WORKING GROUP REPORT

BM Unit Data from Intermittent Generation

Prepared by the BM Unit Data for Intermittent Generation Working Group for submission to the Grid Code Review Panel

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1.0 Summary and Recommendations

The proportion of generation from intermittent power sources is increasing gradually. A substantial proportion of this generation would be able to participate in the Balancing Mechanism and be used by NGET for short term balancing and managing flows across constrained boundaries, although there may not be significant commercial incentive to do so at present, particularly when Renewable Obligations Certificates (ROCs) are taken into account. To expedite this process Generators must provide NGET with data related to the expected capability output of the Generating Unit up to and post Gate Closure. The existing data requirements were developed at time when the predominant sources of energy were not intermittent for which predicting the output is easier when compared with intermittent sources, Therefore it was decided by the Grid Code Review Panel to set up a Working Group to establish whether the data requirements needed to be amended to facilitate the participation of generation powered by intermittent sources in the BM.

1.1. The Working Group recommends changes to definitions of Output Useable and Physical Notification, to clarify the use of these terms with regard to intermittent generation.

1.2. Some members of the Working Group were concerned with the utilisation of Physical Notifications (PNs) to determine Bid/Offer volumes for Generating Units with an intermittent power source. To deal with these concerns the Working Group recommends a further Group investigate a new 'Power Available' signal or another solution to enable economic and efficient management of Bid/Offers in real time.

1.3. The Working Group identified that there is a discrepancy between National Grid's requirement for the provision of the Maximum Export Limit (MEL) and the Generator/System Operator's ability to achieve this using existing processes and systems. Further work is necessary to determine whether the provision of MEL in accordance with NGET's requirements can be achieved in an economic and efficient manner including modifications to Generator and/or System Operator IT systems.

1.4. To deal with these issues the Working Group recommends additional work is undertaken to investigate (i) a new 'Power Available' signal (or another solution) for the management of Bid/Offers in real time and (ii) changes to the provision of MEL.

These recommendations are also included in Section 5.0 of this document.

2.0 Background

2.1. NGET's balancing of electricity supply and demand and management of power flows across critical system boundaries relies on forecasts of Generator output and the ability to reduce and increase that output in real time through the acceptance of Bids and Offers respectively in the Balancing Mechanism. The actions taken by NGET to achieve these objectives are determined using the data provided by Generators and Suppliers under OC2, BC1 and BC2 of the Grid Code. This data includes the expected output of the BMU, upper and lower limits on output, parameters defining the cost and flexibility to move from one output level to another. The accuracy of this data is critical in ensuring that the actions taken by NGET deliver economic and efficient operation of the transmission system. Furthermore the Balancing and Settlement Code (BSC) system use Physical Notifications and Bid-Offer Acceptances in the calculation of imbalance charges.

2.2. The existing data requirements were established at a time when most Generating Units were powered by controllable energy sources like coal and nuclear fission. Over the past five years the capacity of Generating Units powered by uncontrollable sources, in the main wind, has increased significantly. Predicting the output of these generators is more onerous, and some Generators have indicated that this, in part, is hindering their ability to submit accurate BM data and actively participate in the Balancing Mechanism. There are parts of the transmission system where wind generation is becoming an increasingly dominant contribution to flows across constrained boundaries and there have been several occasions where the lack of accurate PNs from some Generators has contributed to problems with managing flows across the boundaries. There is a risk that the occurrence of such events will increase as the proportion of intermittent generation to non intermittent generation increases.

2.3. These issues have been discussed at the Grid Code Review Panel on several occasions. At the meeting in September 2008 it was decided to establish a Working Group to review the data provided under OC2, BC1 and BC2. The Terms of Reference for the Working Group are included in Annexe A.

3.0 Purpose and Scope of the Working Group

3.1. The purpose of the Working Group was to review the data provided under OC2, BC1 and BC2 related to predicting the output from Gensets powered by intermittent sources of energy and the operation of the Balancing Mechanism. The review assessed the fitness for purpose and the need for change, in particular:-

- Amending existing definitions of the data provided under OC2 and BC1 to remove ambiguities for intermittent generation.
- Defining the accuracy of the data
- Reducing the Gate Closure period to enable more accurate data to be provided
- Utilisation of data in the Balancing Mechanism and the need for additional data.

4.0 Working Group Discussions

4.1. Data Provision

4.1.1. General

4.1.1.1. The Working Group acknowledges that there are issues related to the provision of data by other types of generation, e.g. CCGTs but these are different in nature to those experienced by intermittent generation and were not covered by this Working Group.

4.1.2. Output Useable

4.1.2.1. Under OC2, Generators provide the Output Useable for each Genset from 5 years ahead down to 2 days ahead. This is the maximum level of export to the Grid Entry Point taking into account the availability of the Gensets and the source of power. For Generators powered by an Intermittent Power Source the Output Useable could be based on the assumption that the source of power will be available at the optimal level i.e. level at which enables the Genset to provide the Registered Capacity.

4.1.2.2. Output Useable based on the source of power being at the optimal level enables users of the data to determine the maximum contribution to the plant margin and flows across critical boundaries from intermittent generation. For the timescales in which OUs are submitted maximum and zero output are both likely outcomes. Therefore users of the data need to know the maximum possible output to enable the full range of scenarios to be assessed. If the Output Useable is based on the expected availability of the power source it would not be possible to assess the effect of higher availabilities.

