

**Grid Code Review Panel
Intermittent Generation Strategy Paper**

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A Panel Paper by Steven Lam

National Grid

Summary

The purpose of this paper is to describe the different work streams that are being carried out in the area of intermittent generation and to address the difficulties faced by such plant within the Balancing Mechanism. This paper also proposes a strategy for the way forward on coordinating the work within the governance of the Grid Code whilst being mindful of the cross code impacts from any potential solution(s). It is envisaged that the three work streams of C/11 (BM Unit data from intermittent generation), Power Available and High Wind Speed Shutdown (HWSS) will be progressed under the governance of the GCRP and separately report to the relevant code Panels (CUSC, BSC).

Users Impacted

High

Transmission Owners, Small Generators, Medium Generators, Large Generators, System Operator,

Description & Background

C/11 BM Unit Data from Intermittent Generation

The volume of intermittent generation connecting to the Transmission and Distribution networks is increasing gradually and this is set to continue into the future. Generators who wish to participate in the Balancing Mechanism (BM) are obliged under the Grid Code to provide certain data to National Grid such as Physical Notifications (PNs). These data requirements were originally developed for conventional generation, where the projected output of each plant was easier to forecast by parties compared with intermittent generation. In recognition of this, in 2008 the GCRP set up a Workgroup¹ (C/11) to establish whether the data requirements were still appropriate for intermittent generation in order to help facilitate their participation in the BM.

The GCRP consequently issued a consultation in May 2011 which sought views on:

- Allowing the output of intermittent generators to deviate from their PN; and
- Including the unpredictable change of intermittent power as an unavoidable event.

Due to the mixed responses to the consultation, the Workgroup reconvened at the end of 2011 and recommended the issuing of a second consultation to seek views on:

- Relaxing the obligation for intermittent generators to follow their PN provided that they follow good industry practice in submitting PNs but include a caveat that such generators may be curtailed by issuing a Bid Offer Acceptance (BOA) to whatever

¹

<http://www.nationalgrid.com/uk/Electricity/Codes/gridcode/workinggroups/BMUnitDataIntermittentGeneration/>

operating level was required, as dictated by system conditions; and

- Whether PNs should still remain as a best estimate of a generator's expected output.

This second industry consultation is expected to be issued after the GCRP meeting in July 2012.

In addition to this, the Workgroup suggested that a joint BSC/Grid Code Workgroup should be established to investigate how bid/offer payments should be settled for intermittent generators. The Workgroup recommended that a 'Power Available' signal should be investigated as a possible solution to providing more accurate settlement for such generators. This concept of "power available" will be progressed under a separate work stream as described below.

Power Available

Following National Grid's publication of a consultation on managing intermittent and inflexible generation² the concept of Power Available was discussed at the Commercial Balancing Services Group (CBSG). The aim of the discussions at the CBSG was to develop potential solutions to operationally manage the increasing amount of renewable and inflexible generation connecting to the National Electricity Transmission System in the future.

The CBSG reports to the CUSC Panel and was established by National Grid in order to provide the industry with a forum to discuss areas for development relating to commercial balancing services. This group sits alongside the Balancing Services Standing Group (BSSG) but is not deemed as a formal CUSC Standing Group. The BSSG is however, a formal CUSC Standing Group.

Following discussions within the CBSG, in March 2012, the group initiated proposals to develop the concept of Power Available for wind farms. This concept proposes to use data, such as wind speed, to calculate the potential power that would have been produced by a wind farm if they did not have their output curtailed. This value could then be used to assist with the integration of intermittent generation into current balancing arrangements for example as a reference point for settlement of bid/offer acceptances rather than the current method of using the generator's Final Physical Notification (FPN). This approach would however retain the obligation to submit accurate FPNs.

The Power Available concept was originally envisaged to be developed under the CBSG. However, on reviewing the subject matter, taking into account the cross over with the separate Grid Code Workgroups³ on intermittent generation, National Grid proposed to develop this under the governance of the GRCP. On 22 June 2012, National Grid issued a letter to the industry stating this intention, which will be discussed at the next GCRP meeting on 18 July 2012.

High Wind Speed Shutdown

Wind turbines are designed to operate within a specific range of wind speeds. Generally, where the speed exceeds such operating ranges, it can lead to the turbines disconnecting in order to protect against damage due to excessive mechanical loading. The impact this has on the transmission system is that there will be a loss of power

² <http://www.nationalgrid.com/uk/Electricity/Balancing/consultations/>

³ C/11 – BM Unit Data from Intermittent Generation, High Wind Speed Shutdown

leading to a drop in frequency. The secondary effect is the potential uncontrolled reconnection of the turbines once the wind speed returns to a safe operating range. This could lead to a high frequency event due to the additional power from the turbines combined with replacement plant which may have been despatched to mitigate the initial low frequency.

