

# Stage 02: Industry Consultation

Grid Code

## GC0063 – Power Available

01	Workgroup Report
02	Industry Consultation
03	Report to the Authority

This proposal seeks to modify the Grid Code to require intermittent generators to provide a power available signal. This will assist market participation of renewable generation and will improve system security.

This document is open for Workgroup Consultation. Any interested party is able to make a response in line with the guidance set out in Section 14 of this document.

**Published on:** 7 March 2014  
**Length of Consultation:** 20 Working Days  
**Responses by:** 7 April 2014

	<b>National Grid recommends:</b> That the technical requirements are taken forward for Industry Consultation as they better facilitate National grid's development and operation of the Transmission System.
	<b>High Impact:</b> None identified
	<b>Medium Impact:</b> Owners, Operators and Developers of Power Park Modules or other generation with an uncontrollable energy source.
	<b>Low Impact:</b> Owners and Developers of Offshore Networks

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**Any Questions?**

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## About this document

This Industry Consultation summarises the findings of the Power Available Workgroup and presents the conclusions reached through this and the Workgroup Consultation that followed. Any further input is now sought from interested parties in relation to the way forward presented. This will be reflected in the final Workgroup report, as will be submitted to the Grid Code Review Panel (GCRP), which will propose a modification to the Grid Code on the basis of the conclusions reached and feedback received.

Parties are requested to respond by **7 April 2014** to [grid.code@nationalgrid.com](mailto:grid.code@nationalgrid.com)

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## Document Control

<b>Version</b>	<b>Date</b>	<b>Author</b>	<b>Change Reference</b>
0.1	3 March 2014	National Grid	Draft Industry Consultation
1.0	7 March 2014	National Grid	Industry Consultation

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# 1 Executive Summary

## Background

- 1.1 The Grid Code Review Panel established the Power Available Workgroup in July 2012 following the completion of the C/11 Workgroup (BM Unit Data from Intermittent Generation).
- 1.2 Prior to establishing the C/11 Workgroup, the Grid Code Review Panel recognised that the existing Grid Code data requirements were developed at a time when the predominant sources of energy were not intermittent and that predicting the output is easier when compared with intermittent sources. The C/11 Workgroup was established to consider whether the Grid Code data requirements needed to be amended to facilitate the participation of generation powered by intermittent sources in the Balancing Mechanism.
- 1.3 The C/11 Workgroup made a number of recommendations concerning the Physical Notification and Output Useable<sup>1</sup> data flows and in addition to investigate (i) a new 'Power Available' signal (or another solution) used as a proxy for Physical Notifications for the management of Bid/Offer in real time and (ii) changes to the provision of MEL.
- 1.4 A Power Available Workgroup was subsequently convened to consider the C/11 recommendations as defined within the Power Available Workgroup Terms of Reference that were approved by the Grid Code Review Panel.

## The Power Available Workgroup

### Benefits

- 1.5 At a high level, the proposals discussed as part of the Power Available Workgroup would help to facilitate:
  - The efficient integration, participation and operation of renewable generation into the energy market;
  - The opportunity for renewable generation to earn additional revenues from the provision of Balancing Services, for example reserve, Bid Offer Acceptances (BOAs) and frequency response;
  - Reduction in the need to take actions on out of merit alternatives; and
  - Enhanced system security by providing more options for the provision of balancing services particularly in regions where less generation with controllable fuel sources is available.
- 1.6 The above effects of the proposals would improve the efficient operation of the system and allow all BSUoS payers to benefit from reduced costs of the balancing mechanism.

### Workgroup Considerations

- 1.7 The Power Available (PA) Workgroup sought to better articulate the current and anticipated deficiencies in data flows that will become increasingly dominant in the future with the growth of intermittent generation. The identified deficiencies fell into two broad categories: accurate settlement of Bid Offer

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<sup>1</sup> Output useable is defined in Grid Code as a forecast (daily or weekly) value based on the intermittent power source being at a level which would enable the genset to generate at Registered Capacity.

Acceptances (BOAs); and operational data necessary for the System Operator to operate the Transmission System in an economic and efficient manner. The Workgroup recognised that one solution to address both potential categories of deficiency may be possible however these would need to be progressed under separate governance arrangements.

#### Accurate BOA volume settlement

- 1.8 The PA Workgroup considered data flows that were relevant to accurate BOA volume settlement and further noted that the volume of BOAs (Accepted Bids) from intermittent sources in 2013 (Oct 12 – Sept 13) represent ~2.1% of the total volume. It also noted that the solutions being considered for operational data could equally apply to accurate BOA settlement if required, however this would need to be progressed through Balancing and Settlement Code governance arrangements if this was considered necessary by BSC parties. Therefore, the PA Workgroup focused on the first broad category; operational data for the system operator.

#### Operational Data for the System Operator

- 1.9 The Workgroup recognised that when an intermittent generator has reduced its output, the System Operator has no visibility of what the potential headroom could be for the provision of reserve or frequency response if required for operational balancing of the system.
- 1.10 A number of options to overcome this deficiency were considered by the Workgroup:
- 1.11 Option 1 - Standardisation of MEL which would require MEL submissions that would be expected to vary with forecast intermittent energy source, where the update frequency was a variable to be determined by the User;
- 1.12 Option 2 - Dynamic MEL (Power Available signal used to calculate MEL), with an update frequency of [10 minutes]; and
- 1.13 Option 3 - Power Available Data via SCADA i.e. the submission of Power Available as an operational metering signal which would be fed to the National Grid Control Centre via SCADA with the redefinition of MEL used to indicate electrically connected capacity.
- 1.14 At the heart of these options is the Power Available signal. Power Available is an indication of the maximum achievable output which could be delivered by an intermittent generator under the current prevailing conditions (e.g. weather), for example, the present output may have been reduced for the provision of balancing services to the system operator. It is defined as:

*A value / signal prepared in accordance with good industry practice, representing the instantaneous sum of the potential **Active Power** available from each individual **Power Park Unit** within the **Power Park Module / BM Unit** calculated using any applicable combination of meteorological (including wind speed), electrical or mechanical data measured at each **Power Park Unit**. The **Power Available** shall be a value of between 0MW and **Registered Capacity** which is the sum of the potential **Active Power** available of each **Power Park Unit** within the **Power Park Module / BM Unit**. A turbine that is not generating will be considered as not available.*

- 1.15 Whilst the means by which it may be provided and the frequency of update may differ for the options considered by the Workgroup, the underlying nature of the Power Available signal is the same and is based on the prevailing intermittent energy source and characteristics of the Power Park Units (e.g.

wind turbines). However, options 1 and 2 would require the generator to create a MEL profile going forward and therefore would also need to include a forecast element. Conversely, option 3 would require a frequently updated spot value of Power Available which the System Operator would use going forward.

- 1.16 After consideration of the advantages and disadvantages of these options, the Workgroup concluded that option 3 (the Power Available Data Feed to National Grid Control Centre via SCADA data connections) would best address the deficiencies identified. After consideration of the advantages and disadvantages of these options, National Grid's view is that option 3 (the Power Available Data Feed to National Grid Control Centre via SCADA data connections) would best address the deficiencies identified. It is envisaged that this option would only apply to New Generators with a Completion Date on or after 1 April 2015.
- 1.17 In exceptional circumstances where National Grid can reasonably demonstrate that a Power Park Module has a significant effect on the National Electricity Transmission System it may require some existing Generators to provide a Power Available signal. The cost of this approach would need to be assessed on a case by case basis.

## 2 Purpose & Scope of Workgroup



- 2.1 At the July 2012 Grid Code Review Panel (GCRP), National Grid presented the concepts of Power Available and High Wind Speed Shutdown (minutes 2589 and 2607-2618) where it was proposed that a Workgroup should be established to examine whether the development of a power available signal would be appropriate for implementation by intermittent generators.
- 2.2 The GCRP agreed that this issue required further investigation and approved the draft Terms of Reference presented by National Grid (minutes 2590 and 2615 and pp12/34). The GCRP also recommended that, for efficiency, it may be appropriate to hold a joint Workgroup to discuss the two concepts, whilst ensuring that the two sets of terms of references were fully addressed. This report addresses the issue of Power Available.

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### Workgroup Meeting Dates

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M1 - 11 September 2012  
M2 - 09 October 2012  
M3 - 08 November 2012  
M4 - 10 December 2012  
M5 - 12 February 2013  
M6 - 14 March 2013  
M7 - 01 May 2013  
M8 - 11 June 2013  
M9 - 11 September 2013  
M10 - 29 October 2013

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### Terms of Reference

- 2.3 A full copy of the Terms of Reference can be found in Annex 1 the Scope of which are given below:

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 (PN at gate closure) 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 (HWSS) Workgroup
- Identify additional items of information which could be of benefit and assess the value of providing these to National Grid as NETSO
- 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
- Assess whether other renewables should be taken into account

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- 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.

## Timescales

2.4 It was agreed that the Workgroup would report back to the November 2013 GCRP and that subsequently a Workgroup Consultation would be initiated to present the options investigated to stakeholders. This ran from 20 December to 27 January. The conclusions of the Workgroup, as informed by the opinions of the respondents to the Workgroup Consultation, were then written into an Industry Consultation to give interested parties a final opportunity to input to the final report as will be submitted to the Grid Code Review Panel. This will propose a modification to the Grid Code on the basis of the conclusions reached and feedback received.

### 3 An Introduction to the System Operator Challenge



#### What is MEL?

The MEL is used by NGET to determine the amount of power available to the System Operator over and above that indicated by the PNs.

MEL is defined by BC1.A.1.3.1 of the Grid Code, 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.”

- 3.1 The Grid Code was written at a time when there were very low volumes of generation from intermittent power sources connected to the system. The Grid Code requires generators with intermittent power sources, such as wind, wave, or photovoltaic, to interact with the System Operator in the same way as a traditional generator with a controllable power source.
- 3.2 The System Operator receives a number of data items from generators (these are described in more detail in section 5) however two key data submissions are Physical Notifications (PN) and Maximum Export Limits (MEL). Essentially, PN indicates what a generator intends to output (typically between MEL and the Stable Export Limit (SEL)) and the MEL indicate what a generator is capable of outputting at any specific time if requested by the System Operator. Amongst other things, PN and MEL allow the System Operator to:
- Calculate the total generation volume connected to the system and forecast to be connected going forward;
  - Calculate the available reserve on the system provided by the market;
  - Determine transmission constraints;
  - Amend generation output via Bid Offer Acceptances (BOAs) to match demand and manage constraints through the Balancing Mechanism;
  - Hold additional reserve on generation to meet operational requirements; and
  - Despatch frequency response from generation in order to manage the system frequency within operational and statutory limits.

#### System Balancing

- 3.3 The Grid Code envisages that the System Operator aggregates the sum of all notified PNs and compares this with the forecast demand profiles. The SO then plans to take balancing actions to modify the notified total generation to meet the forecast demand. Some of these planned actions can be short term actions that can be taken in real time. Others, such as the starting up or shutting down of entire BM Units, require action to be taken many hours in advance.
- 3.4 The main way in which the System Operator balances generation and demand in real time is by issuing Bid Offer Acceptances (BOAs) that vary generator outputs. BM Participants can submit a series of prices to offer to increase their output from a BM Unit from their PN up to their MEL, and to bid to reduce their output from a BM Unit from their PN down to their SEL.
- 3.5 This process works well where the generating plant operators can control the power source. However, the System Operator is uncertain how effective this process is for generation with an intermittent power source given that such BM Participants may be unable to accurately forecast their output 1 hour ahead of real time for the whole of the relevant balancing period.
- 3.6 The System Operator may also take BOAs, or other balancing actions, to resolve constraints on the Transmission System. These may be thermal constraints, determined by the maximum total post fault capacity of all the circuits connecting one area of the system or may be due to voltage or stability constraints.