4.1.2.3. The Working Group agreed that the Output Useable should be based on the assumption that the Intermittent Power Source will be available at a level which would enable generation at Registered Capacity and that the definition of Output Useable should be amended to make this clear. A proposed change to the Grid Code is given in Section 5.3.1.

4.1.3. Physical Notifications

4.1.3.1. Under BC1.4.2 of the Grid Code, by 11.00 hours of each day, Generators are required to provide predictions of the output from their Gensets for each half hour of the following **Operational Day**. These predictions, known as Indicative Physical Notifications (PNs), should be revised up to Gate Closure by the Generator as circumstances change. At Gate Closure the IPNs for the relevant half hour become Final Physical Notifications (FPN); these cannot be changed.

4.1.3.2. Generators are expected to provide the best estimate of the expected output for their Gensets and these should be prepared in accordance with **Good Industry Practice**. NGET asked the Group to consider whether, given the variety of methods and associated range of accuracies for predicting the output from wind powered generators; it would be prudent to define the accuracy to which **Physical Notifications** should be provided. In addition to benefiting the management of the transmission system, this would assist Generators in selecting predictive tools and offer guidance to the developers on the level of accuracy required.

4.1.3.3. NGET carried out an analysis of historic output from wind generation to determine levels of PN accuracy which could be achieved for wind powered generation. The analysis was based on persistence forecasting in which it is assumed that the instantaneous output from the wind farm will persist for a defined time into the future. In NGET's analysis it was assumed that PNs had been submitted which were equal to the instantaneous output at (a) 1 hour ahead i.e. at Gate closure and (b) half hour ahead of the Settlement Period. The PNs were compared with the actual outputs to measure the accuracy of the predictions. The accuracies based on persistence forecasting at 1 hour and 0.5 hours Gate Closure were very similar at between 2% and 8%. This compares with an average accuracy of around 4% for non intermittent generation. This implies that it should be possible for PNs from wind powered generation to be of similar accuracy to those for non intermittent generation using persistence forecasting and in the absence of a BOA.

4.1.3.4. The Generators' representatives on the Working Group were opposed to defining accuracy for PNs. Some Generators are investing substantial sums of money into systems for predicting turbine output and in the levels of accuracy are improving and this is expected to continue They believe that the current obligations, in particular the obligation to provide PNs prepared in accordance with Good industry Practice (BC2) enable NGET to benchmark PNs against the most accurate submissions and where there is a shortfall take appropriate action.

4.1.3.5. Furthermore, defining accuracy may lead to an overall reduction in the accuracy of PNs. This is because the accuracy would have to be set low enough to accommodate wind farms which are in locations where the predictions of output may be more onerous due natural phenomena like the terrain and wind variability.

4.1.3.6. Although the need to prepare Physical Notifications in accordance with Good Industry Practice is mentioned in the main body of Gird Code it is not mentioned in the definition. The Working Group agreed that the definition of Physical Notification should be amended to reference Best Industry Practice. The amended definition is shown in Section 5.3.2.

4.1.4. Maximum Export Limit (MEL)

4.1.4.1. The Maximum Export Limit is used by NGET to determine amount of power available to the System Operator over and above that indicated by the PNs i.e. headroom.

4.1.4.2. The Maximum Export Limit is defined in BC1.A.1.3.1 as:-

> A series of MW figures and associated times, making up a profile of the maximum level at which the **BM Unit** may be exporting (in MW) to the **National Electricity Transmission System** at the **Grid Entry Point** or **Grid Supply Point**, as appropriate.

4.1.4.3. The 'term may be exporting' could be interpreted as the output based on the wind speed being at:

a) the level which enables the turbines to generate at maximum output,

or

b) the level predicted from forecasts or the current level

4.1.4.4. Generators are obliged to submit revised values for the MEL as follows:-

- Ahead of Gate Closure; as soon as is reasonably practical after a change becomes apparent.
- Within Gate; without delay as soon as a change becomes apparent

The interpretation of these obligations is dependent on the interpretation of MEL. If MEL is based on maximum output then updates are only necessary when plant changes affect output. On the other hand if MEL is based on predicted/actual wind speed updates will also be required when forecast or actual wind speed changes.

4.1.4.5. The Working Group agreed that in order for the System Operator to determine the headroom, MEL would have to be based on the expected maximum output. To achieve this, MEL would have to be based on the predicted wind speed and updated to as these predictions changed.

4.1.4.6. . A number of Generators are frequently updating wind forecasts using methods like persistence forecasting and automatically resubmitting the PNs using EDL/EDT. A similar system would be required to update MEL should this be based on the predicted wind speed.

4.1.4.7. The Group acknowledged that a change to the definition of MEL such that the MEL would be based on the predicted wind speed could result in significant IS costs for the Generators and

these would have to be justified by improvements to the economic and efficient operating of the system. Until this is resolved the representatives from Generators were reluctant to changing MEL submissions. It was agreed that the GCRP would be asked to set a Working Group investigate the provision of MEL based on predicted and actual wind speed, in particular the cost of IS changes vs. the benefits to system operation.

