Centre for Distributed Generation and Sustainable Electrical Energy

Response to the Offshore Electricity Transmission - A Joint Ofgem/BERR Policy Statement

G. Strbac, P Djapic, C. Ramsay

September 2007

MANCHESTER 1824
The University of Manchester

Imperial College London

University of Strathclyde

Response of the Centre for Distributed Generation and Sustainable Electrical Energy to the Offshore Electricity Transmission - A Joint Ofgem/BERR Policy Statement

1. Insufficient justification for the unequal treatment of on-and offshore networks and concerns about the interpretation of network redundancy

We are concerned that the Policy Statement proposes to treat onshore and offshore transmission networks differently in the context of compensation that generators may be entitled to receive due to unavailability of transmission network. We do not believe that there is sufficient justification for the unequal treatment of on- and offshore generation with regard to compensation and we would highlight that if this position is maintained, this proposed arrangement is likely to unfairly discriminate against offshore developments.

Our primary concern comes from the interpretation of the relevance of redundancy in the onshore and proposed offshore networks. We do not believe that the presence of network redundancy can be used as a basis for justification of compensation payments for non-availability of transmission access.

The standards for onshore networks have been defined on the basis of optimising network design to accommodate requirements for reliability and economic efficiency at least cost. The cost benefit approach that we developed[1] that was applied to determine the economically efficient design of offshore networks is conceptually *identical* to that used onshore (although the detailed solutions are different due to different cost structure and the fundamental characteristics of generation). The resulting *optimum* standard represents the efficient network solution that balances costs of operation (e.g. constraint costs, losses etc) against capital investment costs. In the case of the onshore network, the resulting optimal design features a certain level of redundancy. In the case of the offshore network the *economically most efficient* offshore design features *no redundancy*, due to the significantly higher cost of undersea cables when compared to overhead lines, the absence of demand offshore, the relatively low load factor of wind generation and the low capacity (security) value of offshore wind generation that can be relied upon to secure onshore demand.

It is important to note that the presence or absence of redundancy in the network design is a product of the optimisation, not an explicit requirement or pre-specification of the minimum standard. In this context, justification for a reduction in compensation entitlement is taken on the basis that some generators will opt for a connection level that is below the standard. Accordingly they must accept a lower level of compensation payment should transmission access be unavailable. But it is not the level of redundancy that is driving the change in compensation; it is the

[1]P. Djapic, G. Strbac, Cost Benefit Methodology for Optimal Design of Offshore Transmission Systems, May 2007 (www.sedg.ac.uk)

departure from the optimal network design that changes the compensation entitlement. Under this interpretation there is no justification for treating offshore differently from onshore and not fully compensating offshore generators when they are connected to a network which conforms to the optimal offshore standard.

2. Impact of offshore generation on costs of network constraints

Furthermore, when considering compensation arrangements, it is important to quantify the level and materiality of constraint costs in the entire system. We are concerned that this is not addressed in the Policy Statement and that no impact assessment was conducted to support the proposal presented in the document.

Although the optimal network design requires no redundancy, the reliability performance of the offshore network is still high, particularly for larger wind farms. This is driven by the power transfer limitations of AC undersea cables. The 132kV AC cables currently in use can carry up to about 250MW while modern 400kV overhead lines can carry over 2000MW over longer distances. For example, a connection of a 600 MW wind farm offshore will require installation of at least three 132 kV cables due to limited power transfer capability of undersea cables. After the loss of one of the cables, our analysis shows that (because two functional cables remain, and because of the relatively low load factor of the connected generator) this results in expected energy curtailment of only around 8 % of the total energy production expected until the fault is repaired. Given relatively small number of expected faults in offshore networks (transformers fail on average once in 33 years and there will be on average one failure of a 50km cable in 25 years) expected energy constrained due to outages of offshore network components (costed at £75/MWh and including the value of ROCs) will also be relatively small. This level of constraints cannot justify the construction of redundant offshore networks and also indicates that outage events are likely to be less severe than implied in the Policy Statement.