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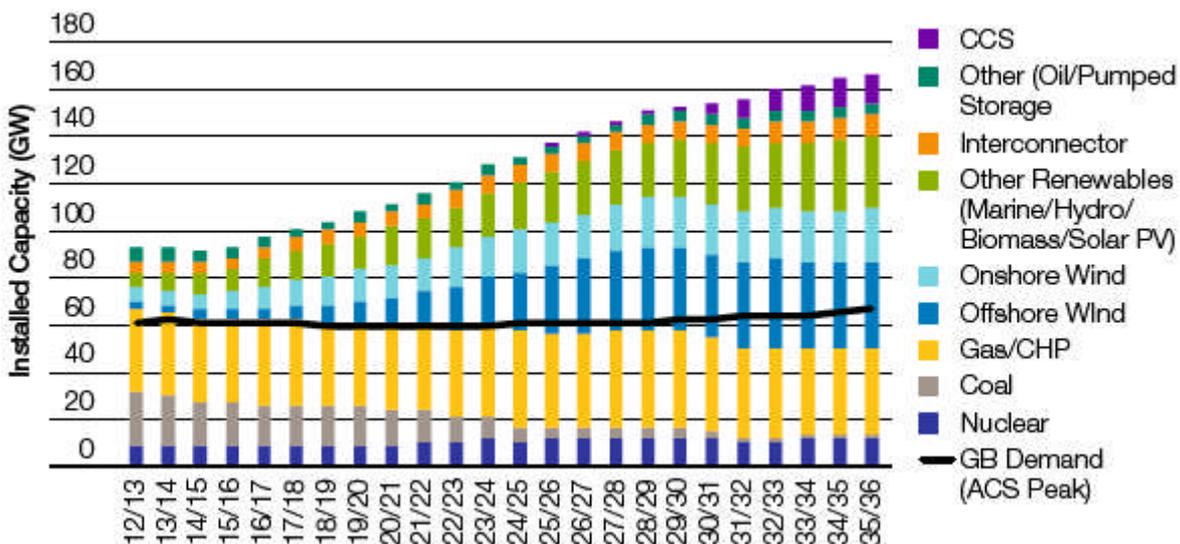
## Frequency Response

3.7 Frequency response is despatched by instructing a generator to operate in a frequency responsive mode of operation. The volume of response is specified through the Grid Code based on the Registered Capacity of each Generating Unit or Power Park Module and confirmed through compliance tests following commissioning. These tests are used to derive the Frequency Response Matrix, but the actual frequency response available in the operational timeframe is determined by establishing the output of the generator relative to its Maximum Export Limit and deriving the frequency response capability at that operating point from the tested frequency response matrices. Typically, the System Operator will change the operating point of the generator via a BOA to obtain the required frequency response capability.

## Intermittent Generation trends

3.8 The projected amount of renewable generation that is contracted to connect to the system within the next 5 years is shown in Figure 1 below, with the majority of the new connections being from wind farms. This chart is based on data in National Grid's Transmission Entry Capacity (TEC) Register.

*Demand and generation background: Gone Green*



**Figure 1 : Demand and Generation Background: Gone Green 2013.**

3.9 In order to manage the system efficiently, the System Operator requires a clear understanding of the output that a generator is capable of given the available power source and any associated uncertainties. This understanding will become more important as the volume of intermittent generation grows. In addition the System Operator is continuing to improve its wind forecasting capability to support operational decisions it must make in advance of real time. The wind forecasting process employed by the System Operator is described in section 5.33.

3.10 At present, BOAs would normally only be taken on wind generation to manage specific system constraints, rather than just to balance energy. However, the System Operator considers this likely to change in the next few years as wind generation forms a greater proportion of the overall generation mix. National Grid has already had occasions of wind generation contributing up to 25% of minimum demand on a windy summer night.

3.11 As intermittent generation grows in volume, the System Operator expects its use of balancing actions and frequency response from intermittent generation to grow. This will particularly be the case during periods of low demand and

high wind where use of services from intermittent generation may be the most economic solution. If this were not possible, services would need to be procured from other sources (e.g. interconnectors, generation, demand, energy storage) that would not ordinarily operate during such market conditions and are therefore likely to be more expensive options. In addition to this, wind power is technically well placed to provide rapid frequency response which will be required during periods of low system inertia that result from lower demand minimums and reduced levels of rotating plant synchronised to the system.

- 3.12 There are parts of the National Electricity Transmission System (NETS) where wind generation is providing an increasingly dominant contribution to flows across constrained boundaries and therefore the use of BOAs from intermittent generation may be the most economic option available to manage the constraint. The constraints on these boundaries will be impacted by planned transmission outages, connection of generation under the Connect and Manage regime and insufficient transmission capacity to cater for the available generation and prevailing demand.
- 3.13 Given these trends, the System Operator needs to consider whether it will be able to continue to efficiently manage the Transmission System with the data flows it is currently entitled to receive as defined in the Grid Code and subsequently provided by intermittent generation. The remaining sections of this report address the terms of reference of this Workgroup.

## 4 Specific Issues for the System Operator

- 4.1 This section describes 3 challenges to the System Operator's ability to efficiently manage the Transmission System. These are:
- Awareness of head room from intermittent generation when curtailed;
  - The provision of frequency response from intermittent generation; and
  - For MEL and PN data, the difference between data submitted and the actual physical outturn.
- 4.2 The System Operator performs a residual balancing role and the costs of actions it takes to ensure that the system is operated in a safe, secure and economic manner are recovered from consumers through the Balancing Services Use of System (BSUoS) Charge.

### Headroom from Intermittent Generation

- 4.3 Headroom, as used in this report, is the capacity of a Generator to increase its output from its current operating point. Typically, headroom is created following an earlier BOA Acceptance to reduce output or where a Generator is part loaded in response to market conditions.
- 4.4 As noted in section 3, the System Operator may require generation to reduce or increase output by Bid Offer Acceptances in the Balancing Mechanism. At present, this occurs infrequently for intermittent generation and typically only behind an export constrained boundary. However, given the anticipated growth in wind generation, the System Operator expects such actions to become more common in future. Generally, the System Operator does not receive an indication of whether wind generator reductions can be reversed, i.e. whether they have headroom. This lack of visibility of headroom from wind generators can lead to other plant types being despatched to increase output, which may be less economical and more carbon intensive than despatching a wind farm. Similar considerations may apply to other forms of variable generation.
- 4.5 In discussing the lack of visibility of headroom from wind farms, the example below illustrates the case that, after a Bid/Offer Acceptance (BOA) to reduce a generator's output, PN and MEL do not give an indication of its headroom. As noted in paragraph 3.3, any discrepancies between these data flows and the actual positions they are intended to represent create errors and uncertainties which, in aggregate, can lead to wider imbalances between generation and demand, less optimal management of system reserve (headroom), frequency response and constraints with consequential increased costs passed on to end consumers.

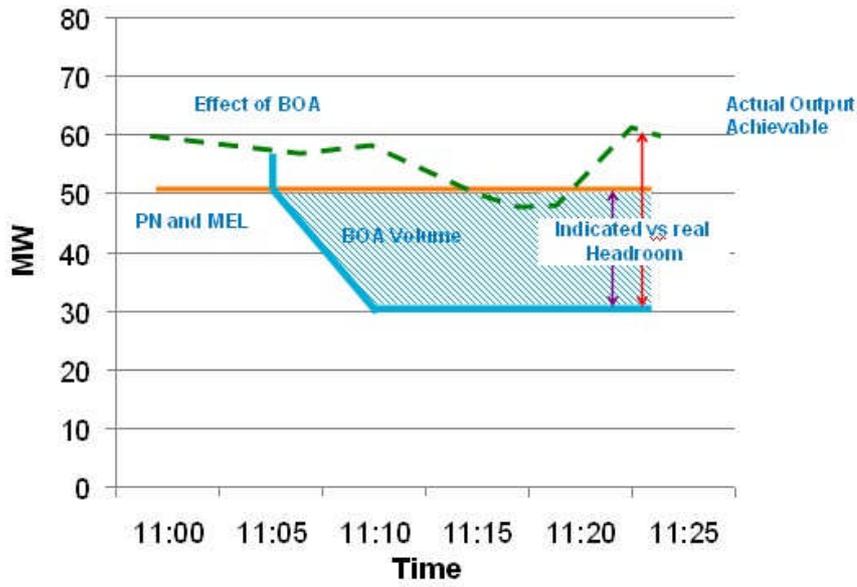
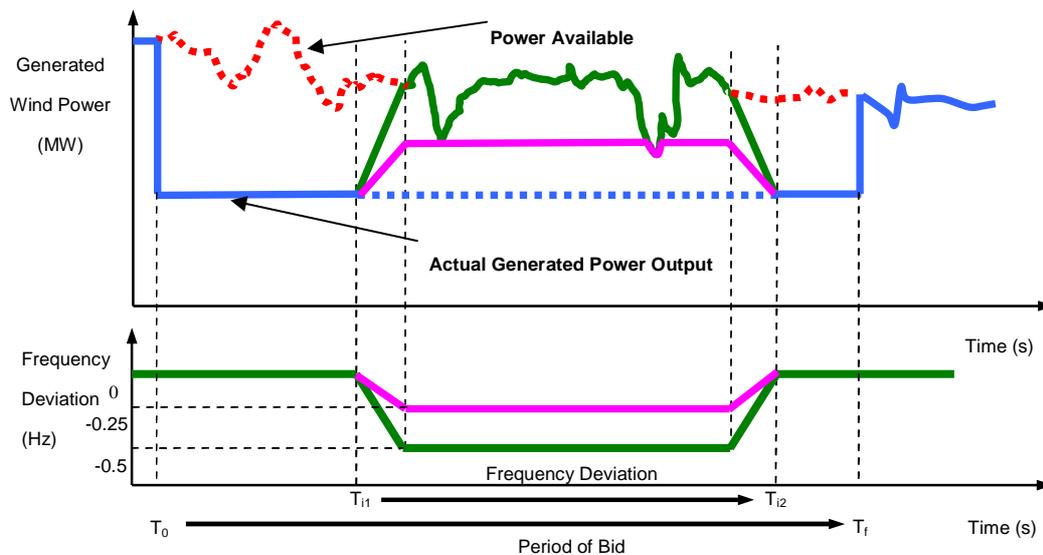


Figure 2: Illustration of the limitation in using PN and MEL data submitted to determine actual headroom

## Frequency Response from Intermittent Generation

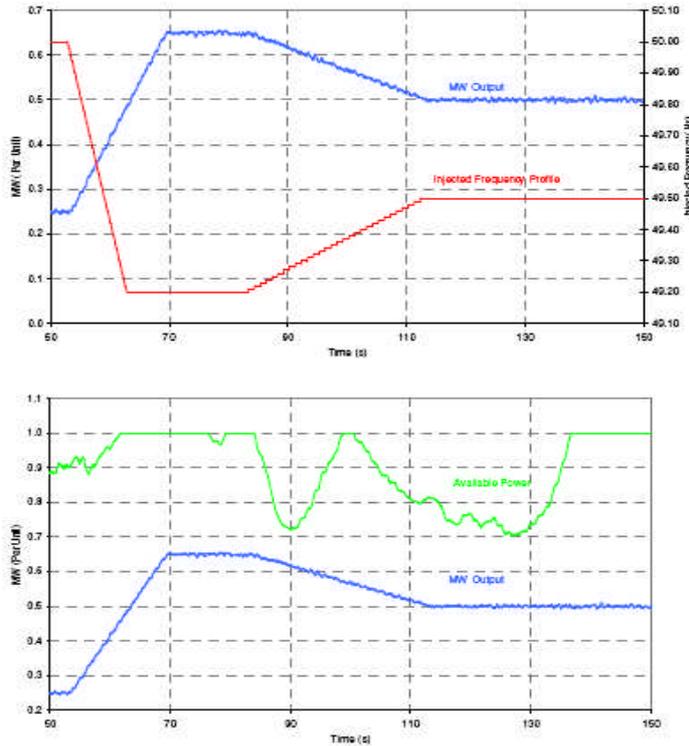
- 4.6 Under the Grid Code, the majority of Generating Units<sup>2</sup> or Power Park Modules installed within a Large Power Station are required to have a frequency response capability. In the operational phase, a number of these Generators will be instructed to operate in Frequency Sensitive Mode and be required to provide frequency response to help ensure that the system frequency is maintained within specific limits should there be a loss of Generation or change of Demand. As the instruction process relies on forecasted output through the combination of Maximum Export Limits (MELs) and PNs, it is important to ensure that the MEL and PNs remain accurate to set the baseline for such balancing services. Without this, the System Operator cannot be certain of the frequency response capability at a point in time.
- 4.7 The requirement for Power Park Modules forming part of a Large Power Station (which includes wind farms) to contribute to and have the capability to provide frequency control was introduced into the Grid Code in June 2005 following consultation H/04. Whilst wind generation is not widely used for contributing to primary and secondary frequency response at present, this is likely to change as greater volumes connect and displace plant with controllable power sources. Experience to date has demonstrated that, if the wind resource is sufficient, wind farms can deliver very good and fast acting response capabilities. Figure 3 below provides an example of how a wind farm can provide low frequency response.