4.1.4.8. The Group discussed how NGET could determine the MEL based on actual/predicted wind speed where it is being provided on the assumption that the turbines are operating at maximum output. Wind turbines currently operate the maximum possible output, hence pre-Gate Closure the PN is equivalent to the MEL (based on predicted wind speed) and within-Gate the output is equal to the MEL where this is based on actual wind speed. It was suggested by the representatives from Generators that, under these conditions, NGET could use the PN data as a proxy for MEL. However in future if wind turbines may operate below MEL for commercial reasons this substitution method would not be valid

4.2. NGET's Role in Wind Forecasting

4.2.1. Over the past five years NGET have been developing a tool for predicting the output of wind powered generators using forecasts of wind speed. This is applied to all large wind powered generators and has been successful. NGET use the output to predict plant margins and flows across constraint boundaries. This enables strategies for managing the impact of intermittency on the transmission system to be developed

4.2.2. NGET presented an overview of their forecasting tool to the Working Group:

http://www.nationalgrid.com/uk/Electricity/Data/WindPowerOperation/

4.2.3. The Working Group discussed whether it would be more economic and efficient for the industry if PNs for wind powered generation were provided by a single body, thereby avoiding duplication of investment in wind forecasting tools. Given their success in forecasting the output from wind generation it was suggested that NGET could continue in undertaking this role. However the objective of NGET's process is to predict the aggregated output from wind generators on a GB basis and within constrained parts of the system. It could not be used to construct PN data because this needs to take into account other factors which are only known to the Generators, e.g. turbine availability and commercial considerations. In the future when the quality of PNs provided by wind powered BMUs improves, NGET would review the need to continue making forecasts for these Generators but forecasting would continue to be required for non BMU generators.

4.3. Potential Process Changes

4.3.1. Changes to Gate Closure

4.3.1.1. PN accuracy would be improved if BM Units Generators were able to change their PNs after Gate Closure. The analysis carried out by NGET (see above) to evaluate the accuracy of persistence forecasting at 1 hour ahead and 0.5 hours ahead showed only a small improvement in accuracy. This indicates that allowing PNs to be changed closer to real time to reflect changes in the level of the energy source would deliver only a small improvement in accuracy and this may not be sufficient to justify changes to BM systems etc

4.3.1.2. ELEXON brought the results of a BSC investigation into reducing Gate Closure to the attention of the Working Group (Standing Issue Group 35 Report 9th April 2009) The BSC Panel set up a Group to asses the benefits of reducing Gate Closure from 60 minutes to 30 minutes. The Group was unconvinced of the merits of moving Gate Closure although areas for further analysis were identified and it was suggested that the potential for moving Gate Closure should be re-examined once BM Systems became more automated.

4.3.1.3. The results of NGET's analysis concurs with this view in that the improvement to the accuracy of PNs from wind farms arising out of a reduction in Gate Closure is insufficient to bring forward the re-examination of moving Gate Closure recommend by the BSC Group.

4.3.2. Obligation to Follow the PN

4.3.2.1. In all probability the wind speed (hence power output) in real time will not be the same as that predicted regardless of the method used. NGET were asked by the Working Group to confirm that the obligation to follow PNs (BC 2.5.1) made allowances for the unpredictability of the wind. When the wind speed is lower than that predicted generators will not be able to follow the PN. Under BC 2.5.1 the obligation to follow the PN is relaxed where an unavoidable event requires a change in the output of the BM Unit. A reduction in wind speed would be considered to be an unavoidable event; therefore providing the PNs were prepared in accordance with Good Industry Practice the obligation to follow the PN would be waived. Where the wind speed is higher than predicted the obligation might be expected to remain because the BM unit output could be reduced to match the PN.

4.3.2.2. The Generators' representatives' view is that this would penalise owners of wind generators for events beyond their control and unnecessarily restrict the production of generation from renewable sources. It was therefore agreed that BC2.5.1 should be amended to include any deviation of wind speed form the predicted level as unavoidable event.

4.3.3. Payments for Bids and Offers and Impact on BSUoS Charges

4.3.3.1. Payments to Generators for accepting Bids and Offers are based on the energy difference between the instructed output and the PN prevailing at Gate Closure. It is currently envisaged that, for Generating Units powered by an Intermittent Power Source (namely wind farms), Bids only will be issued by NGET.

4.3.3.2. For intermittent generation, inherent forecasting errors will result in the FPN as utilised by the settlement process being different from the un-curtailed output. In addition, if the wind speed reduces after a Bid has been accepted the Generator could be overpaid for a combination of the Bid volume and also any underlying under-delivery against the PN. On the other hand if the wind speed increases after Bids have been accepted and the generating unit's output increases despite its submitted PN, Generators could arguably be underpaid. It is NGET's view that the way in which PNs are currently used post Gate Closure may incentivise Generators to submit excessive PNs to avoid being underpaid for Bid acceptance and reduce the risk of generating above the PN.

