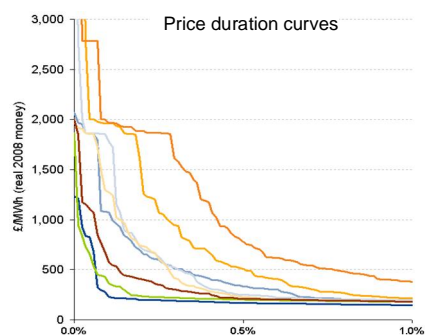
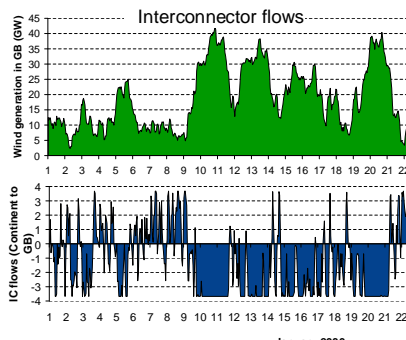
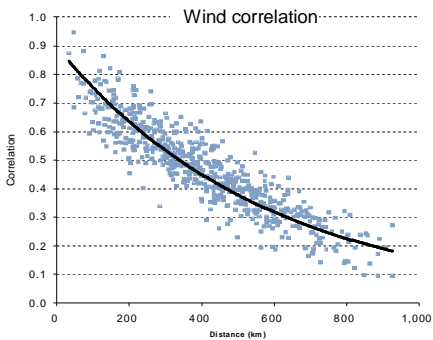
Chart shows location of proposed wind farms in Europe, along with average annual wind speeds.

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Proposed issues for investigation

Wind generation	<ul style="list-style-type: none"> Are extreme weather events correlated in North West Europe? What are the hourly production curves for typical and outlying years resulting from expected growth in wind capacity in NWE?
Pricing impacts	<ul style="list-style-type: none"> Will price spikes and negative prices be a regular feature of the market?
Dispatching of conventional and nuclear plant	<ul style="list-style-type: none"> How will the dispatching of existing and proposed conventional and nuclear plants be affected by renewable production? To what extent will thermal plant be pushed to lower load factors?
Impact on earnings of typical plants	<ul style="list-style-type: none"> What are the consequences of pricing and dispatch impacts on expected earnings of typical plants, taking into account both upsides and downsides?
Flexibility of capacity	<ul style="list-style-type: none"> How much flexible capacity will be required to complement renewable capacity?
Security of supply	<ul style="list-style-type: none"> What reserve margin will be required to guarantee particular levels of supply security? Is demand side management a vital component in managing a high renewables world?
Interconnection	<ul style="list-style-type: none"> Where should interconnection be reinforced or developed? What are the effects of a North Sea grid?
Transmission	<ul style="list-style-type: none"> Will internal transmission constraints become a critical issue?

Results will give detailed understanding of the key impacts of variable generation



Results will include:

- Wind speed and generation analysis
- Hourly and annual market prices
- Thermal generation profiles
- Internally consistent new build of capacity
- Wider system aspects (emissions and total cost)
- Interconnection, and flows between countries
- Revenue by plant type
- Return on Investment
- Profitability by plant type.

Illustrative results from GB Implications of intermittency study

In 2030, will North-West Europe markets exhibit similar behaviour to that seen in modelling of the GB market?