**Figure 3: Example of low frequency response from wind generation**

<sup>2</sup> The obligations on Generating Units and Power Park Modules within a Large Power Station to provide frequency response are dependent upon size, type, location and Completion Date and defined in CC.6.3.7(e) and CC.6.3.7(f) of the Grid Code.

4.8 The actual performance of a wind farm in its ability to provide frequency response is shown in Figure 4 below. This was recorded during a Grid Code Compliance test.



**Figure 4: Example of frequency response from wind farm during a Grid Code Compliance test**

### Physical Notification and MEL accuracy

- 4.9 This is discussed in more detail in section 5 however, the accuracy between the Physical Notification at gate closure and the actual outturn does vary between different generation types. For example, PNs from generators with a variable primary energy source such as wind may not be as accurate as those from thermal or hydro generation.
- 4.10 There is an observed variation in PN accuracy between wind generators with some generators relying on default data.
- 4.11 PNs are submitted for each half hour trading period and the output from a generator with a variable primary energy source is likely to vary within a trading period.
- 4.12 It is challenging for wind generators to provide a highly accurate PN for two reasons. Firstly, day ahead PN submissions may be subject to significant forecasting errors. Secondly, hour ahead PN resubmissions for a whole half hour trading period are an estimate of the average output for that trading period and while the PNs may be subject to less forecasting error over the whole trading period (compared to day ahead), the PNs ignore the reality that wind power may vary significantly within that period.
- 4.13 The average PN following error is described in more detail in section 5.6, however, this error means that the System Operator cannot always make operational decisions based on PN data submitted from wind generators.
- 4.14 As noted in the preceding paragraphs, MEL is used by the System Operator to determine the level of frequency response that a generator is capable of providing and the head room that is available. MEL is interpreted in a number of ways by wind farm operators and updated with varying frequency from hourly to monthly. At present, the System Operator cannot reliably use MEL data for the calculation of frequency response and head room.

## 5 Current Information Provision and its use

5.1 To help define the scope of the issues, the Workgroup discussed what information and data was currently being provided by wind generators and how this was used by National Grid. The objective was to consider whether the current data was sufficient for the System Operator and to ascertain whether new items were required. The main data items are set out below:

### Pre Gate Closure Data

- Physical Notifications
- Bid/Offer data

### Post Gate Closure Data

- Operational Metering Data
- Maximum Export Limits (MEL)
- Dynamic Parameters
- Wind speed and direction on a Power Park Module basis rather than from individual turbines.

### Historic Recorded Data

- Recorded information received from data loggers such as Dynamic System Monitoring and Ancillary Services Monitoring equipment
- Historic recorded data from Compliance Tests including a Power Available Signal for frequency response testing purposes and test results

### Planning Code Data

- Static data received under the Grid Code used for offline modelling and analysis purposes (Power Park Module MW, MVA and Performance Chart, Power Park Unit data including Control System Parameters and Power output / wind speed curves).

5.2 The generator licence requires the Generator to comply with the Grid Code.

### **Physical Notifications (PN)**

5.3 Under BC1.4.2 of the Grid Code, generators are required to provide the best estimate (Physical Notification or PN) of their output for each half hour of the following day, which may then be revised up to an hour before real time (Gate closure). This then becomes their Final Physical Notification which is then used by the System Operator to determine the current generator output and forecast output going forward.

5.4 The Grid Code defines the PN as:

*“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.”*

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A PN can be profiled within a settlement period.

- 5.5 A recent Grid Code change, C/11, removed the obligation for wind generators to follow their Physical Notification (PN), provided that they follow good industry practice i.e. submit PNs that are a true and accurate reflection of their estimated output. This was introduced because wind generators can find it difficult to follow PNs due to the variable nature of their primary energy source. However, if the generator participates within the BM, in times of system stress, a £0 BOA may be issued to the generator to return to their PN.
- 5.6 Currently, in operational timescales, National Grid control engineers can elect to use either Physical Notifications (PNs) from a wind farm or existing MW metered output from the wind farm in calculating expected total generation between four hours ahead and real time. The reason for this is partly historic in that in the early days of wind power in 2005 and 2006 there was little enthusiasm from wind farms at that time to submit PN data. Many chose to submit nothing and others chose to submit zero. It was at this stage that it was decided that an internal wind power forecasting capability would need to be developed within National Grid. Over the subsequent years there has been a vast improvement in the quality and frequency of the data being submitted by wind farms.
- 5.7 In terms of timing, National Grid requires accurate PN data 90 minutes ahead of real time in order to plan the system effectively, There are three critical decision points where accurate information is important. At the day ahead stage (24 hours ahead of real time) National Grid requires accurate information to enable assessment of margins and headroom on the system. The critical point for deciding whether extra generation is needed to be warmed up and made ready to generate is 4 hours ahead of each cardinal point<sup>3</sup> on the demand curve. After gate closure (1 hour ahead) adjustments are performed by Engineers at the Electricity National Control Centre to manage frequency and constraints. These adjustments and the settlement of them are performed relative to the PN submitted.

### Current accuracy of PNs at Gate Closure compared with actual outturn from intermittent generators

- 5.8 Figure 5 below highlights the lower accuracy of wind generation PNs compared with other generation types.

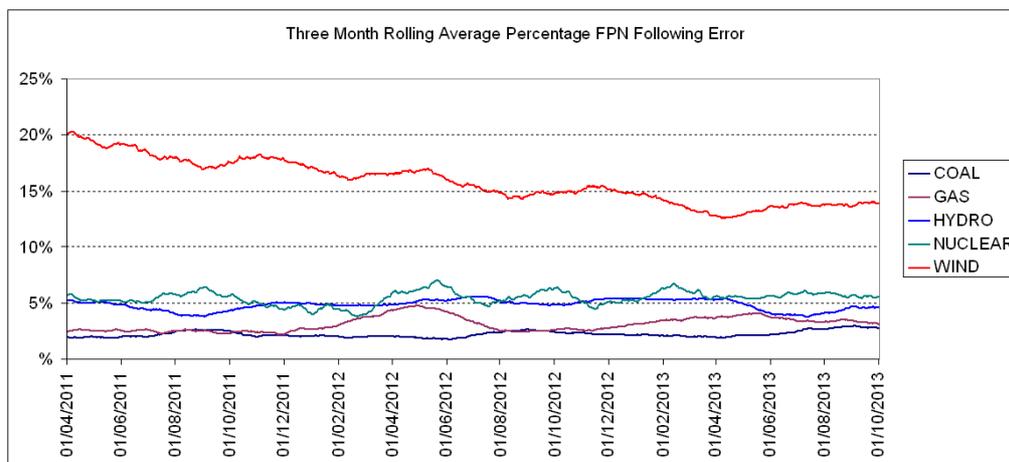


Figure 5: Comparison of PN following error between generator types.

<sup>3</sup> Cardinal points are peaks and troughs in the national electricity demand across the day that the System Operator uses to pre plan transmission and generation actions

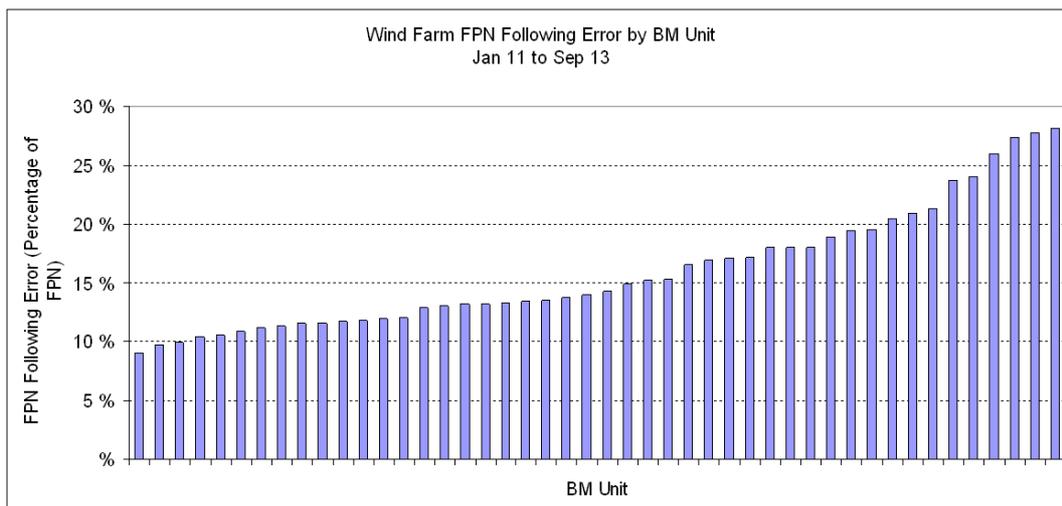
5.9 Percentage PN Following Error is defined as:

$$PNaccuracy(\%) = \frac{Average(ABS(PN_{GateClosure} \pm BOAs - MeteredOutput))}{MaxMeteredOutput}$$

5.10 The PN accuracy is defined as the average absolute difference in MWh per settlement period between the expected value (PN at Gate Closure modified by BOAs) and actual metered output, divided by the maximum metered output from the BMU. For example, a 100MW BMU that submitted a PN of 25MW with double that (50MW) for the metered output would yield an accuracy of 25%.

5.11 The analysis has been based on all data since 1<sup>st</sup> January 2011 giving a 3 month rolling average from the start of April 2011. The absolute difference in MW between expected (PN at Gate Closure) and actual metered output divided by PN at gate closure (FPN). The analysis was done for all BMUs with a maximum metered output greater than 10MW.

5.12 Figure 6 below illustrates the average PN following accuracy by Balancing Mechanism Unit (BMU) individual wind BMUs above 10 MW between January 2011 and September 2013.



**Figure 6: PN following accuracy by Wind BM Unit (Jan 2011 – Sept 2013)**

5.13 The mean PN following error for wind BMUs over this period is 15.9%. This compares with 2.9% for coal, 3.1% for gas, 4.9% for hydro and 5.5% for nuclear over the same period.

**Maximum Export Limits (MEL)**

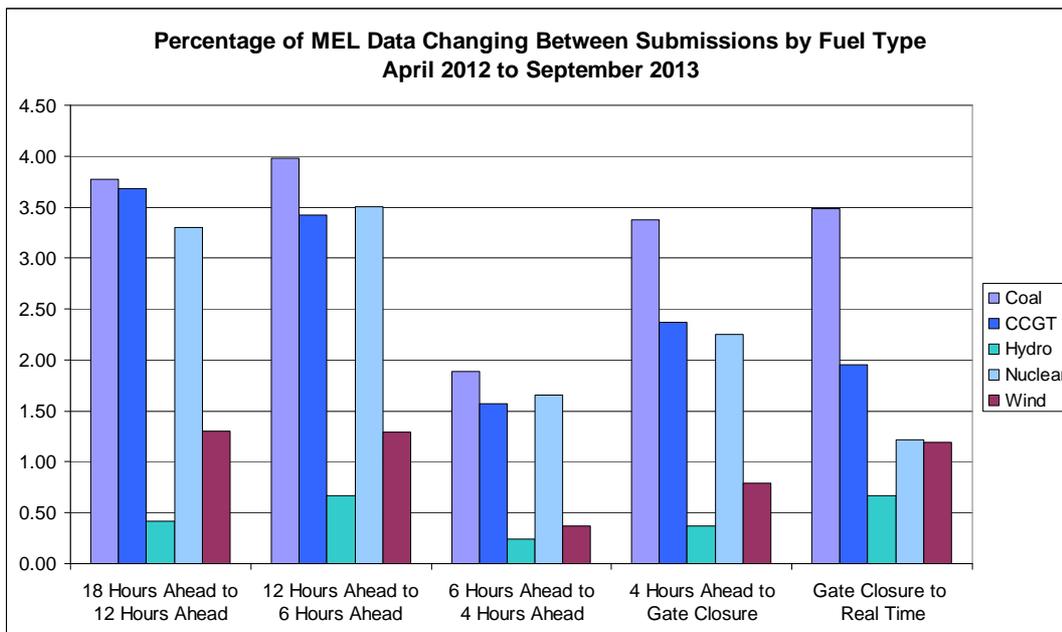
5.14 In addition to providing PNs, BM Participants (generators) also submit Maximum Export Levels (MELs) for each settlement period. This is the maximum export that a BM Unit chooses to make available via the Balancing Mechanism during the settlement period. The MEL is used by NGET to determine the amount of power available to the System Operator over and above that indicated by PNs and is used in the despatch of frequency response and to determine reserve levels provided by the market.