4.3.3.3. NGET have undertaken a basic analysis of the effect of erroneous PNs from wind powered generators on BSUoS cashflows. This shows that when Bids are taken on Generators short on energy the effect is overpayment regardless of whether the PN is above or below the actual output. However when Generators are long on energy, overpayments for Bids taken when the PN is above actual output will (over time) be offset by underpayments for Bids taken when the PN is below the actual output. Therefore the net effect on BSUoS cashflows will be mainly dependent on the volume of Bids taken on wind powered generators when they are short on energy. The analysis is given in Annexe B

4.3.3.4. A potential solution to mitigate the effect on BSUoS cashflows would be use the output of the generators at the time the Bid instruction was issued as an indication of the un-curtailed output to calculate Bid Offer payments, i.e. persistence. However the consensus was that there would be many occasions when this would not be accurate enough, especially where a generator is curtailed on a rising wind profile, and Bid payments/BSUoS costs would be adversely affected. Two other solution were discussed which would require significant changes to BM processes.

4.3.3.5. The function of the PN and MEL would be interchanged. The PN would become the maximum reasonably expected output and the MEL would be the expected output. Payments for accepting Bids and Offers would be based on the PN. This provided the following benefits:

- Informs National Grid of expected output
- Reduces risk of generating above PN and contravening Grid Code

- Reduces risk of inadequate compensation should wind farm receive a BOA
- Consistent with other generators

4.3.3.6. Although this approach would tend to mitigate underpayments to Generators with wind farms for accepting Bids. The Working Group are concerned that calculating Bid/Offer payments using PNs which are different from the actual output, will result in increased BSUoS costs. This is discussed below.

4.3.3.7. The Working Group agreed that:

- PNs should represent the Generator's best estimate of output consistent with the definitions in 5.3.2, i.e. PN should not be substituted with MEL in real-time
- An obligation to continually resubmit MEL close to real time would be impractical unless the process was automated. .

4.3.3.8. The introduction of a new a BM parameter, the Power Available Signal. The prevailing wind speed at the generator site would be converted into a power available signal using a bespoke algorithm. In the event of a Bid/Offer being accepted, this parameter would be used instead of the PN to determine the un-curtailed energy volume. An additional benefit is that the power available signal would be equivalent to providing frequent updates of MEL and would provide an accurate real-time indication of headroom. The Working Group identified a number of potential disadvantages of the Power Available signal:

- It breaks the link between PN and settlement, which may result in less incentive on a generator to submit best estimate PNs.
- Settlement of Bid/Offer payments for wind powered generation using Power Available may discriminate against other forms of generation

4.3.3.9. A proposal to use Power Available signals to indicate the reserve held by the Power Park Module was discussed by the Working Group set up to review Grid Code Obligations for Power Park Modules and Synchronous Generating Units G/06. However the proposal was withdrawn pending further review of dynamic data. These discussions did not include proposals to use the Power Available signal instead of PN to determine energy volumes.

4.3.3.10. A note describing this methodology, which was discussed by the Working Group, is in Annexe C. There would be a requirement to install accurate wind speed measurement systems at windfarms of similar integrity to energy settlement metering. The Working Group concluded that the proposal to introduce Power Available into the BM was worthy of further investigation by a joint Grid Code BSC Working Group. Amongst the issues to be considered would be

- The feasibility of developing sufficiently accurate algorithm to convert wind speed into power available.

- Changes to BM and BSC systems

4.3.3.11. The cost of these would have to be compared with the benefits in terms of reduction in potential increases in BSUoS costs.

4.3.3.12. Some members of the Group proposed that the use of Power Available signals should form part of a wider review of dynamic parameters used in the Balancing mechanism. Other members felt that this would take a long time to conclude and delay the introduction of the Power Available signal should it be deemed to be of benefit. The Grid Code Panel will be invited to determine the way forward.

5.0 Working Group Recommendations

5.1.1. The Working Group recommends that the changes to the definitions of Output Useable and Physical Notification should be taken forward as Grid Code Amendment Proposal along with changes to the obligation to follow PNs. The objective of these changes is to improve clarity with regard to data provided by Generating Units Powered by Intermittent Power Sources.

5.1.2. The Working Group recommends that BC2.5.1 is changed to allow the output of Intermittent Generators to deviate from the PN where this is due to an unavoidable event.

5.1.3. The Working Group recommends that a joint Grid Code BSC Working Group be set up to investigate:

a) how Bid Offer payments should be settled for generators powered by intermittent power sources including the feasibility of introducing a new item of real time data 'Power Available'. This would be used in place of the FPN to determine payments for Bid Offer and Acceptance.

b) the benefits and costs of providing the Maximum Export Limit based on predicted and actual wind speed.

5.1.4. The GCRP is asked to determine whether this investigation should be undertaken as a stand alone issue or as part of a wider review of the Balancing Mechanism process.

