

From: [REDACTED]@ntlworld.com]
Sent: 20 February 2011 21:03
To: Electricity Market Reform
Subject: EMR - UK Power System Operation - issues with Large Penetrations of renewables.

Good evening.

The analysis concerning the level of variable output Generation that the system can handle has concentrated on penetration by percentage of energy. Current proposals for Onshore and Offshore Wind seem to give a total of 28-30GW, projected to provide @33% of the total GB electrical energy.

However, Power Demand is always perfectly in balance with Generation, with any mismatch in the totals causing an immediate frequency deviation to correct both elements and maintain the balance condition. The GB System demand varies from 60GW at the Winter weekday Peak (overnight minimum 39GW) down to 24GW at the summer minimum weekend trough.

Therefore the impact of variable renewables needs to be analysed in terms of the range of ratios of their Power output to Demand. Over a number of high Demand winter weekdays it is perfectly possible for the Wind output to vary from 64% (say 25GW high wind at overnight trough 39GW) down to 6% (3.5GW low wind output at 60GW Peak). The % level of wind output will of course be much higher at the lower demand levels experienced in the summer.

The Poyry report commissioned by National Grid actually shows worse situations.

Our isolated 60GW system only as limited interconnection (3.5 GW inc Ireland) and only 2.7GW of Pumped Storage. Under high wind, low demand conditions there will be insufficient 'headroom' to accommodate enough regulating type plant above the Nuclear and other embedded base generation level. The only reason and Denmark can run with high wind is the control afforded by Norwegian Hydro and even that has limitations; the new Norway-Belgium Interconnector now allows Nordpool to export excess output to UCTE. European Wind (esp Germany/Spain) is of course operating within the vast 350GW Interconnected UCTE system and has less of a relative impact.

And, there is no way that GB customer response can vary relating to wind output changes (say 5GW to 25GW over

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subsequent winter days) where that range is 33% of the Peak demand and 50% of the Trough!! There is only so much demand you can shift on a given day; weekday to weekend has more potential while seasonal movement would be even more difficult.

In summary, the Power penetration impact of renewables has been identified but has not been properly analysed. In addition to variability we also have the predictability issues to deal with; if the level of regulating plant is limited by high penetration of wind then uncertainty makes things worse. That could introduce severe imbalance problems in the Wholesale market and very expensive balancing actions. Curtailment of renewables at high output levels reduces their load factor which is of course completely contrary to their purpose. All this adds up to a greater financial burden on the retail customer and possibly an unstable Power system.

I have 22 articles available online covering Future Power Systems (FPS), starting with some of the basics (including FPS1 covering the balance principle which is not always well understood). FPS4 has a nasty example of wind unpredictability and variability impact. FPS 20 and 21 cover the Smart Enterprise and the Smart Customer while FPS22 looks at evaluating the worth of various strategies to determine the best approach for Power (Big+Little), Heat and Transport. After all, the strategies for each of the three sectors are becoming increasingly dependent on the others. Let me know if you would like the links.

Best Regards

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Retired, but still being a nuisance and open to contracts Ex
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