5.15 The MEL indicates the amount of capacity that is available on a particular unit and is submitted by a generator in order to help the System Operator with

reserve scheduling. This may be submitted within gate closure and can be different from a generator’s PN. It is defined in the Grid Code 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.”*

- 5.16 For wind generation, MEL can be perceived as being based on actual or predicted wind speed in order to calculate the actual or forecast maximum capacity respectively. However, this would require frequent updates to MEL which may not be practical compared to submissions from generation with controllable energy sources.
- 5.17 The Workgroup acknowledge that, across the industry, there are different practices for submitting MEL; some parties put in MEL as installed capacity, some set MEL to PN and others provide a more dynamic MEL (i.e. a MEL dependent upon the actual availability and output of the plant at a particular time).
- 5.18 Maximum Export Limit (MEL) is very important to National Grid to provide awareness of how much capacity margin is available on the system. For a marginal power station with a controllable fuel source, the difference between the PN and the MEL gives an indication of the headroom or spare capacity that is available to be instructed if needed.
- 5.19 Currently, 1.4% of MEL submissions by Power Park Modules are changed between gate closure and real time. This compares to 1.3% for nuclear, 2.2% for CCGT and 3.8% for coal.
- 5.20 The graph below shows the percentages of MEL submissions that are changed (y axis) for each fuel type over various time frames. The data relates to the period April 2012 to September 2013. Generally, wind MELs are changed less frequently than other fuel types across all timescales, with the exception of hydro.



**Figure 7: Percentage of MEL data changing between submissions by fuel type (April 2012 – Sept 2013)**

5.21 If the submitted MEL was dependent on wind output, there would be a greater variation whereas, if MEL was based on the available capacity, there would be less variation. Figure 7 suggests that the MEL data is generally submitted on the latter basis.

### **Bid / Offer data**

5.22 Bid / Offer data specifies MW operating points and the costs associated with deviating generation from its current operating point as indicated by its Physical Notification. These are very important in the decision making process at the National Electricity Control Centre. When Bids and Offers need to be accepted to manage system issues they are taken in cost order with the cheapest option taken before more expensive options, unless system constraints dictate otherwise. In this way, the need to optimise the geographical distribution of plant on the electricity transmission system is achieved in the most economic way.

### **Wind speed / direction**

5.23 Wind Speed and Wind Direction is currently received from 50% of the BMU wind farms. This is around 45 sites at the present time. This information is used for two purposes. Firstly to verify the quality of the wind speed and direction forecasts provided by our weather forecast provider. If these forecasts are found to be inaccurate relative to the measured wind speed and direction at the wind farm site, then adjustments are made to the forecasting models to take this into account in the short term and feedback is given to the weather companies so that improved weather forecasts can be received in the longer term. Secondly the wind speed and wind direction measurement data is used to build more accurate models that enable more accurate forecasting by the System Operator.

### **Operational Metering**

5.24 National Grid as System Operator, require Operational Metering Data which is used for control of the Transmission System in real time. At the present time, National Grid require aggregated wind speed and direction (amongst other operational metering signals e.g. MW, MVAR's, Voltage, tap position and frequency) for each Power Park Module, the requirements for which are specified in the Bilateral Agreement. At the present time if a fault occurs to the operational metering, National Grid would generally require it to be repaired within 5 days of notification of the fault unless otherwise agreed.

5.25 All the operational metering signals are generally treated in the same way within the Bilateral Connection Agreements, and it is usual practice for the generator to provide the specified operational metering signals to the Grid Supply Point. National Grid would then take these signals and provide the communications routes back to the National Electricity Control Centre at Wokingham. In terms of ongoing maintenance, National Grid will pay for the communications infrastructure from its Control Centre to the Grid Supply Point and the Generator will pay for the communications infrastructure from the Grid Supply Point to the Power Park Modules.

5.26 An example setting out the Bilateral Connection Agreement schedule and its description of the communication routes is described in Annex 3.

### **Power Available signal for testing frequency response**

5.27 Generators are required to provide a Power Available ("Avail") signal to National Grid for compliance testing purposes only. These requirements are detailed in OC5.A.1.3 (c) and CC.6.6.2 of the Grid Code but in summary when a wind farm is undertaking compliance testing for frequency response testing

purposes, they will be required to supply a Power Available signal with a sampling rate of typically 10Hz. This signal however should not be confused with operational metering signals which are provided to National Grid for the purposes of operating the Transmission System.

## Frequency Response

5.28 As noted in section 3.7 above, Frequency response from wind is despatched by instructing a generator to operate in Frequency Sensitive Mode (FSM). The volume of response provided is calculated using the de-load point from MEL and making reference to a frequency response capability matrix for the generator concerned.

5.29 The Workgroup noted that some wind farms (through operation of individual wind turbines) are capable of providing frequency response in two ways:

- Maintaining a set de-load from the maximum operating output given the prevailing wind conditions (i.e. the wind turbine output would follow the wind output less a fixed headroom); some wind turbines can operate in this way;
- Operate at a fixed specified loading point below the maximum (i.e. the level of headroom and hence reserve would vary depending on wind speed in reference to the fixed loading point of the wind farm) varying output because of frequency changes only); all wind turbines can operate in this way;

5.30 The latter mode of operation is used in the GB. There is no suggestion that this will change, however it is worth noting that either mode of frequency response requires the same data flow to calculate the frequency response capability that is provided.

## Wind Farm Data Collection and Signal Processing

5.31 In terms of data and signal processing, the required operational metering data is currently limited to aggregated wind speed and direction for each Power Park Module with a refresh rate of 5 seconds or better. The wind farm developer determines how to derive these signals either from a met mast or via transducers from the wind turbines themselves. It should be noted that such signals may already be available from the Wind Farm SCADA system which the wind farm owner and manufacturer will use for operational purposes. Presently, there is no standard for the provision of wind speed and wind direction operational metering other than the refresh rate.

## Data Communications between wind farms and the System Operator

5.32 The System Operator receives data from all generators via Electronic Data Transfer (EDT), Electronic Data Logging (EDL) and Supervisory Control and Data Acquisition (SCADA). These are described in more detail in Annex 3 however the key characteristics are as flows:

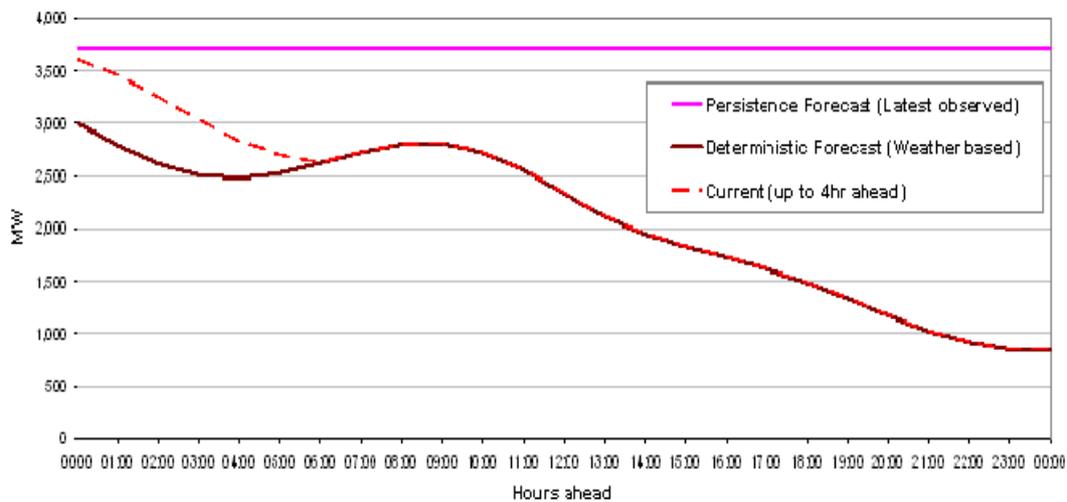
- EDT – Generator data received from the Trading Point responsible for the wind farm. PN's and Bid Offer data are provided to the System Operator via this medium.
- EDL – communication between the System Operator and Generating Unit or Power Park Module control point where BOA acceptances are issued and ancillary services instructions given such as frequency response and reactive power. Dynamic parameters such as MELs may also be communicated by this medium.

- SCADA – all operational metering data and in the case of wind farms, wind speed and direction.-
- Contingency communications (e.g. fax)

### How is current data used to derive System Operator forecast output?

5.33 The Workgroup questioned how current data on wind speed and PNs from wind farms was used to help derive a forecast of output and whether this had a large margin of error.

5.34 In the timescale 0 to 6 hours ahead, the aggregate wind forecast is a combination of the metered output (Persistence forecast) and the wind power forecast that has been derived from the weather forecast. The two results are combined together in a linear way. At the real time point (0 hours ahead) the forecast and the metered values are equal. At 3 hours ahead the result is 50% metering and 50% forecast. At 6 hours ahead the result consists of 100% of the wind power forecast and 0% metering. This is shown in Figure 8 below.



**Figure 8: Wind Power forecast combining deterministic and persistence methodologies**

5.35 The forecast output is constantly updated on a rolling basis as new metering data is received by the System Operator.

### Wind Farm Operators' Wind Forecast Data

5.36 It was noted that wind farm operators that are party to the BSC require forecasting data flows for both trading purposes and the calculation of PNs. Some parties use a common forecasting system and data set for both trading and operational purposes whereas other parties take a separate approach.

5.37 At gate closure two data streams are submitted by, or on behalf of Wind Farms:

- Notifications from parties representing aggregated traded positions (MWh/Settlement Period) are submitted to the Energy Contract Volume Aggregation Agent (currently Elexon)
- Physical Notifications for each BMU are submitted to the System Operator