5.2. Initial View of National Grid

5.2.1. National Grid agrees with the Working Group recommendations pending discussion at the Grid Code Review Panel of this Working Group Report

5.2.2. National Grid intends to:-

- Consult with Authorised Electricity Operators on making changes to the Grid Code in line with the Working Group recommendations contained in this report
- Ask the GCRP to set up a Grid Code/BSC Working Group to investigate:

a) how Bid Offer payments should be settled for generators powered by intermittent power sources including the feasibility of introducing a new item of real time data 'Power Available'. This would be used in place of the FPN to determine payments for Bid Offer and Acceptance

b) the benefits and costs of providing the Maximum Export Limit based on predicted and actual wind speed

5.3. Impact on the Grid Code

5.3.1. Change to the definition of Output Useable, **OU:**

The (daily or weekly) forecast value (in MW), at the time of the (daily or weekly) peak demand, of the maximum level at which the **Genset** can export to the **Grid Entry Point**, or in the case of **Embedded Power Stations**, to the **User System Entry Point**. In addition, for a Genset powered by an Intermittent Power Source the forecast value is based upon the Intermittent Power Source being at a level which would enable the Genset to generate at Registered Capacity

5.3.2. Change to the definition of Physical Notification, **PN:**

Data that describes the **BM Participant**'s best estimate of the expected input or output of **Active Power** of a **BM Unit** and/or (where relevant) **Generating Unit,** the accuracy of the **Physical Notification** being commensurate with **Good Industry Practice**.

5.3.3. Change to obligations to follow **PN:**

BC2.5.1 Accuracy of **Physical Notifications**

As described in BC1.4.2 (a), **Physical Notifications** must represent the **BM Participant's** best estimate of expected input or output of **Active Power** and shall be prepared in accordance with **Good Industry Practice**. Each **BM Participant** must, applying **Good Industry Practice**, ensure that each of its **BM Units** follows the **Physical Notification** in respect of that **BM Unit** (and each of its **Generating Units** follows the **Physical Notification** in the case of **Physical Notifications** supplied under BC1.4.2 (a) (2)) prevailing at **Gate Closure** (the data in which will be utilised in producing the **Final Physical Notification Data** in accordance with the **BSC**) subject to:

(a) variations arising from the issue of **Bid-Offer Acceptances** which have been confirmed by the **BM Participant**; instructions by **NGET** in relation to that **BM Unit** (or a **Generating Unit**) which require, or compliance with which would result in, a variation in output or input of that **BM Unit** (or a **Generating Unit**); or

(b) any variations arising from compliance with provisions of **BC1**, **BC2** or **BC3** which provide to the contrary,

(which in each case gives rise to an obligation (applying **Good Industry Practice**) to follow such **Physical Notification** as amended by such variations and/or instructions), unless in relation to any such obligation it is prevented from so doing as a result of an unavoidable event (existing or anticipated) in relation to that **BM Unit** (or a **Generating Unit**) which requires a variation in output or input of that **BM Unit** (or a **Generating Unit**). Examples (on a non-exhaustive basis) of such an unavoidable event are unpredictable changes in the level of the Intermittent Power Source, plant breakdowns, events requiring a variation of input or output on safety grounds (relating to

personnel or plant), events requiring a variation of input or output to maintain compliance with the relevant Statutory Water Management obligations and uncontrollable variations of input of **Active Power**.

Any anticipated variation in input or output from the **Physical Notification** in respect of that **BM Unit** (or a **Generating Unit**) prevailing at **Gate Closure** (except for variations arising from the issue of **Bid-Offer Acceptances** or instructions by **NGET** as outlined above) for any **BM Unit** (or a **Generating Unit**) post **Gate Closure** must be notified to **NGET** without delay by the relevant **BM Participant** (or the relevant person on its behalf). Implementation of this notification should normally be achieved by the submission of revisions to the **Export and Import Limits** in accordance with BC2.5.3 below.

5.4. Impact on the National Electricity Transmission System

5.4.1. The changes proposed by the Working Group will enhance the economic and efficient operation of the National Electricity Transmission System. The changes will facilitate Balancing Mechanism participation by Intermittent Generation leading to increased competition in short term balancing and curtailing of generator output to manage flows across constrained boundaries.

5.4.2. Assessment against Grid Code Objectives

The proposed changes to the Grid Code will better facilitate and maintain Grid Code Objectives:

5.4.2.1. to permit the development maintenance and operation of an efficient, coordinated and economical system for the Transmission of electricity.

5.4.2.2. to facilitate competition in the generation and supply of electricity;

5.4.2.3. to promote the security and efficiency of the electricity generation, transmission and distribution system in Great Britain

5.5. Impact on Generators

5.5.1. The proposed changes to the Grid Code are for clarification and will not change the Generator's current operational practices hence the impact is negligible.

5.6. Impact on other industry documents

5.6.1. Impact on Core Industry Documents
None

5.6.2. Impact on other Industry Documents
None

Annexe A

Terms of Reference for the Grid Code Working Group to Review the Provisions of BM Unit Data Provided by Intermittent Generation

Background

1. NGET's management of the short term balance between supply and demand and power flows across critical system boundaries relies on forecasts of Generator output and the ability to vary that output through the acceptance of Bids and Offers in the Balancing Mechanism. The actions taken by NGET to achieve these objectives are determined using the data provided by Generators and Suppliers under BC1 and BC2 of the Grid Code. This data includes the expected output of the BMU, limits on output, parameters defining the cost and flexibility to move from one output level to another. The accuracy of this data is critical in ensuring that the actions taken by NGET deliver economic and efficient operation of the transmission system.