Correspondingly, our analysis suggests that the impact of additional constraint costs from the offshore wind network will not add significantly to the existing constraint costs on the system. Our assessment[2] indicates that after all Round II projects are connected the expected costs of offshore wind energy that will be constrained due to failures on the network, are between £10.8m and £13.1m per annum (this is under very conservative assumptions regarding network repair times with *average* repair times for faulty offshore transformers of 6 months and for cables, 2 months). When compared with post BETTA constraint costs that are in the region of £100m, costs of offshore wind driven constraints would make a relatively modest contribution to the overall constraint costs. This contributes to the argument that compensation and access arrangements offshore should follow the onshore regime, as connection of offshore wind does not materially change the overall volume of constraint costs.

[2] P. Djapic, G. Strbac, Grid Integration Options for Offshore Windfarms, November 2006 (www.sedg.ac.uk)

3. Inconsistency between the standard and proposed compensation regime

It is also important to stress that if the criteria for development of the standard are to change, then this will have repercussions for the optimal network design recommended by the efficient standard. The methodology that we developed (that was also used to form the recommendations for the planning standard), is based on a key assumption that wind energy curtailed due to the unavailability of network represents a *long term average (expected) value* of energy constrained over the life time of the project. These expected values of energy curtailed can be approximately achieved when considering the operation *of a portfolio of offshore schemes over a long period of time*.

If the reality is that of no compensation for constrained off-shore generation then individual generators are effectively bearing the risk of restricted access and energy curtailment alone. This is a very different scenario from the consideration of a diversified portfolio of risk from a group of offshore wind farms, as there is potentially a significant variation in the energy curtailed when considering single farms. An individual farm may experience a higher or lower number of outages than the expected long term average would suggest, and hence higher or lower levels of constrained energy than the long term average. Clearly, the risks of achieving higher values of energy curtailed than the long term average value, on an individual project (particularly small schemes that would be connected though a single cable), may be sufficiently higher than that used in the developed standard (which is based on the onshore model of the GBSO responsible for a portfolio of generators, thus diversifying the risk of any single one being unable to access the network, as onshore).

If projects are to be considered in isolation, this might (seemingly) warrant network designs with higher levels of redundancy (and higher corresponding investment costs). In other words, the new recommendations for standards on the design of offshore networks are only appropriate if the constraint costs are spread across a portfolio of schemes (as in the onshore network) and not borne by individual generators. In fact, the proposal in the Policy Statement to treat on- and offshore networks differently undermines the offshore SQSS. It will now be a matter for developers to analyse their project risks and agree with the offshore TO an asset-compensation package that minimises overall costs. This approach would then result in the installation of more asset than required by the offshore SQSS, which would be clearly inefficient.

4. Conclusions

In summary, we believe that unequal treatment of on-and an off-shore generation with regard to compensation payments for transmission access is not justified as both networks are designed on the same principles. The Policy Document does not provide evidence that these networks should be treated differently. The fact that the outcome of the optimisation for design of on- and offshore networks leads to different levels of network redundancy is a product of different input characteristics, it is not indicative of a pre-specified compromise in level of security of offshore networks.

Furthermore, if the proposed position of the different treatment of offshore and onshore networks in relation to compensation is to be maintained, then the developed security standards should be reviewed. The developed standard is inconsistent with an approach of no compensation, so must be adapted to reflect this transfer of risk from the SO to individual wind farms. This many then lead to a minimum standard that recommends a higher level of redundancy in the offshore network. But it does not take advantage of the reduction in risk that can be conferred by a single system operator taking a portfolio approach to constraint management and will ultimately lead to a more costly offshore network solution.

We hope that Ofgem and BERR will review the proposed arrangements for compensation regime associated with offshore transmission networks in the light of this presentation of our concerns.