

[REDACTED]

10 March 2011

**Electricity Market Reform – consultation document**  
**Comments on behalf of Durham Energy Institute**

*Executive summary*

This submission refers to Consultation question: Options for Market Efficiency and Security of Supply. Our perspective is that of modellers interested in security of supply.

Q.19.

We believe that any debate on whether or not a capacity mechanism is introduced must be informed by a robust generation adequacy risk measure. Unfortunately we do not believe that that the analysis presented in the consultation document was comprehensive enough to answer, with a high enough level of confidence, the most fundamental question: will a capacity mechanism be necessary in future in order to deliver an acceptable level of generation adequacy risk, as compared to the past? The main problems with the presented analysis are: (i) the chosen measure of risk; (ii) lack of comparison with historical level of risks; (iii) the target risk measure; (iv) treatment of uncertainty and wind generation.

Q22

If the Government's preference for a targeted, volume-based mechanism, with a central body responsible for the targets, we believe that the current GB short-term operating reserve (STOR) tender could be extended to provide that service. This would bring significant benefits because STOR is already integrated with the Balancing Mechanism and the implementation costs would be low. A potential resistance from National Grid could be overcome by designing a suitable incentives mechanism.

*Full text*

This submission refers to Consultation Question: Options for Market Efficiency and Security of Supply. Our perspective is that of modellers interested in security of supply.

***Question 19. Do you agree with our assessment of pros and cons of introducing a capacity mechanism?***

We believe that any debate on whether or not a capacity mechanism is introduced must be informed by a robust generation adequacy risk measure. This permits assessment of the risk in any given investment scenario, and also guides the design of energy and capacity markets

by setting a baseline for what the market should deliver (e.g. an adequate capacity mix should be consistent with appropriate returns on investment). Unfortunately we do not believe that the analysis presented in the consultation document was comprehensive enough to answer, with a high enough level of confidence, the most fundamental question: will a capacity mechanism be necessary in future in order to deliver an acceptable level of generation adequacy risk, as compared to the past? The main problems with the presented analysis are: (i) the chosen measure of risk; (ii) lack of comparison with historical level of risks; (iii) the target risk measure; (iv) treatment of uncertainty and wind generation.

#### *The chosen measure of risk*

This risk measure should ideally be based on probabilistic risk assessment. However, derated plant margin, as used in Redpoint report, may reasonably be used as a proxy for risk provided that appropriate capacity value measures may be defined.<sup>1</sup>

The key point which must be recognised in any robust risk assessment is that calculating an absolute level of adequacy risk is almost certainly not possible. In a recent paper<sup>2</sup>, we demonstrated that uncertainties in conventional plant availability probabilities alone place uncertainty covering an entire order of magnitude on generation adequacy risk results in the present GB system. There will clearly be additional uncertainties arising from model structure approximations, imperfect foresight in making future system projections over demand and technology growth, future fuel prices, how investment decisions are made etc. This uncertainty must be reflected in the way that calculations are structured and results presented.

#### *Lack of comparison with historical levels of risk*

We believe that rather than attempting to calculate an absolute level of risk (10% derated capacity margin or unserved energy/probability of brown out - Fig. 10 of the Redpoint report), it is much more robust to choose an acceptable benchmark level of risk (or derated margin) by performing an equivalent calculation for historic years in which the installed capacity is judged to be adequate<sup>3</sup>. Unfortunately the Redpoint report does not include such a comparison – all the graphs analysing the effect of capacity payments start from year 2010, see e.g. Fig. 51, 59, 60. This lack of historical comparison, combined with the difficulty to assess the absolute level of risk, makes it difficult to assess whether or not a capacity mechanism will be needed in the future.

We have performed such a modelling in our group and the graphs below shows the headline GB capacity margin (blue line) and the GB derated margin (red line) based on ACS peak demand and total installed capacity. The derated margin has been calculated using the availability factors provided in National Grid Winter Outlook reports. The diagram shows also the future headline and derated capacity margin calculated using a dynamic simulation model of the aggregated GB generation investment market<sup>4</sup>. The model uses an 'energy-only' market setting to estimate the economic profitability of investments and forecast the