2. The existing data requirements were established some time ago when virtually all Generating Units were powered by controllable energy sources like coal and nuclear fission. Since then the capacity of Generating Units powered by uncontrollable sources, primarily wind has increased significantly predicting the output of these generators is more onerous, and some Generators have indicated that this is hindering their ability to submit BM data and actively participate in the Balancing Mechanism. There have been several occasions where these factors have significantly affected NGET's operation of the GB Transmission System and the occurrence of such events can be expected to increase as the proportion of intermittent generation to non intermittent generation increases. Consequently at the Grid Code Review Panel meeting in September 2008 it was decided to establish a Working Group to review the data provided under BC1. The data provided by Suppliers takes into account predicted output from embedded Small Power Stations hence increasing levels of embedded intermittent generation will impact on the accuracy of the data. The effect of this on NGET's ability to operate the system needs to be considered. Furthermore the project to replace the BM system through which the data is submitted is underway and it would be prudent to ensure that the project takes account of any changes to the data provided.

3. Generators also provide forecasts of output ahead of real time in accordance with OC2 i.e. Output Usable. This is defined in the Grid Code as maximum export level but with intermittent generation this could be interpreted in a number of ways. Therefore there is a need to verify that the compatibility of the assumptions made by Generators in providing this data are compatible with the assumptions made by NGET in using it. This may lead to a requirement for additional information.

4. The working group will consider:
    - How the current arrangements could be amended to facilitate provision by intermittent generation.
    - If changes are required to reflect the uncontrollability of the primary source of power.

- The effect on system operation of 'inaccuracies in Supplier data' due to increasing levels of embedded intermittent generation.
- NGET's and the Generators understanding of Output Useable for intermittent generation and whether additional data is required.

5. We are seeking representatives for this Working Group which will commence in April 2009. Please provide nominations to Richard Dunn by close of play on 31st January 2009.

Objectives

6. The working group will complete a review of the existing requirements for data under BC1 to:
    - identify where the requirements are incompatible with the intermittent nature of the primary power source;
    - Identify any changes required to improve the compatibility;
    - Develop proposals to change the Grid Code to accommodate changes to BM data requirement.

Deliverables

7. The Working Group will provide a report to the Grid Code Review Panel which will:
    - detail the findings of the working group's review of the existing arrangements for the provision of BM data, and
    - recommend proposed changes to Grid Code in respect of requirements to provide BM data under BC1 and BC2.

Timescales

8. The Working Group is required to complete its review of the provisions of BMU data provided by intermittent generation and recommend any proposed changes to the Grid Code Review Panel by February 2010.

Annexe B

Initial Assessment of Impact on BSUoS Payments of Deemed PNs for Windfarms

By Matthew Roberts National Grid

The Grid Code Working Group on BM Data from Intermittent Generation has proposed that the FPN for wind farms might be replaced by a 'deemed' FPN (Power Available) representing the amount of available power from the wind turbine i.e. the deemed FPN would be determined by converting wind speed to power output using a conversion algorithm.

The appendix explains the effect on wind farm cash flows in detail, in summary these are:

- When bids are accepted and the wind output is higher than forecast the Generator will be underpaid (under the current rules) by:-

  forecast_error (MWh) x (ROC payment + SSP)

- When bids are accepted and the wind output is lower than forecast the Generator will be overpaid (under the current rules) by

(if they are short)
forecast_error (MWh) x (SBP – Bid Price)

or (if they are long)
forecast_error (MWh) x (SBP – Bid Price)

- No effect on cash flows unless National Grid accepts bids

With Generators providing PNs in accordance with good industry practice, over time, the volume of overforecasting and underforecasting will tend to equalise and any overpayment to Generators will mainly accrue when the wind output is lower than forecast, and the Generator is short on energy in the Balancing Mechanism.

Appendix – Assessment of Bid Payments based on Deemed FPNs

Assumptions

Pricing

SSP	£20/MWh	
SBP	£50/MWh	
Bid Price	£-70/MWh	(assuming £70/MWh is the ROC payment)

Assumed PNs submitted to reflect best estimate of forecasting output.

BOAs

No Offers accepted

Detailed Cash flows (Assuming the Windfarm Sells its Entire Forecast Output)

No BOAs Accepted

FPNs do not affect either contracted or metered MWh. Therefore, no change in cash flows

50% Bids Accepted, Available Wind is higher than forecast (at Gate Closure)

Control target 60MW output

Submitted FPNs		**Deemed FPNs**	
$Contract_{GC}$	100MW	$Contract_{GC}$	100MW
FPN	100MW	PN_{GC}	100MW
Wind Available	120MW	Wind Available	120MW
		PN_{Deemed}	120MW
Bid	40MW	Bid	60MW
Contract	60MW	Contract	40MW
Meter	60MW	Meter	60MW

Cash flows

Bid	40MW	@ £-70/MWh	Bid	60MW	@ £-70/MWh
SSP	0MW	@ £20/MWh	SSP	20MW	@ £20/MWh
SBP	0MW	@ £50/MWh	SBP	0MW	@ £50/MWh

Therefore, with deemed FPNs the windfarm owner will be better off by forecast_error x (SSP – Bid Price).

