NETS SQSS Fundamental Review: April Consultation Response

C.J. Dent and J.W. Bialek (Durham University)
S. Zachary (Heriot-Watt University)
Contact address: chris.dent@durham.ac.uk

Introduction
We welcome this opportunity to present our views on the SQSS Fundamental Review, based on the April 2010 Consultation Document.

In this response, we concentrate on Working Group 3 (Main Interconnected Transmission System), and in particular on the probabilistic and statistical modelling methods which might be employed in system planning.

As this is an interim consultation for the MITS planning/wind integration part of the SQSS, with the main consultation on this area still to come, we confine ourselves to high level comments on the benefits of different philosophies for the future MITS planning standard (although we would be happy to discuss in more detail the latest thoughts from the Transmission Licensees as presented at the recent Industry Review Group meeting)

More detail on our views regarding risk-based planning, and the history of system planning standards in GB, may be found in C.J. Dent *et al*, *The Role of Risk Modelling in the Great Britain Transmission Planning and Operational Standards*, Probability Methods Applied to Power Systems Conference, 2010.

Separate demand security and constraint cost standards
We support the concept of a two-part standard (as is the case at present), with the first part providing a minimum network capacity on demand security grounds, and the second allowing additional capacity to mitigate constraint costs. The second part is sometimes referred to as the ‘wind integration’ part, as most transmission capacity for connecting wind will ultimately be driven on economic (i.e. constraint cost), rather than security grounds.

Continued use of the current deterministic standard for the security part
Historic experience shows that in an all-conventional system the present ‘planned transfer plus interconnection allowance’ (PT+IA) approach has delivered an appropriate level of demand security at a reasonable cost. Providing an appropriate scaling factor for wind can be accepted by the industry, its continued use as a demand security standard represents a sound approach.

We recommend that the scaling factor used for wind (or the method for determining it) should form part of the SQSS itself; these are not expected to be controversial, as due to the ‘wind integration’ part of the SQSS, a low demand-security scaling factors for wind will not result in restricted network capacity to connect wind.

We also recommend that an official statement of the purpose of the PT+IA part of the SQSS should be made, along with a formal justification for continued use of this deterministic standard.

The appropriate scaling factor for wind might be informed by risk-based capacity credit assessments; we would be happy to advise on this based on Dr. Chris Dent's work on generation adequacy assessment for National Grid's Winter Outlook. We also suggest that if the 'ranking order' approach to selecting contributory generation remains, then wind's scaling factor should be a risk-based capacity credit rather than a winter mean load factor.

CBA versus deterministic rule for wind integration

The question of cost-benefit analysis versus deterministic rule for the wind integration part of the standard is probably the most controversial issue facing the SQSS Review Group.

The main advantage of deterministic rules is that they provide a simple computation methodology involving a small set of input parameters. As a result, once the system planning background is defined, they quickly provide a single value for required transmission capacity. However, as they are usually peak power flow-based, deterministic rules do not reflect directly the driver of 'wind integration' transmission capacity, namely constraint costs.

On the other hand, due to uncertainty over future system backgrounds (generator locations, demand levels, prices etc.), the transmission capacity resulting from a CBA approach depends sensitively on the input assumptions. However, CBA does reflect the true drivers behind 'wind integration' reinforcements.

Moreover, it could be argued that the sensitivity of the result of a CBA to its input assumptions is simply a reflection of the nature of the decision being made, and that this must include an assessment of how the upgrade proposal performs under a range of different future system scenarios.

Our preferred approach is therefore CBA, with consideration of an appropriate range of future scenarios in the analysis. We acknowledge the benefits of deterministic rules, and are open to discussion as to whether they can form a robust standard for wind integration reinforcements; however, as they are not directly reflective of the underlying issues, any proposal for a deterministic standard requires very careful justification.

Use of formal optimisation models for CBA

The great difficulty in using a formal optimisation model for performing a cost-benefit analysis is that the computational overhead from the optimisation model prevents inclusion of high engineering detail. This is acknowledged in Section 3.2.4 of the Consultation Document, which discusses limitations of the present DTIM approach; in particular, that section discussed the simplified dispatch and wind models embedded in DTIM.

It is clear that no restriction should be placed on the methods which the Licensees use for internal studies; a distinction must therefore be made between the formal

SQSS, which provides the framework for regulatory justification, and any heuristics which the Licensees develop for internal use. However, we are sceptical as to whether a formal optimisation model can include sufficient detail to make a robust regulatory justification.

It may also be difficult to consider uncertainty in future system background within a formal optimisation approach; due to the need for an embedded stochastic dispatch model, the system evolution in formal planning models is typically deterministic. In reality, the best solution considering uncertainty might not be the optimal solution in any single deterministic scenario.

Use of CBA for demand security
We are also sceptical as to whether the cost of customer disconnection risk can be assessed sufficiently robustly to perform a CBA between it and capital reinforcement costs.

There are various reasons for this

- Putting a cost on demand security risk requires assessment of the value of lost load.
- Almost all demand security risk calculations consider adequacy risk only (the risk of insufficient available generating capacity at any instant in time), as opposed to the risk arising from disturbances (the immediate consequences of fault events); the latter currently dominate the risk arising at transmission level.
- The small transmission-generation adequacy risk is presently dominated by the generation side, not transmission; this is expected to remain the case.
- Quantifying the risk from disturbances is a very difficult task indeed, as there is a vast multiplicity of possible events, all of which are very unlikely individually. Moreover, the consequences of even a precisely specified severe fault event are hard to quantify using a dynamic system simulation.
- There is a benefit to society from a reliable transmission system, which goes beyond the immediate costs of any single customer disconnection event.
- System adequacy risk calculations are very sensitive to errors in the input generator reliability data (for a detailed analysis, see Dent and Bialek, *Non-iterative Method for Modelling Systematic Data Errors in Power System Risk Assessment*, IEEE Trans. Power Syst., in press, copy available on request.)

Demand security CBAs might be more useful in the design of individual generator/demand connections, where the scope of the relevant issues for modelling is more limited.

Requirement for improved wind resource data and statistical modelling
Good wind resource data, and a resulting high quality statistical wind resource model, is a necessary pre-requisite for robust use of any planning methodology. For deterministic rules, a robust wind model is required for studies justifying the rule, and such a wind model is required directly for a CBA involving constraint costs.

The best GB wind dataset currently available is that produced for Poyry’s Impact of Intermittency report. However, as it is based on wind speed data from meteorological stations, this might not be representative of actual wind farm locations; this issue will be particularly important when disaggregated network studies are performed.

In our view, the development of improved GB wind datasets is vitally important for truly robust wind integration studies. Within this, particular attention must be paid to offshore wind data, in view of the projected rapid expansion of offshore wind capacity, and the very limited availability of historic offshore wind speed measurements.

A properly spatially diverse wind resource model might make fitting a deterministic rule to constraint costs simulations harder, as the nature of flows on different boundaries would become more individual. A deterministic rule might also have difficulties coping with transmission technologies with very different capital costs (particularly onshore overhead lines versus undersea HVDC cables).

We would be delighted to discuss further how, with our combined statistical, engineering and economic experience, we could assist the Licensees in developing such models.

Conclusions

We believe that the key directions which Work Package 3 of the Review should explore are:

- Creation of the necessary realistic statistical wind model, and improved underlying wind resource dataset.
- Consideration of how uncertainty in the future system background should be incorporated in regulatory justification of capital expenditure.
- Achieving an industry consensus on the best practice for cost-benefit analysis between constraint and capital costs.