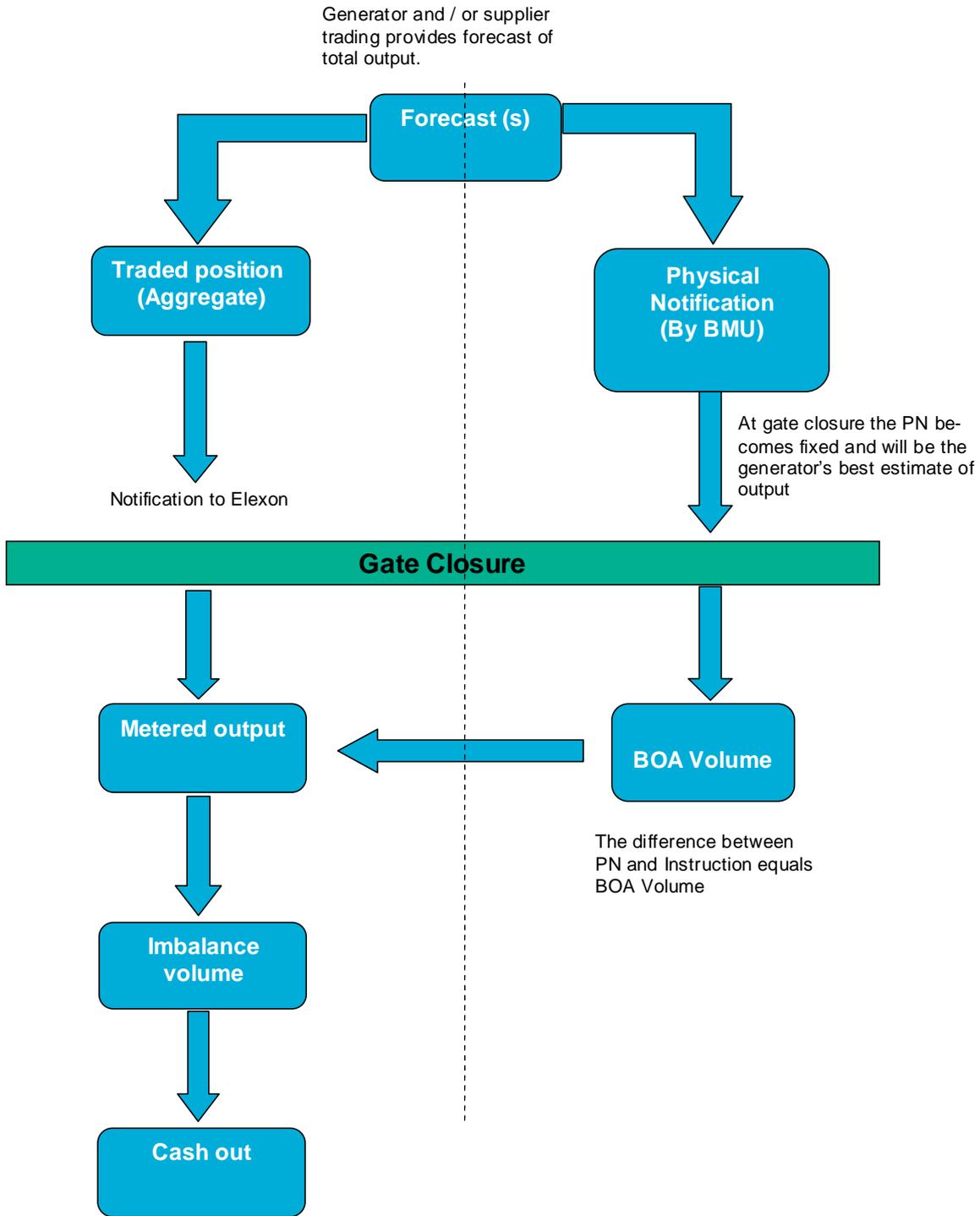
5.38 For wholesale energy trading, Trading Parties submit Notifications to the Energy Contract Volume Aggregation Agent (ECVAA, one of the agents mandated by the BSC) prior to gate closure and any differences between the Notified position and metered outputs (MWh / Settlement Period) are cashed out at the prevailing cash out price. For physical parties (i.e. generators), the

Notified position in effect represents a forecast output at gate closure for the settlement periods concerned.

- 5.39 Any Bid Offer Acceptance (BOAs) volumes (MWh/SP for a BMU) accepted by the System Operator in the Balancing Mechanism are calculated with reference to the Physical Notification at gate closure and these volumes are added (or subtracted) to the Notified positions. This means that, assuming PNs are accurate; any imbalance exposure associated with BOAs is removed. BOAs are paid at the rates (£/MW) submitted by the Generator's Trading Point into the Balancing Mechanism. The following Figure 9 helps to explain this.

**Trading Party Account  
(BSC data)**

**BMU data for SO (Grid  
Code data)**



**Figure 9: High Level Illustration of BSC and Grid Code data flows**

## 6 Perceived Deficiencies

- 6.1 The identified deficiencies fell into two broad categories: operational data necessary for the System Operator to operate the Transmission System in an economic and efficient manner; and accurate settlement of Bid Offer Acceptances (BOAs).

### Required Operational Data from Intermittent Generation

- 6.2 Assuming that no changes to wind power output need to be taken, the System Operator is currently able to undertake many of its overall activities where PNs and other data would ordinarily be used by using a combination of forecasting wind power output and wind output metered data. This assumes that wind output is maximised to harness the available wind.
- 6.3 Within Gate Closure, where an intermittent generator is requested to deviate from its preferred operating point (assumed to be maximised to harness the available resource) to a specified output via a BOA, the System Operator is uncertain what the potential output that Power Park Module could return to, should the need arise. This data would enable the System Operator to manage reserve levels and frequency response capability more efficiently.
- 6.4 For generation with a controllable power source, this is indicated by the Maximum Export Limit; however the current definition of MEL and the subsequent data that is provided from intermittent generation (e.g. wind) does not allow the System Operator to establish the level of headroom that is available for the reasons set out in sections 5.145.14 to 5.210. That is, there is a variation in the interpretation of the definition of MEL by wind farm operators and the level of accuracy that can be achieved.

### Bid Offer Acceptance volume (MWh) accuracy

- 6.5 As already noted, the Grid Code defines the PN as:

*“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”*

A PN can be profiled within a settlement period. Inherently then, the PN data contains forecast data going forward.

- 6.6 BOAs can be issued to deviate intermittent generation to specific operating points, however the cost of taking a BOA is calculated with reference to the Physical Notification and submitted price. Any significant discrepancies between actual output and PN may therefore lead to an uneconomic decision by the System Operator and an incorrect settlement of a BOA.
- 6.7 Balancing and Settlement Code (BSC) modification proposal P197 (‘Erroneous Calculation of Bid Offer Acceptance Volume’) previously considered how BOA volumes could be calculated for a BMU where MEL was re-declared below its PN. P197 was focused on the scenario of thermal plant that re-declared its MEL below its PN, but still had its BOA volume calculated from PN. Similarities were noted with variable fuel source generation (e.g. wind farms) whose power output deviates from PN but their BOA volumes continued to be calculated from PN. P197 was understood to be rejected on the basis that, although it was an issue, this was not sufficiently material to warrant making changes to systems. It was noted that it may be appropriate for a BSC change to be considered addressing both the P197 issue and the deviation of variable fuel source generation from the declared PN, for example by calculating BOA volumes from an updated baseline.

- 6.8 The Grid Code Workgroup concluded that it was possible to use any of the options that were considered to address operational considerations (through the Grid Code) and to also calculate BOA volumes for Settlement (through the BSC). However, the Workgroup expressed different views on whether BOA volume settlement accuracy was an issue that needed addressing and, if it were, whether implementation of any BSC changes needed to be aligned and coincident with Grid Code changes. Therefore, the Workgroup considered it sensible to describe the potential settlement issues impacting the BSC that were apparent within this Workgroup report and then focus solely on progressing relevant Grid Code changes to address operational issues. Accurate settlement of Bid Offer Acceptances (BOAs) would be taken forward separately through BSC governance arrangements if this was considered necessary by BSC parties.
- 6.9 Although, from a practical perspective, it is possible to address 1) operational considerations through the Grid Code and 2) BOA volume settlement accuracy through the BSC separately (and with different implementation dates), differences of opinion were expressed over whether it was appropriate to implement any proposed changes to the Grid Code before any potential corresponding BSC arrangements were concluded.
- 6.10 The Workgroup recognised that the margin of error was higher within intermittent generation compared to other generation however the materiality was not thought to be currently significant but may increase in the future as intermittent generation volumes increase and the System Operator takes more balancing actions on intermittent generation. The following table shows the volume of BOAs taken between for different generator fuel sources. (1<sup>st</sup> Oct 2012 – 30<sup>th</sup> Sept 2013)

	CCGT	COAL	GAS	HYDRO	OCGT	OIL	WIND	Total
<b>Volume of Offers</b>	3,438,367	2,643,013	13,223,389	1,351,042	32,896	11,442	1,078	20,701,227
<b>Volume of Bids</b>	-2,680,321	-9,177,284	-9,657,549	-619,899	-4	-952	-467,835	-22,603,844
<b>Percentage of Offers</b>	16.6	12.8	63.9	6.5	0.2	0.1	0	
<b>Percentage of Bids</b>	11.9	40.6	42.7	2.7	0	0	2.1	

- 6.11 It was noted that any developments that may have implications on settlement of BOAs may affect Power Purchase Agreements that underpin investments in wind farms. Consequently, concern was expressed over any proposals that may affect settlement. As noted, further consideration of the terms of reference by this Workgroup concluded that settlement implications would be most sensibly progressed under BSC arrangements.

### Benefits of addressing these perceived deficiencies

- 6.12 At a high level, overcoming these deficiencies will facilitate the efficient integration, participation and operation of renewable generation to supply electricity to GB consumers.
- 6.13 It would facilitate the opportunity for generators with a variable primary energy source to participate in the provision of Balancing Services (e.g. reserve, BOAs and frequency response) and earn additional revenues.
- 6.14 It would help avoid the necessity of taking actions on out of merit alternatives.
- 6.15 Where automation is possible, additional operational burden on renewable generation operators should be reduced.

- 6.16 It would improve the efficient operation of the system and potentially reduce BSUoS costs
- 6.17 Facilitating the provision of Balancing Services from intermittent generation will also enhance system security particularly in regions where less generation with controllable fuel sources are present.
- 6.18 In the long-term it is likely that the changes proposed in the provision of additional data items to solve these deficiencies should lead to a review of the existing data requirements under BC1 and BC2 of the Grid Code. However, this would have to also consider the extent to which any changes implemented applied only to new connectees going forwards or to all parties.

## 7 Description of Options

7.1 In considering the issues highlighted by National Grid, the Workgroup discussed whether or not changes were required to the existing processes or whether solutions could be sought which were outside of the current Grid Code obligations. Three options were found worthy of consideration and are described below

- Option 1 - Standardisation of MEL where the update frequency was a variable to be determined by the Generator;
- Option 2 - Dynamic MEL (Power Available signal used to calculate MEL), with an update frequency of [10 minutes]; and
- Option 3 - Power Available Data Feed to the National Grid Control Centre via SCADA data connections; MEL used to indicate connected capacity

7.2 At the heart of all of the options is the Power Available signal. Power Available is an indication of the maximum achievable output which could be delivered by a wind farm under the current prevailing weather conditions when, for example, the current output may have been reduced for the provision of balancing services to the system operator. It is defined as:

A value / signal prepared in accordance with good industry practice, representing the instantaneous sum of the potential **Active Power** available from each individual **Power Park Unit** within the **Power Park Module / BM Unit** calculated using any applicable combination of meteorological (including wind speed), electrical or mechanical data measured at each **Power Park Unit**. The **Power Available** shall be a value of between 0MW and **Registered Capacity** which is the sum of the potential **Active Power** available of each **Power Park Unit** within the **Power Park Module / BM Unit**. A turbine that is not generating will be considered as not available.

### Option 1 - Standardisation of MEL

7.3 There is currently inconsistency in BM data provided by wind farm operators. Some BMUs set their MEL to be the Registered Capacity, or some other high fixed value, while others set their MEL equal to their PN.

7.4 Under this option, PNs would continue to be provided by wind farm operators through the BM. BC1.A.1.3.1 is modified to ensure a consistent definition of MEL is used by all wind farms. The MEL would provide the forecast maximum output profile expected forward from real time through the BM. It would be recalculated and submitted periodically and potentially may be provided manually.

7.5 A standard methodology for calculation of MEL would be agreed and would be expected to vary with forecast wind output.

7.6 This may improve the accuracy of total headroom calculated from the sum of synchronised MELs, but may not resolve the problems associated with wind headroom and provision of frequency response following a reduction in output via a BOA. This would depend on the accuracy achieved which would be influenced by the frequency of update.

7.7 Settlement of any BOAs would continue to be against PN.

7.8 Wind farm operators would have to modify their systems to send the data.

## Option 2 - Dynamic MEL (Power Available signal is used to calculate MEL)

- 7.9 Under this option, PNs would continue to be provided by wind farm operators through the BM as now. BC1.A.1.3.1 is modified to ensure a consistent definition of MEL is used by all wind farms. In addition, each wind farm periodically recalculates its current MEL, and re-submits its MEL profile forward from real time through the BM. It is anticipated that this would occur every ten or fifteen minutes and follow a standard methodology for calculation of current MEL. Given the frequency of MEL revisions, persistence modelling could be deployed to generate the profile forward from real time through the BM by the operator. It is anticipated that this will be an automated solution.
- 7.10 Settlement of any BOAs would continue to be against PN.
- 7.11 This option could allow National Grid to calculate headroom provided by any wind farms operating below MEL, and could allow wind farms to provide low frequency response, as National Grid would be able to calculate the volume of response currently being provided by a wind farm.
- 7.12 This option would result in an increased volume of data flowing through the BM and Elexon systems. Wind farm operators would have to modify their systems to send the data, and National Grid would have to modify their systems to make use of the frequently updated MEL data.