50% Bids Accepted, Available Wind is lower than forecast

Control target 50MW output

Submitted FPNs		**Deemed FPNs**	
$Contract_{GC}$	100MW	$Contract_{GC}$	100MW
FPN	100MW	PN_{GC}	100MW
Wind Available	80MW	Wind Available	80MW
		PN_{Deemed}	80MW
Bid	50MW	Bid	30MW
Contract	50MW	Contract	70MW
Meter	50MW	Meter	50MW

Cash flows

Bid	50MW	@ £-70/MWh	Bid	30MW	@ £-70/MWh
SSP	0MW	@ £20/MWh	SSP	0MW	@ £20/MWh
SBP	0MW	@ £50/MWh	SBP	20MW	@ £50/MWh

Therefore, with deemed FPNs the windfarm owner will be worse off by forecast_error x (SSP – Bid Price).

Detailed Cash flows (Assuming the Windfarm Spills its Entire Forecast Output)

No BOAs Accepted,
No change in cash flows… as before.

50% Bids Accepted, Available Wind is higher than forecast (at Gate Closure)
Control target 60MW output

Submitted FPNs		**Deemed FPNs**	
$Contract_{GC}$	0MW	$Contract_{GC}$	0MW
FPN	100MW	PN_{GC}	100MW
Wind Available	120MW	Wind Available	120MW
		PN_{Deemed}	120MW
Bid	40MW	Bid	60MW
Contract	-40MW	Contract	-60MW
Meter	60MW	Meter	60MW

Cash flows

Bid	40MW	@ £-70/MWh	Bid	60MW	@ £-70/MWh
SSP	100MW	@ £20/MWh	SSP	120MW	@ £20/MWh
SBP	0MW	@ £50/MWh	SBP	0MW	@ £50/MWh

Therefore, with deemed FPNs the windfarm owner will be better off by forecast_error x (SSP – Bid Price)

50% Bids Accepted, Available Wind is lower than forecast
Control target 50MW output

Submitted FPNs		**Deemed FPNs**	
$Contract_{GC}$	0MW	$Contract_{GC}$	0MW
FPN	100MW	PN_{GC}	100MW
Wind Available	80MW	Wind Available	80MW
		PN_{Deemed}	80MW
Bid	50MW	Bid	30MW
Contract	-50MW	Contract	-30MW
Meter	50MW	Meter	50MW

Cash flows

Bid	50MW	@ £-70/MWh	Bid	30MW	@ £-70/MWh
SSP	100MW	@ £20/MWh	SSP	80MW	@ £20/MWh
SBP	0MW	@ £50/MWh	SBP	0MW	@ £50/MWh

Therefore, with deemed FPNs the windfarm owner will be worse off by forecast_error x (SSP – Bid Price).

Annexe C

USE OF PHYSICAL NOTIFICATIONS FOR THE ISSUE BID-OFFER ACCEPTANCES TO GENERATING UNITS / BMUs WITH AN INTERMITTENT POWER SOURCE

6th November 2009

Paper to the Grid Code Review Panel – BM Unit Data for Intermittent Generation Working Group

1. Introduction

The Working Group is currently considering the process to be followed for the submission of Grid Code data within operational timescales for generating units (BMUs) with an intermittent power source. In particular, it is considering the submission of Physical Notification data (PN) under the provisions of Balancing Code 1 (BC1). National Grid (NG) has indicated that it requires accurate PNs for both the efficient operation of the transmission system and to enable bid-offer acceptances (BOAs) to be issued to such generating units.

2. Grid Code Issue

BOAs are issued by NG under the provisions of Balancing Code 2 (BC2) in order to change the output of generating units from that notified by its PN. A BOA will normally comprise between 2 and 5 time points / MW levels which are to be achieved by the generating unit. A generating unit with an intermittent power source, particularly wind farms, are likely to have a financial incentive (ROCs and energy payments) to always operate at the maximum output permitted by the available power source with no fuel savings arising from a reduction in output. This presents a number of difficulties in issuing BOAs to such generating units: -

i) In the absence of a BOA, the power output can be expected to either increase or decrease as the power source changes, irrespective of the PN. Should the PN represent the likely maximum output of the generating unit, the metered output is likely to be always less than the PN.

ii) An offer acceptance is unlikely to be delivered since any increase in metered power output would be limited by the power source, although the PN / MEL may indicate that an increase in output would be achievable.

iii) A bid acceptance may be delivered, although the available intermittent power source may reduce the output below the level of expected power output based on the PN / MEL during the time period that the bid is being delivered.

iv) During a period of bid acceptance, the maximum achievable output from the prevailing power source will become less certain and

therefore any submitted PN / MEL during this period may be considered less reliable.

3. BSC / CUSC Issue

For conventional generating plant, the FPN during the period of a BOA is used within the settlement process to determine the energy volume attributable to a BOA and to calculate the payment to the generator. This process works reasonably efficiently for conventional generating units, where the submitted PN / MEL are generally an accurate reflection of the likely output of the generating unit. However, the inherent inaccuracies associated with the PN / MEL for generating units with intermittent power sources means that the calculated volumes and payments associated with BOAs are unlikely to be accurate.