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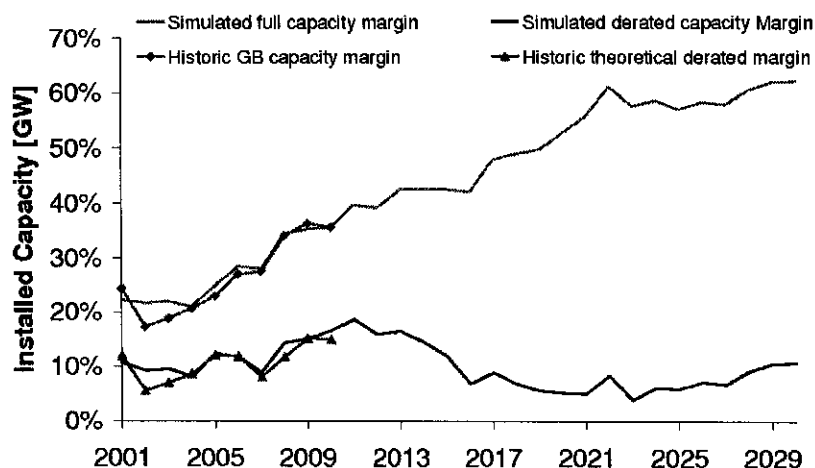
<sup>1</sup> An example of this may be seen in the Appendix to National Grid's 2010/11 Winter Outlook Consultation written by Dr. Chris Dent, in which risk and derated margin metrics are shown to be largely equivalent.

<sup>2</sup> Dent and Bialek, IEEE Transactions on Power Systems 26(1), 120-127, Feb 2011

<sup>3</sup> We understand that this was the case for much of the 2000s, and that the present risk level is perhaps unsustainably low due to CCGT being commissioned in anticipation of coal plant retiring due to the Large Combustion Plant Directive.

<sup>4</sup> The project is sponsored by UK Energy Research Centre

evolution of security of supply. Comparison between the modelled and actual capacity margins shows a good agreement of our model with reality, which gives a degree of confidence in the realism of our future projections. We strongly believe that a similar historical comparison should be made in the Redpoint report<sup>5</sup>. We would be happy to share our insights on future trends with DECC or its advisors.



#### *The target risk level*

The next question is what the target capacity margin one should aim for. The consultation document assumes the target 8-12% derated margin as within Repoint's model this achieves 4-0.5GWh expected energy unserved. It is interesting to note that the CEGB planning margin allowed for ~8.6GWh/yr after voltage reductions when the 28% margin (8.8% derated) was adopted<sup>6</sup>. This might seem to suggest that the current risk standard is more onerous than the CEGB one, which is rather surprising given the reputation of CEGB as the strong guardian of security of supply. However, such an argument assumes that the risk models and data used in the two calculations permit calculation of absolute levels of risk which are comparable between the models, which is not the case. One can only investigate how a given measure performs over a period and hence look at changes in the risk level in future scenarios.

An important parameter in designing a capacity mechanism is the Value of Lost Load (VOLL). It is interesting to note that the proposed levels of VOLL (10-30 £/kWh) are an order of magnitude higher, even when inflation is taken into account, than those used historically (2 £/kWh inflation-indexed under Pool and CEGB). This would again seem to suggest that CEGB was more relaxed about security of supply.

#### *Treatment of uncertainty and wind generation*

We are unable to comment on the precise treatment of wind generation in Redpoint's margin and risk analysis, as we can find in their report no detailed description of their risk/capacity credit model structure, nor of the wind resource data on which their calculations were based. Our experience is that given the statistical relationship between wind availability and demand (via the dependence of both on the weather) adequacy risk modelling results for GB depend

<sup>5</sup> It is impossible to compare our results with Redpoint's due to lack of knowledge of their modelling assumptions and lack of historical calculations for their derated margins.

<sup>6</sup> Electricity Council, *Report on the Generation Security Standard*, September 1986.

strongly on data from a small number of hours of extreme demand<sup>7</sup>. One must therefore be very cautious in treating wind and demand time series, particularly from the 2000s when there were very few periods of truly extreme demand. It may well be the case that there may be great uncertainty in the best available estimate for the probability distribution of available wind capacity at times of extreme demand.

We suggest strongly that much more detail on model structures and data should be available for modelling studies which are used in determining public policy; otherwise, it is impossible for independent parties to analyse the robustness of the conclusions drawn.

**Question 22 Do you agree with Government's preference for the design of a capacity mechanism:**

- **A central body holding responsibility**
- **Volume-based, not price-based**
- **A targeted mechanism, rather than market wide.**

If the Government's preference is accepted, we believe that the current GB short-term operating reserve (STOR) tender could be extended to provide this service. Under the proposed changes, a central body could decide on quantity, type and timing of new plant required to meet any risk standard and notify National Grid. Adopting a model which is similar to the STOR would bring significant benefits including

- Integration with the Balancing Mechanism (BM) which is already in place for monitoring
- STOR mitigates against "double-payments" by having direct links to the BM and strict rules are already defined
- The system is already in place, thus reducing implementation costs

Obviously NGET may object to using STOR for solving long-term security of supply problems but we believe that an appropriate incentive mechanism might go a long way to persuade NGET to accept that option.

We would be very happy to discuss any of these views further with DECC or its advisors, and in particular we would be interested to explore how our technical modelling expertise could benefit future economic studies.

Yours sincerely,



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<sup>7</sup> As an example, in one calculation based on a long historic demand time series for England and Wales, we found that more than 50% of the value of the calculated risk metric arose from 5 very cold days in early 1987.