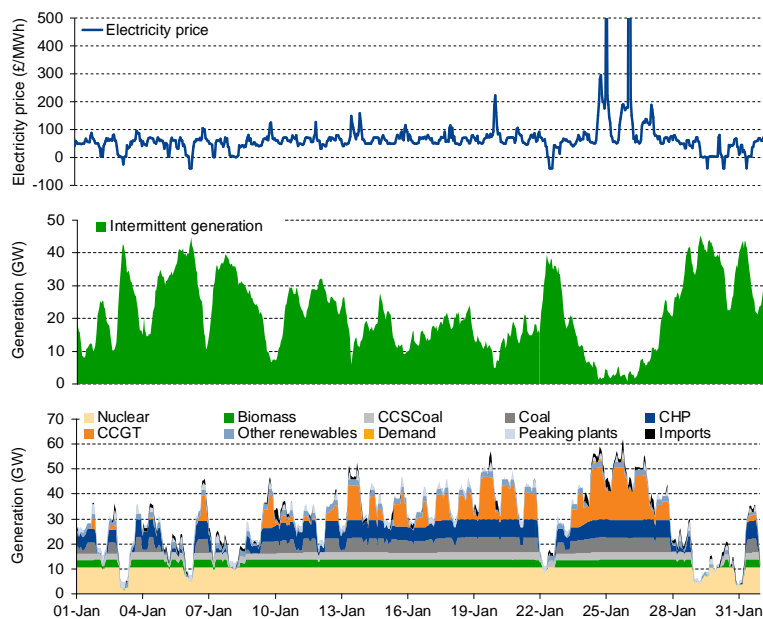


Diagram shows GB generation patterns for a month in January 2030, assuming installed wind capacity of 43GW and wind patterns from across GB based on January 2000.

Project co-ordination

The intent behind the multi-client nature of the study is that it provides the opportunity for debate and consensus on a number of important points, which will improve the quality of the final results for all participants. Furthermore, we hope participants would be able to contribute data (suitably anonymised) to further increase the accuracy of the work.

We anticipate two levels of participation:

- **'Founder'** status for first movers which includes a place on the steering committee, the opportunity to shape the study, a private workshop, and access to all study data; and
- **'Study Member'** status which gives access to the study results, the interim and final presentation and data for the core scenario(s).

The steering committee will sculpt the scope of the project, having input to the scenario definition and sensitivity tests, and will guide decisions on aspects of modelling methodology. The Founder places will be limited and we will seek to achieve a balance of interest groups.

It is envisaged that further client-specific and confidential work would be carried out at preferential rates for individual participants.

Next steps

We have now issued the formal study proposal and have set a deadline of **23 April** for interested parties to join the study.

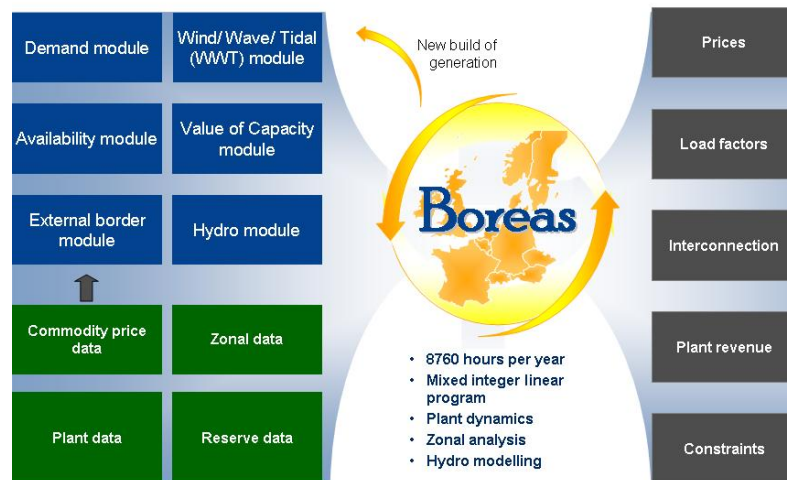
The study will commence at the end of April, and finish in late 2010.

Modelling

All too often studies into renewables avoid the difficult questions and so the results are therefore somewhat lacking. Pöyry proposes creating a North-West European electricity model ('Boreas') that will be fit for purpose in this regard. This model will form the keystone of our assessment, simulating scenarios for future wind penetration in the region and enabling

us to determine what strategic investment choices should be made now to take advantage of the opportunity that these major changes represent.

The model will deliver insights for strategy



Why Pöyry Energy Consulting?

Pöyry is ideally placed to carry out this multi-client study. We have a highly sophisticated modelling capability that has been developed over 20 years in the European markets, and we model all European electricity markets for our quarterly update service.

In spring 2009, we completed the 'Implications of Intermittency on the GB and Irish markets' study. In 2008, we completed a multi-client study looking at the implications of large-scale wind power in Northern Europe. Currently, we are working on a multi-client study assessing the implications of renewable and variable generation on the gas markets of the UK and Ireland.

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