4. Proposed Solution

Whilst the delivery of energy in response to an Offer acceptance can be managed to a certain extent, it is unlikely that Bid acceptances to reduce output, for example to alleviate transmission constraints, are likely to be efficient and fit for purpose. The use of PN / MEL for the calculation of BOA energy volumes and the corresponding payment to generators with intermittent power sources may result in windfall payments to the generator at the cost of a significant increase in BSUoS. It is proposed that an alternative mechanism be developed to ensure that such transmission constraints are managed more efficiently than would be the case under the process currently applied to conventional generating units.

For generating units with an intermittent power source (especially wind farms) a bid acceptance would be achieved as follows:

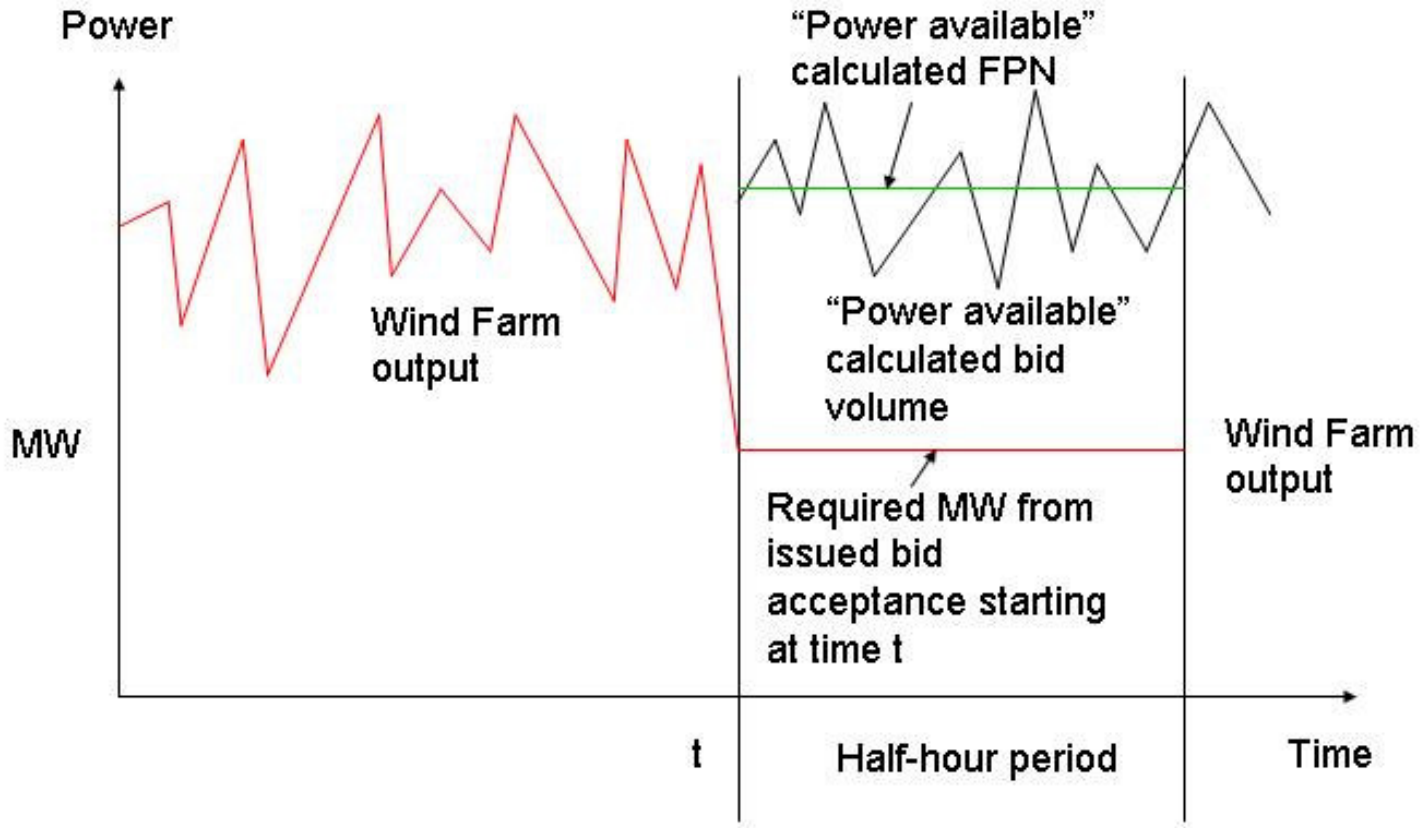
- Compensation would continue to be based on the Generator's bid price. However, the volume of energy reduction would be determined using a "power available" signal to calculate a cap on the FPN. The capped FPN would serve as the baseline against which bids would be remunerated.

- The signal may also be used to automatically produce a real-time value of MEL.

- The obligation may be placed on the generator to produce this signal, which would be based on the number of wind turbines available, the prevailing wind speed and using a validated methodology.

5. Way forward

It is envisaged that this proposal would necessitate changes to both the CUSC and Grid Code. It is proposed that, at this stage, the Working Group develops an appropriate Grid Code mechanism to deliver the "power available" and to identify any other changes needed to be made to BC1 and BC2. It is expected that the changes needed to be made to the CUSC and any other changes would be included as a recommendation within the Working Group Report.


Power
"Power available" calculated FPN
Wind Farm output
"Power available" calculated bid volume
MW
Wind Farm output
Required MW from issued bid acceptance starting at time t
t
Half-hour period
Time