## Option 3 - Power Available Data Feed to National Grid Control Centre

- 7.13 Under this option, wind farms would submit PNs as now and, following a standard definition, MEL which would indicate the total connected capacity. However, rather than providing a periodic update of MEL, wind farms would provide a separate periodic value for Power Available, at [X time] intervals direct to National Grid's Electricity National Control Centre. This value would be the maximum output that could be delivered by the wind farm with the current wind conditions, and would be calculated using an agreed standard methodology. The System Operator would use this data, persistence modelling and forecast data to make operational decisions for reserve and frequency response based on its forward projections.
- 7.14 This signal could potentially be fed over the existing SCADA data connections used to provide operational metering. National Grid would use the data internally for operational purposes, but the settlement process would not be affected.
- 7.15 As a general comment, discussions held with manufacturers support the view that if a signal is already available within the wind farm SCADA system, it should not be difficult or costly to provide to the System Operator provided such requirements are specified with such signals when requested at the design stage. However, additional work would need to be undertaken to determine whether this signal could be used for the provision of an operational signal to the System Operator.
- 7.16 Settlement of BOAs would be against PNs as now.
- 7.17 This option would allow National Grid to calculate headroom provided by any wind farms operating below their current maximum possible output, and could allow wind farms to provide low frequency response, as National Grid would be able to calculate the volume of response currently being provided by a wind farm.
- 7.18 Providing the total connected capacity through MEL would also assist in the System Operators wind forecasting process. It also has the advantage of allowing the System Operator to have greater visibility of all wind farms not

just those which are BM Units in their own right and subject only to Central Volume Allocated (CVA) metering.

- 7.19 This option does not impact on BM systems. Wind farm operators would have to modify their SCADA systems to send the data, and National Grid would have to modify their systems to make use of the additional information. It was noted that wind speed and direction were already transmitted via SCADA systems at a 5 second interval and it may be no more onerous to provide 5 second interval data rather than, for example, 10 – 15 minute interval data.

### Further Refinement of Options

- 7.20 The Workgroup noted that the main difference between the “Standardisation of MEL” and “Dynamic MEL” options was the frequency of data update as that it would be expected to vary with forecast wind output.
- 7.21 The table below summarises the differences between the three options and describes the features, advantages and disadvantages of each.
- 7.22 It was noted by the Workgroup that the costs for implementing any of these solutions needs further consideration and would benefit from seeking wider views as they vary between Generators and wind farm designs.

### Other Considerations

- 7.23 It was noted by the Workgroup that the accuracy of PNs might be improved if the period between gate closure and real time was reduced; however this was not the case for MEL data as this data flow can already be varied within gate closure irrespective of the gate closure period. Consequently, the Workgroup did not consider that a shorter gate closure would address the deficiencies identified for MEL.
- 7.24 Following submission of the draft report to the November GCRP, one member was interested to understand the implications of the options with respect to Licence Exempt Embedded Medium Power Stations (LEEMPS). So far as Power Available is concerned, Option 1 (Standardisation of MEL) and Option 2 (Power Available signal is used to calculate MEL) would not be applicable to LEEMPS or indeed Generators which do not participate in the wholesale electricity market as they are not bound by the market rules and hence products such as MEL. Option 3 (Power Available Data Feed to National Grid Control Centre) could equally be applied to BM and non-BM participants as this option is based on the operational metering requirements specified at the connection application stage rather than a commercial product required as a consequence of operating in the Balancing Market.
- 7.25 It is acknowledged that in respect of LEEMPS, the operational metering arrangements are generally based on an internet based mobile telephone technology system rather than that applied to conventional large power stations which have direct and duplicated communications channels. Whilst it is technically possible to add Power Available to the suite of signals available from LEEMPS based wind farms the costs of this additional functionality would need to be understood.
- 7.26 National Grid has no intention of requiring a Power Available signal to be provided by Small Embedded Power Stations. The only exception to this requirement would be where a Small Embedded Power Station is required to provide a set of Operational Metering Signals. It is recognised that the issue relating to Operational Metering in respect of Small Embedded Power Stations which have registered as a BM Unit is still an issue for debate and as such falls outside the scope of this Consultation.

7.27 National Grid has no intention of requiring existing LEEMPS to retrospectively provide a Power Available signal under option 3 if this were subsequently approved by the Authority as part of any future Grid Code modification.

The following tables show the options:

Features	Option 1 Standardised MELs	Option 2 MEL Updated at Regular Intervals	Option 3 Power Available Signal to ENCC outside BM systems
<b>Data Exchange</b>			
MEL	<p>Under this option, PNs would continue to be provided by wind farm operators through the BM. BC1.A.1.3.1 is modified to ensure a consistent definition of MEL is used by all wind farms</p> <p>The MEL would provide forecast maximum output profile expected forward from real time through the BM. It would be recalculated and submitted periodically and potentially may be provided manually.</p> <p>A standard methodology for calculation of MEL would be agreed and would be expected to vary with forecast wind output.</p>	<p>Under this option, PNs would continue to be provided by wind farm operators through the BM as now. BC1.A.1.3.1 is modified to ensure a consistent definition of MEL is used by all wind farms.</p> <p>In addition, each intermittent generator periodically recalculates its current MEL, and re-submits its MEL profile forward from real time through the BM. It is anticipated that this would occur every ten or fifteen minutes and follow a standard methodology for calculation of current MEL. Given the frequency of MEL revisions, persistence modelling could be deployed to generate the profile forward from real time through the BM by the operator. It is anticipated that this will be an automated solution.</p>	<p>MELs manually submitted, reflecting availability of individual turbines in the same way as MEL reflects availability of conventional plant.</p>
PN	No Change	No Change	No Change
Power Avail	A value representing Power Available will be used by the Generator to calculate and submit	A value representing Power Available will be used by the Generator to calculate and submit MELs with	A Power Available signal will be provided via SCADA to NGET.

	MELs	a defined update rate.	
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<b>Features</b>	<b>Option 1</b> Standardised MELs	<b>Option 2</b> MEL Updated at Regular Intervals	<b>Option 3</b> Power Available Signal to ENCC outside BM systems
<b>SO balancing actions</b>			
BOA dispatch	This will be done as now with reference to PN data and submitted BOA prices	This will be done as now with reference to PN data and submitted BOA prices	This will be done as now with reference to PN data and submitted BOA prices
Wind forecasting	This will be done as now (set out in sections 5.23 and 5.33 – 5.35)	This will be done as now (set out in sections 5.23 and 5.33 – 5.35)	This will be done as now (set out in sections 5.23 and 5.33 – 5.35)
Frequency response and reserve	<p>Today the headroom between MEL and PN is used to determine the availability of frequency response and reserve; this will continue to be done with reference to MEL.</p> <p>The EBS system will assume that after a BOA the BMU will return to the PN level. It will then calculate headroom, response holding etc from the difference between the BOA level and the assumed position at the end of the BOA, which is the PN.</p>	<p>Today the headroom between MEL and PN is used to determine the availability of frequency response and reserve; this will continue to be done with reference to MEL</p> <p>The EBS system will assume that after a BOA the BMU will return to the PN level. It will then calculate headroom, response holding etc from the difference between the BOA level and the assumed position at the end of the BOA, which is the PN.</p>	<p>Today the headroom between MEL and PN is used to determine the availability of frequency response and reserve; with option 3 instead the Power Available signal will be used in conjunction with the loading point of the generators which will give a more accurate representation.</p> <p>Also with option 3, the EBS system will assume that after a BOA the BMU will return to the Power Available level. It will then calculate headroom, response holding etc from the difference between the BOA level and the assumed position at the end of the BOA, which is the PA.</p>
<b>Data Volumes</b>	No significant change	Significant increase in volume of BM data sent to National Grid and Elexon / BMRA	No increase in BM data systems. Very small percentage increase in the volume of Scada data received by SO.
<b>Cost (Subject to consultation)</b>			

Implementation	Low but will depend on currently adopted practice	Low for wind farms with existing automated process Medium for wind farms installing new automated process	Low to medium
Ongoing Operation	Low for wind farms adopting automated process , Potentially medium for those adopting a manual process	Low for wind farms adopting automated process; medium for those adopting a manual process	Low to very low – maintenance of single additional analogue signal.
<b>Implementation Timescale</b>	Only limited by Grid Code change	Would require time for wind farms to develop and implement automated system if desired	Would require time for integration of signal to SCADA systems and modification to SO systems.

Features	Option 1 Standardised MELs	Option 2 MEL Updated at Regular Intervals	Option 3 Power Available Signal to ENCC outside BM systems
<b>Changes to Codes and associated documents</b>	Clarify definition of MEL in Grid Code for intermittent generation	Changes to Grid Code to codify frequency of MEL data.	Changes to Grid Code to require data – may be different ways to obtain data for new and existing generators and clarify definition of MEL  Changes to Procurement Guidelines to clarify how National Grid would assess the value of services from windfarms where volumes may change in the future.
<b>Settlement</b>	No Change  Information provided by Elexon website would need review for consistency	No Change  Information provided by Elexon website would need review for consistency	No Change  Information provided by Elexon website would need review to ensure that data provided is valuable to market participants
<b>Delivery of Requirement</b>			
Headroom	There is a risk that the SO cannot reliably calculate current headroom provided by any wind farms operating below maximum output because of inconsistent and unknown refresh rates and the triggers for resubmission. The risk is reduced if all adopt the same 'Good Industry Practice' around criteria for updating MEL which would give the SO more confidence.	SO able to calculate better estimate of headroom, depending on frequency of update although potentially same issue of accuracy regardless of refresh rate. The risk is further reduced if all adopt the same 'Good Industry Practice' around criteria for updating MEL which would give the SO more confidence	SO able to calculate headroom subject to operational metering refresh rate

Response Volume	SO cannot reliably calculate current response volume held on any wind farms operating in frequency sensitive mode because of inconsistent and unknown refresh rates and the triggers for resubmission.	SO able to reliably calculate estimate of response volume held on any wind farms operating in frequency sensitive mode, based on consistent and known refresh rate of [10 minutes]. Refresh rate would not improve accuracy necessarily though.	SO able to reliably calculate estimate of response volume held on any wind farms operating in frequency sensitive mode, based on consistent and known refresh rate of [10 minutes]
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Features	Option 1 Standardised MELs	Option 2 MEL Updated at Regular Intervals	Option 3 Power Available Signal to ENCC outside BM systems
<b>ADVANTAGES</b>			
For intermittent Generators	<p>Potentially no system and process changes depending on current practice</p> <p>Potentially low overhead</p> <p>To the extent that the option provides the SO with confidence in capability, there is a greater opportunity for wind generation to earn additional revenues for the provision of services</p>	<p>Some operators would not need to change their systems</p> <p>To the extent that the option provides the SO with confidence in capability, there is a greater opportunity for wind generation to earn additional revenues for the provision of services</p>	<p>For most Generators power available signal is already within control system. For new Generators this would probably be the easiest system to implement.</p> <p>To the extent that the option provides the SO with confidence in capability, there is a greater opportunity for wind generation to earn additional revenues for the provision of services</p>
For System Operator	<p>No system changes</p> <p>Consistent basis on which MEL data is provided. However the refresh rate and triggers for resubmission will be inconsistent and may not provide a reliable indication of headroom and response volume available.</p> <p>I</p> <p>Option 1 does not provide a consistent refresh rate. This would introduce greater overall error for the System Operator. One party considered that if common good industry practice is adopted then this may provide a reliable indication.</p>	<p>Minor system changes associated with increased volumes of data</p> <p>Consistent basis on which MEL data is provided and consistent refresh rate.</p> <p>Refresh rate of 10 minutes or less will provide more reliable indication of headroom and response volume available, enabling response and reserve to be used from windfarms rather than curtailing wind and bringing on conventional plant.</p> <p>Functionally, for the SO options 2&amp;3 are identical.</p>	<p>Consistent basis on which Power Available signal is provided and consistent refresh rate.</p> <p>Refresh rate of 10 minutes or less will provide more reliable indication of headroom and response volume available , enabling response and reserve to be used from windfarms rather than curtailing wind and bringing on conventional plant.</p> <p>Functionally, for the SO options 2&amp;3 are identical.</p>