A paper was submitted to the GCRP by National Grid in January 2012 to raise the issue of high wind speed shutdown and the impacts this has on system operation. This proposed two areas of work:

- To place obligations on wind farm operators to provide data to National Grid to warn of a risk of high wind speed shutdown; and
- Develop requirements to reduce the impact of high wind speed shutdown and reconnection to the transmission system.

A workshop was held on 11 April 2012 to further discuss these issues with relevant industry stakeholders. This workshop concluded that a Workgroup should be established under the governance of the GCRP to develop solutions to the issues over high wind speed shutdown. The draft Terms of Reference were presented at the May 2012 GCRP meeting and are due to be agreed at the July 2012 meeting.

Proposed Solution

It is recognised that C/11, Power Available and High Wind Speed Shutdown all have potential cross over in work. However, as each group addresses a specific issue relating to intermittent generation and requires relevant technical expertise to resolve, it is proposed that they should remain separate. Furthermore, each group is at different stages of progression, therefore it is not feasible to combine these work streams. Where possible, the Workgroup meetings will be held on the same day and location to minimise travel if members need to attend multiple Workgroup meetings. National Grid will provide the chairperson for the Workgroups and such appointed body will ensure that developments in each area will be communicated to each Workgroup and to the relevant code Panels.

It is envisaged that the GCRP should remain as the overarching Panel for coordinating the work being progressed under intermittent generation due to the Grid Code containing the technical parameters which generators have to comply with. Any changes to the code may also impact settlement arrangements for example, therefore the BSC and CUSC Panels should be kept aware of the developments.

Impact & Assessment

Impact on the National Electricity Transmission System (NETS)

The proposals will help to operationally manage the increasing amount of intermittent generation connecting to the transmission system

Impact on Greenhouse Gas Emissions

The proposals may reduce the operating reserve from conventional plant, required to manage intermittent generation, thereby reducing carbon emissions.

Impact on core industry documents

BSC

Impact on other industry documents

None

Supporting Documentation

Have you attached any supporting documentation YES

If Yes, please provide the title of the attachment:

- Annex 1: Open letter: Development of 'Power Available' concept
- Annex 2: Power Available Workgroup Draft Terms of Reference
- Annex 3: High Wind Speed Shutdown Draft Terms of Reference

Recommendation

The Grid Code Review Panel is invited to:

1. Agree to act as the main coordinator for proposals relating to intermittent generation that affect the Grid Code
2. Approve the proposal for progressing power available under the governance of the GCRP and;
2. Initiate a Workgroup to develop the power available proposal



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22 June 2012

Development of 'Power Available' concept

Dear Industry Colleague,

The high wind conditions that took place across Scotland in 2011 resulted in a number of balancing actions being taken by National Grid on wind farms to reduce their output to alleviate constraints on the electricity transmission system. These events were highlighted in a consultation issued by National Grid in September 2011⁴ which set out the issues of managing intermittent generation and invited views on the matter. Following the closure of the consultation, we discussed the industry responses within the established industry forum Commercial Balancing Services Group (CBSG).⁵ At the time, we believed this was the most appropriate forum to discuss such issues as it allowed for the consideration of cross code impacts and developments. The aim of the discussions was to develop potential solutions to operationally manage the increasing amount of renewable and inflexible generation connecting to the electricity transmission system in the future. In addition to this, we have continued to engage with the wider industry to communicate the importance of participation in the Balancing Mechanism (BM).

Following the discussions within the CBSG, the group have initiated proposals to develop the concept of "Power Available" for wind farms. This concept proposes to use data such as wind speed to calculate the potential power that would have been produced by a wind farm if they did not have their output curtailed in the BM. This value could then be used to assist with the integration of intermittent generation into current balancing arrangements for example as a reference point for settlement of bid/offer acceptances rather than the current method of using the generator's Final Physical Notification (FPN). This approach would however, retain the obligation to submit accurate FPNs.