<p>For Consumers</p>	<p>Potentially lower BSUoS costs depending on how reliably the System Operator can calculate headroom and frequency response holding on wind farms. This would depend on the MEL update frequency and consistency across Generators.</p> <p>Improved security of supply due to improved visibility of headroom and response volumes.</p>	<p>Consistent basis of MEL submission and the frequency [10 minutes] of update would allow the System Operator to utilise response and reserve from more economical sources resulting in lower BSUoS costs than Option 1. Subject to data accuracy; if this is no better then outcome is same as option 1</p> <p>Improved security of supply due to improved visibility of headroom and response volumes.</p>	<p>Consistent basis of Power Available submission and the frequency [10 minutes] of update would allow the System Operator to utilise response and reserve from more economical sources resulting in lower BSUoS costs than Option 1. Subject to data accuracy; if this is no better then outcome is same as option 1. The availability aspect would be the same as included in MEL under Options 1 and 2.</p> <p>This may be a lower implementation cost than option 2, but is the subject of the consultation.</p>

Features	Option 1 Standardised MELs	Option 2 MEL Updated at Regular Intervals	Option 3 Power Available Signal to ENCC outside BM systems
<b>DISADVANTAGES</b>			
For intermittent Generators	<p>Would have to pay a share of increased balancing costs due to extra response and reserve holdings. Although this may be less than the status quo against relative wind volume.</p> <p>This assumes that the redefinition of MEL (resubmission rates and triggers) will not improve these matters because of the inconsistent refresh rates that could result.</p> <p>Reduced access to response and reserve markets unless SO confidence can be assured through improved accuracy.</p>	<p>Some operators would incur significant additional operational costs.</p> <p>Increased volume of MEL data could cause system issues</p> <p>Would have to pay a share of increased balancing costs due to extra response and reserve holdings. Although this may be less than the status quo against relative wind volume. [no different than option 1].</p> <p>Reduced access to response and reserve markets unless SO confidence can be assured through improved accuracy..</p>	<p>Some existing generators could incur costs making data available.</p>
For System Operator	<p>Inconsistent refresh rate for MEL submission farms may make operational decisions less efficient and may limit the provision of services from the most economic providers.</p> <p><i>If the frequency of update is longer than [10 minutes] and inconsistent between Generators, the reliability of any calculations for headroom and frequency response may be sub-optimal.</i></p> <p>Does not capture LEEMPS or Generators which</p>	<p>Significant increase in BM data could require system expansion.</p> <p>Does not capture LEEMPS or Generators which are not party to the wholesale electricity market.</p>	<p>Need to modify SCADA system to handle new data.</p> <p>Option 3 will capture LEEMPS (for new plant) as CC.6.4.4 states that operational metering from a LEEMPS station can be requested at the application stage if needed and the requirements of CC.6.5.6 then apply which includes the modified text for a PA signal.</p> <p>For non-BM Participants the operational metering requirements (ie CC.6.5.6) will apply if there is a contractual relationship and they are signatories to the Grid Code (ie SVA registered) but will not extend to those parties who have no contractual relationship with the SO (ie Small Embedded Power Stations).</p>

	are not party to the wholesale electricity market.		
For Consumers	<p>Increased costs due to extra balancing costs being passed through – relative to current penetration, not if GIP emerges.</p> <p>Reduced security of supply due to increased uncertainty in volume of response and headroom. – not if GIP emerges.</p>	<p>Additional costs passed on from those wind farms seeing higher operational costs. – relative to current penetration, not if GIP emerges</p> <p>Reduced security of supply due to increased uncertainty in volume of response and headroom – not if GIP emerges.</p>	<p>Costs incurred by some generators implementing change would be passed on to consumers. This would need to be weighed against the benefits.</p>

## 8 Power Available Signal

- 8.1 At the heart of both Standardisation of MEL and Power Available Data Feed to National Grid Control Centre options is the Power Available signal. Whilst the means of provision and the frequency of update may be different, the underlying nature of the signal is the same.
- 8.2 The mechanical power which can be extracted from a wind turbine is defined by equation (1):-

$$P = 0.5\rho AC_p(\lambda, \beta)v^3 \quad (1)$$

Where:-  
P = The power available from the turbine (Watts)  
 $\rho$  = The air density (Kg/m<sup>3</sup>)  
A = swept area (m<sup>2</sup>)  
C<sub>p</sub> = Power Extraction Coefficient which is dependant upon the tip speed ratio ( $\lambda$ ) and Blade Pitch Angle ( $\beta$ ).  
v = Wind Speed (m/s)

More generally, when the term power is plotted against wind speed, the graphical representation results as shown below.

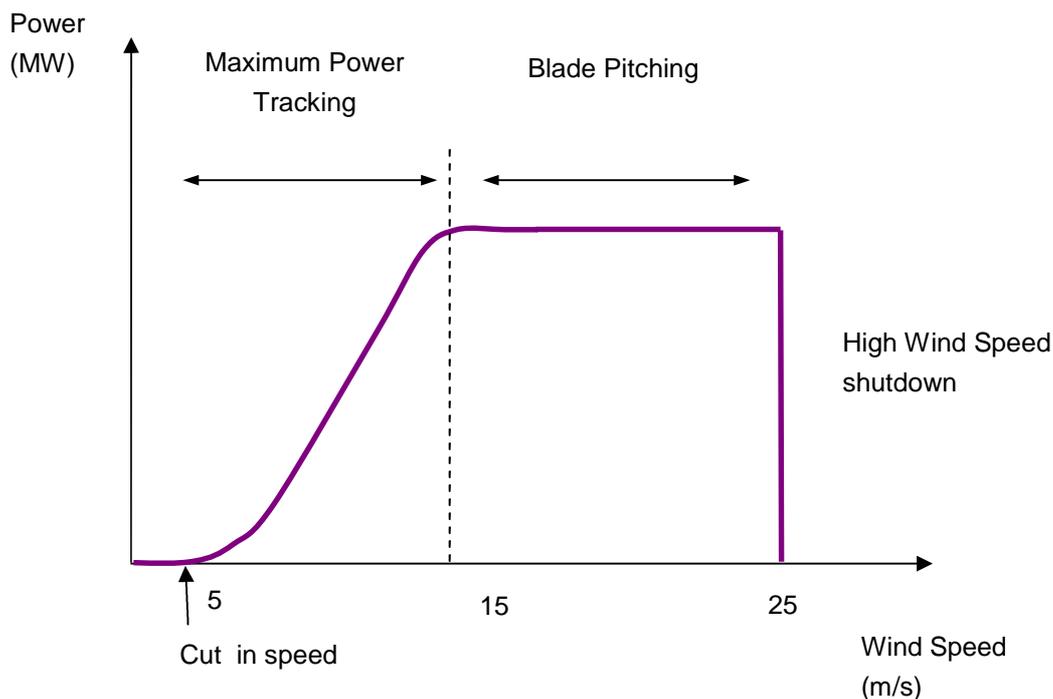


Figure 10: Wind Turbine Power / wind speed curve

- 8.3 Under Maximum Power Tracking mode the wind turbine is operating at peak output and effectively following equation (1). When the wind speed exceeds its rated value, typically between 11 – 14m/s (depending upon manufacturer and turbine type), blade pitching will be initiated which is required to prevent damage to the turbine structure and generator.
- 8.4 Since the wind speed across a wind farm site will vary significantly, and knowing that the power output is heavily influenced by the wind speed, the best way of determining the power output from the wind farm is to sum the individual output of each wind turbine.

- 8.5 Where there is no curtailment, each wind turbine will generate an output in proportion to the cube of the wind speed unless the turbine is operating beyond its rated value through operation of the pitching system. Under this mode of operation, the output from the wind farm should be equivalent to the available power from the wind farm.
- 8.6 Where however a wind farm is operating in a de-loaded mode, for example to provide low frequency response, each turbine will effectively be spilling wind, in which case PN and Power Available will not be the same. The process in which this is achieved and the actual recorded available power when each turbine is de-loaded is more complex to determine, largely as a result of the non linear behaviour of the turbines when they are not operated at peak output. Clearly this becomes an Intellectual Property (IP) issue for the turbine manufactures as there are a number of ways it can be achieved besides the accuracy to which such a signal can be determined.

### How should the Power Available signal be calculated?

- 8.7 The Workgroup considered how the signal should be calculated and whether a formulaic definition should be derived, whether a level of accuracy should be specified or other such method.
- 8.8 Information provided at the Workgroup suggests that most operators already have some form of power available signal or similar that is used for testing frequency response capability and to provide a similar signal to National Grid for operational metering purposes would not be too onerous.
- 8.9 However, it was noted that where a wind farm was operating to maximise its output (i.e. it was not de-loaded), the Power Available signal could have a small difference to the metered output because of the basis of the Power Available calculation.
- 8.10 Intellectual property issues were raised with the methods that different manufacturers use to convert raw data into power available. It was noted that these issues can be avoided if data aggregation and conversion into some form of power available signal is done by the wind farm, or at the wind farm control point, rather than by National Grid.
- 8.11 It was also noted for comparison that the Grid Code defines the PN as '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.'
- 8.12 The Workgroup considered that a similar obligation of best estimate commensurate with good industry practice taking into account prevailing wind speed, direction and number of turbines connected could provide sufficient accuracy without transgressing intellectual property issues or potentially introducing an unnecessary burden on wind farms with accuracy obligations. This later point was of particular concern for some Workgroup members who had cited examples of the Irish market requirements on accuracy.

## Accuracy required for the provision of data

8.13 The Grid Code defines the PN as ‘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**.’ It is envisaged that similar obligations would exist for the provision of a Power Available signal.

## How frequently should a signal be provided?

8.14 In assessing the frequency of updates from a potential Power Available signal, the Workgroup noted that it was worth calculating an optimal refresh period. For example, a second by second signal may not provide any additional benefit over a 5 minute signal. As a test of update frequency, actual output, MEL and PN at gate closure from a wind farm BMU, relating to a windy day in February 2013 is plotted below. A possible Dynamic MEL / Power Available signal has been drawn for illustrative purposes only as the value of metered output at the start of the 10 or 15 minute window. It is not intended to suggest that this should form the basis of the calculation of Dynamic MEL or Power Available. These graphs suggest that 10 minutes may be an appropriate refresh period. It was noted that 10 minute data frequencies are typical for SCADA data.