In National Grid's opinion, the CBSG has taken this proposal as far as it can. We therefore intend to progress this work under the guidance of the Grid Code Review Panel and will bring forward proposals for the Panel's consideration to the next meeting on July

⁴ <http://www.nationalgrid.com/uk/Electricity/Balancing/consultations/>

⁵ <http://www.nationalgrid.com/uk/Electricity/Balancing/CommercialBalancingServicesGroup/>

18th 2012. This purpose of this letter is to ensure that the broadest range of stakeholders are aware of this work and can participate either through their Panel representative or more directly if they feel this is appropriate.

The aim of the work will be to develop the concept of Power Available such that it may be used to support the operation and settlement of the system against a backdrop of increasing intermittent generation. This may then lead to relevant industry code modifications, e.g. to the Grid Code and the Balancing and Settlement Code (BSC). The group will initially be set up as a Grid Code Work Group and formally report to the Grid Code Review Panel to ensure that the collective work on intermittent generation is captured under the same governance arrangements. We envisage that this group will take around 6 months to fully develop the concept, but we anticipate that the group will agree an implementation plan in line with its assessment of the generation which may benefit from Power Available.

We are aware of other work streams being carried out on intermittent generation in the Grid Code such as C/11⁶ and more recently; high wind speed shutdown. Whilst these topics are concerned with separate issues and are at different levels of progression, there is a need to ensure coordination and sharing of information between topics where relevant. Accordingly, they will be continuing as separate Work Groups but report to the Grid Code Review Panel. The Panel may initiate further informal workshops in this area, from time to time, as issues necessitate this.

A draft Terms of Reference can be found attached to this letter which contains the proposed scope for the group to develop this work.

If you wish to discuss the content of this letter or have any further queries please contact Steve Lam on 01926 653534 in the first instance.

Yours sincerely

Ian Pashley
Electricity Codes Manager

⁶BM Unit Data from Intermittent Generation

<http://www.nationalgrid.com/uk/Electricity/Codes/gridcode/consultationpapers/>

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Power Available TERMS OF REFERENCE

Governance

1. The Workgroup was established by Grid Code Review Panel (GCRP) at the July 2012 GCRP meeting.
2. The Workgroup shall formally report to the GCRP.

Membership

3. The Workgroup shall comprise a suitable and appropriate cross-section of experience and expertise from across the industry, which shall include:

Name	Role	Representing
Michael Edgar	Chair	
Robyn Jenkins	Technical Secretary	
	National Grid Representative	National Grid
	Industry Representative	Transmission Users
	Industry Representative	Wind Turbine Manufacturers
	Industry Representative	Wind Industry Experts
	Authority Representative	Ofgem
	Observer	

Meeting Administration

4. The frequency of Workgroup meetings shall be defined as necessary by the Workgroup chair to meet the scope and objectives of the work being undertaken at that time.
5. National Grid will provide technical secretary resource to the Workgroup and handle administrative arrangements such as venue, agenda and minutes.
6. The Workgroup will have a dedicated section on the National Grid website to enable information such as minutes, papers and presentations to be available to a wider audience. The link to the Grid Code Workgroups page is:

<http://www.nationalgrid.com/uk/Electricity/Codes/gridcode/workinggroups/>

Scope

7. The Workgroup shall consider and report on the following:
 - Clearly define the defect that Power Available attempts to resolve by:
 - Quantifying the current accuracy of FPNs from intermittent generators
 - Quantifying the volume of energy curtailed from intermittent generators

- Identify how the concept of Power Available can be implemented by:
 - Creating a technical standard to calculate Power Available across different turbine manufacturers
 - Identify the method by which data will be collected
 - Identify the obligations on wind farms to collate data
 - Identify how data will be aggregated and converted into a Power Available signal
 - Assess the accuracy (based on time intervals) required for the provision of such data
 - Identify the technical equipment required
 - Examine any required information systems changes
 - Quantify the benefits to wind farms that can be gained from Power Available by:
 - Examining the potential volumes of generation that can utilise such a signal for settlement purposes, within both current and future connections
 - Review the information that is currently available to wind farm operators and assess the value of this to National Grid as National Electricity Transmission System Operator (NETSO).
 - Take into account any analysis carried out by the high wind speed shutdown Workgroup
 - Identify additional items of information which could be of benefit and assess the value of providing these to National Grid as NETSO
 - Take into account any analysis carried out by the high wind speed shutdown Workgroup
 - Assess the investment required to implement a minimal Power Available signal versus a highly accurate signal aggregated on a per turbine basis
 - Examine how Power Available will operate under different scenarios such as:
 - high wind speed shutdown
 - turbine faults
 - Assess whether retrospective application of Power Available will be appropriate
8. The Workgroup will also:
- Take account of and feed into the "high wind speed shutdown" work being carried out under a Grid Code Workgroup
 - Take account of the work in C/11 – BM Unit data from Intermittent Generation. This proposed a concept of calculating a generator's Maximum Export Limit (MEL) based on predicted/actual wind speed

- Take account of relevant international practice and the approach taken in European Code development.

Deliverables

9. The Workgroup will provide updates and a Workgroup Report to the Grid Code Review Panel which will:
 - Detail the findings of the Workgroup;
 - Draft, prioritise and recommend changes to the Grid Code and associated documents in order to implement the findings of the Workgroup; and
 - Highlight any consequential changes which are or may be required,
 - Provide a recommendation on how to progress the solution(s)

Timescales

10. It is anticipated that this Workgroup will provide an update to each GCRP meeting and present a Workgroup Report to the January 2013 GCRP meeting.
11. If for any reason the Workgroup is in existence for more than one year, there is a responsibility for the Workgroup to produce a yearly update report, including but not limited to; current progress, reasons for any delays, next steps and likely conclusion dates.

High Wind Speed Shutdown TERMS OF REFERENCE

Governance

12. The High Wind Speed Shutdown Workgroup was established by the Grid Code Review Panel at the May 2012 GCRP meeting. The issue was original submitted to the January 2012 GCRP where it was agreed that an industry workshop should take place prior to the establishment of a Workgroup.
13. The Workgroup shall formally report to the GCRP.

Membership

14. The Workgroup shall comprise a suitable and appropriate cross-section of experience and expertise from across the industry, which shall include:

Name	Role	Representing
Michael Edgar	Chair	
Robyn Jenkins	Technical Secretary	
	National Grid Representative	National Grid
	Industry Representative	Transmission Users
	Industry Representative	Wind Turbine Manufacturers
	Industry Representative	Wind Industry Experts
	Authority Representative	Ofgem
	Observer	

Meeting Administration

15. The frequency of Workgroup meetings shall be defined as necessary by the Workgroup chair to meet the scope and objectives of the work being undertaken at that time.
16. National Grid will provide technical secretary resource to the Workgroup and handle administrative arrangements such as venue, agenda and minutes.
17. The Workgroup will have a dedicated section on the National Grid website to enable information such as minutes, papers and presentations to be available to a wider audience.

Scope

18. The Workgroup shall consider and report on the following:
- (a) Using information currently available, quantify the potential change in risk to the Total System presented by the need to protect wind turbines at high wind speeds by:
 - (i) examining the potential volumes of affected generating capacity over time;

- (ii) reviewing existing information on the response to high winds over individual windfarms and the GB and Offshore wind fleet as well as relevant international data; and
- (iii) comparing high wind shut down power infeed changes to other power infeed changes in the power system including large infeed losses - generator trips, HVDC trips – and large changes in power flows – e.g. interconnector loading changes.

19. In the context of this risk, the Workgroup will:

- (a) Review the actions that National Grid may need to take to manage high wind conditions given the risks quantified above;
- (b) Review the information that is currently available to wind farm operators on the High Wind Shutdown status of wind turbines and assess the value that provision of this information to National Grid will yield;
- (c) Identify additional items of information which could be of benefit and assess the value of providing these to National Grid;
- (d) Assess the value of setting out requirements to reduce the impact of High Winds by limiting that rate at which turbines across a windfarm disconnect and reconnect; and
- (e) Determine an appropriate implementation timescale for any new requirements.

20. The Workgroup will also:

- (a) Take account of other industry developments with respect to wind farms in information provision and operation; and
- (b) Take account of relevant international practice and the approach taken in European Code development. The scope of the Workgroup shall not include:

Deliverables

21. The Workgroup will provide updates and a Workgroup Report to the Grid Code Review Panel which will:

- Detail the findings of the Workgroup;
- Draft, prioritise and recommend changes to the Grid Code and associated documents in order to implement the findings of the Workgroup; and
- Highlight any consequential changes which are or may be required,

Timescales

22. It is anticipated that this Workgroup will provide an update to each GCRP meeting and present a Workgroup Report to the January 2013 GCRP meeting.

23. It is anticipated that this Workgroup will develop an implementation plan in line with its assessment of Generation affected by High Wind speeds and its development and connection timescales.

24. If for any reason the Workgroup is in existence for more than one year, there is a responsibility for the Workgroup to produce a yearly update report, including but not

limited to; current progress, reasons for any delays, next steps and likely conclusion dates.