### 15 Minute Signal

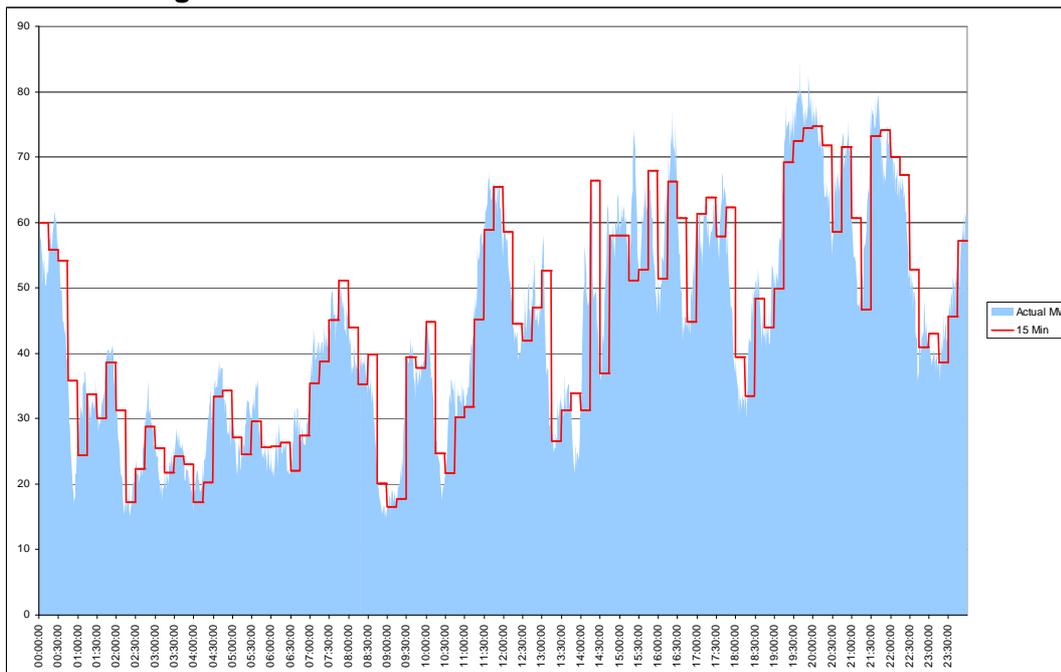
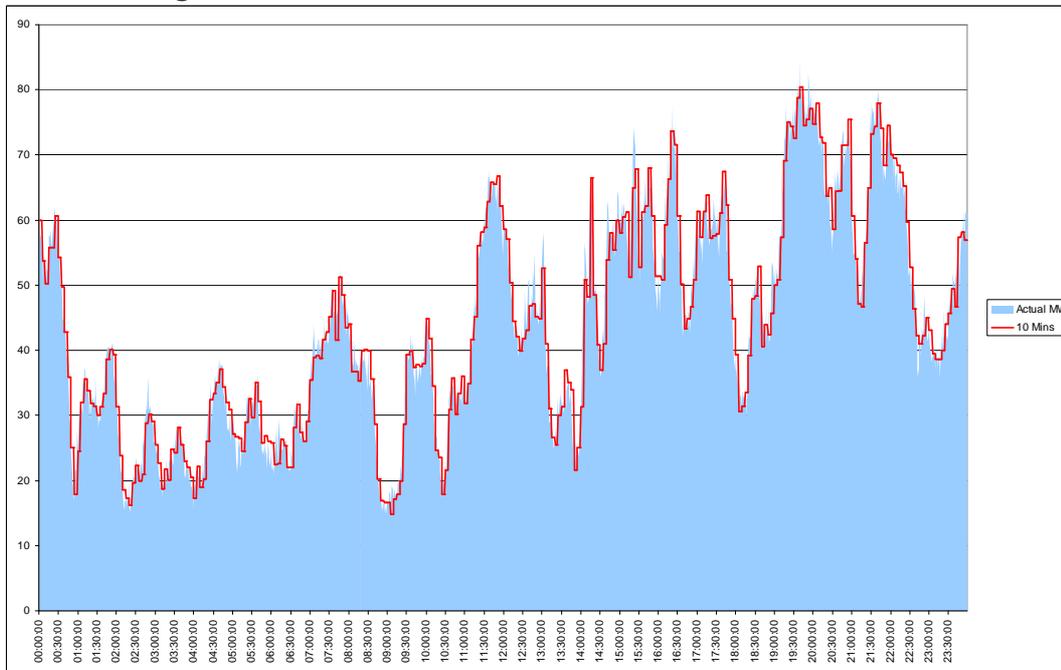


Figure 11: Wind metered output at 15 minute intervals compared with actual

## 10 Minute Signal



**Figure 12: Wind metered output at 10 minute intervals compared with actual**

8.15 During the Workgroup discussions, it has been highlighted that a MW Availability figure is required in Ireland to facilitate the market. It was agreed by the Workgroup that NGET's requirement for a dynamic MEL or power available signal would require a different calculation than the one required in Ireland for Settlement purposes. It was also pointed out that not all turbine manufacturers are currently active within the Irish Market.

8.16 Whilst this analysis suggests a 10 to 15 minute interval could achieve a good level of accuracy from a persistency perspective if, for example, the data was provided via the SCADA system, it may be more efficient to provide data at a refresh rate of 5 seconds as currently applied to wind speed and direction.

### Power Available under different scenarios

#### High wind speed shutdown

8.17 It is anticipated that as the power available signal would be calculated by the wind farm, it would take account of data from individual turbines as to whether they were shut down.

#### Turbine faults

8.18 The turbine is available if it is available to produce energy.

### Additional items of information which could be of benefit

8.19 The provision of wind speed, direction and MW data on an individual turbine basis could assist National Grid in developing more sophisticated wind power forecasting models, but the Workgroup agreed that this was not necessary to address the issues that the Power Available signal sought to address.

## Turbine capacity is greater than Transmission Entry Capacity (TEC)

8.20 The Power Available signal should reflect the action of any wind farm active power control excluding BOA action.

## 9 Impact Assessment

9.1 The Workgroup considered the areas that might be impacted by each of the two options under consideration.

- Code changes
- Wind Farm data management / SCADA configuration
- Impact on current data signals between Generation and System Operator
- Communications
- Operating Procedures
- Dispatch and control systems
- Settlement
- Testing, validation and compliance
- Regulatory Considerations
- Cost of implementation
- Retrospective Application

### Option 1 Impact (Standardisation of MEL)

#### Code changes

9.2 Grid Code BC1.A.1.3.1 will need to be modified to ensure a consistent definition of MEL. The Grid Code will also need to specify which forms of generation this would apply to and when it would become applicable. BC1.4 -Submission of Data would need to be reviewed.

9.3 The text required to give effect to the proposal is contained in Annex 2 of this document.

#### Wind Farm data management

9.4 A wind farm would need to produce a MEL based on wind speed and other parameters to calculate and submit a profile going forward. This may require a new process to be implemented if parties are not already doing so.

#### Communications

9.5 No additional communication channels would need to be established as existing arrangements could be used, however the volume and frequency of data may necessitate upgrades to current systems in order to transmit and process the data.

## Operating Procedures

- 9.6 If the MEL data provided is sufficiently robust, the System Operator would be able to enact procedures already established for existing generation with regard to frequency response and calculation of overall reserve.

## Dispatch and Control Systems

- 9.7 If the MEL data provided is sufficiently robust, no changes would be needed to dispatch and control systems. Data received could be used in a similar way to other forms of generation.

## Settlement

- 9.8 No changes would be needed to the settlement systems.

## Testing, validation and compliance

- 9.9 No additional validation is expected although the System Operator would monitor the performance of MEL data.

## Regulatory Considerations

- 9.10 Consideration would need to be given to whether there were sufficient benefits to justify different treatment for particular generators.

## Cost of Implementation

- 9.11 This is yet to be determined but the Workgroup will be seeking information through the proposed consultation on their recommendations.

## Option 2 Impact (Standardisation of MEL)

- 9.12 The workgroup noted that the impacts for option 2 were similar to option 1 however an update frequency of 10 minutes would have a greater impact on wind generator data management and therefore a more significant cost of implementation.

## Option 3 Impact (Power Available Signal via SCADA)

### Code changes

- 9.13 Grid Code BC1.A.1.3.1 will be modified to ensure a consistent definition of MEL. The Grid Code will also need to specify which forms of generation this would apply to, and when the requirement will be applicable. It is the intention for this modification to apply to new plant with completion dates from 1 April 2015, although it may be necessary to require some existing Generators to provide a Power Available signal where the need for this can be reasonably demonstrated due to a significant effect of upon the National Electricity Transmission System. BC1.4. -Submission of Data and CC.6.5.6 – Operational metering will also need to be reviewed.

## Transmission Licence Condition C16 changes (Procurement Guidelines and Balancing Principles Statement)

- 9.14 There may also be changes to Licence Condition C16 documents which would need to be reviewed.

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## Power Park Module data management

- 9.15 A Power Park Module would need to produce a MEL based on the wind turbines available. This will require a new process to be implemented.
- 9.16 A new Power Available signal would be required from the Power Park Module to the System Operator. Section 5.27 describes the existing requirement for a Power Available signal for the purposes of compliance testing. Initial investigations suggest that it is possible to route an additional Power Available signal into the suite of operational signals already provided to National Grid.

## Communications

- 9.17 If existing SCADA systems can be used to convey the Power Available signal, no additional communication links would need to be established, however the SCADA system would need to be amended to accommodate the Power Available signal. Data is currently communicated at 5 second intervals and so the addition of another data item is not thought to be onerous.

## Operating Procedures

- 9.18 The system operator would be able to enact procedures already established for existing generation with regard to frequency response and calculation of overall reserve.

## Dispatch and Control Systems

- 9.19 An additional, intermediate data processing step would need to be introduced to receive the Power Available signal and MEL data and subsequently create a profile that mimicked the MEL profile data received by other generation. This could then be used by existing dispatch and control systems.

## Settlement

- 9.20 No changes would be needed to the settlement systems

## Testing, validation and compliance

A testing and compliance process would need to be developed to ensure adherence to the Grid Code. It is anticipated that this could be combined with the current process for testing generator frequency response and reactive capability.

## Regulatory Considerations

- 9.21 Consideration would need to be given to the appropriateness of specific requirements on wind farms or other forms of generation where the primary fuel source cannot be controlled.

## Cost of Implementation

- 9.22 The Workgroup recognised that this was likely to be different for parties depending on the systems and processes adopted. The Workgroup believed that further information should be sought from the wider community in order to inform this assessment.

## 10 Implementation Considerations

10.1 The Workgroup considered the aspects of implementation should the proposals be taken forward.

- Retrospective application
- When should new requirements apply from
- Which generation should this apply to?
- Should other renewables be taken into account
- European Network Code implications
- Significant Code Review on Balancing

### Retrospective application

10.2 National Grid as the System Operator noted its preference for option 3; however, it noted that it was not the intent to apply the requirements retrospectively unless it could be reasonably demonstrated that such a Generator had a significant impact on the Transmission System and that in this case the costs associated with implementation and the benefits that would be achieved would need to be assessed.

10.3 It is acknowledged that both Option 1 and Option 2 would apply equally to new and existing generators from an agreed date post-implementation as they affect the way in which data is submitted to National Grid as part of the Balancing Mechanism. Option 3 however would only by default be applied to new Generators.

10.4 If National Grid identified a need to receive a Power Available signal from an existing Generator on the basis of Transmission System need, then this would have to be agreed bilaterally with the Generator. It was noted that the implementation of a Power Available signal was expected to be relatively inexpensive if implemented at the build stage however the costs of retrofitting such a signal would require further analysis.

### Application of Option 1 (Consistent MEL)

10.5 It was noted that in order to achieve a consistent MEL from wind farms this would need to apply to both existing and new wind farms. The requirement would apply from an agreed date.

### Application of Option 2 (Dynamic MEL)

- 10.6 It was noted that, in order to achieve a Dynamic MEL from wind farms, this would need to apply to both existing and new wind farms. The requirement would apply from an agreed date. However, some distinction could be made between obligations on existing and new generators (e.g. frequency of update)
- 10.7 It was noted that the implementation of a Dynamic MEL approach was expected to be relatively inexpensive if implemented at the build stage but that the cost of retrofitting such a signal would require further analysis. This would have a bearing on how and whether it was applied to existing generators.

### **Application of Power Available Signal via SCADA (Option 3)**

#### **MEL Data**

- 10.8 The MEL associated with a Power Available signal via SCADA option (option 3) represents the connected capacity applicable and would not need to be updated frequently. This may be implemented easily and therefore it may not be necessary to distinguish between existing and new wind farms as implementation may be low impact and therefore this could be uniformly applied to existing and new wind farms.

#### **Power Available Signal**

- 10.9 It was noted that the implementation of a Power Available signal was expected to be relatively inexpensive if implemented at the build stage, but that the cost of retrofitting such a signal would require further analysis. The cost of such a retrofit would have a bearing on whether it was considered appropriate to be applied to existing generators.
- 10.10 If a decision was taken to require a Power Available and there was a key business need to apply this to existing as well as to new wind farms, then this would need to be justified for the specific existing windfarms from which it was to be required. Such a decision would require further analysis.
- 10.11 It was noted that the benefits to a wind farm from Power Available may mean that wind farm operators may choose to apply power available to their wind farms in any event.

#### **When should new requirements apply from?**

- 10.12 This will depend on the adopted solution, whether the proposals will apply to existing as well as new windfarms and the consequential time required to implement relevant process and system changes. Further analysis is required however the likely time frame would be 12 to 24 months from any approval date to allow the necessary changes to be implemented.

#### **Which generation should this apply to?**

- 10.13 It is anticipated that the proposals would apply to those generators to which Grid Code BC1 and BC2 applies. These generators are currently required to submit MEL data. It was noted by the Workgroup that further information should be obtained to understand whether there were particular technology constraints in meeting any new obligations.

#### **Should other renewables be taken into account?**

- 10.14 Whilst the discussions to date have so far concentrated on the requirements from wind generation, consideration also needs to be given as to whether there is a need for a power available signal from other forms of generation.
- 10.15 For renewable sources of generation powered by a variable primary energy source, such as wave, tidal and solar, the Workgroup considered that they should be treated in the same way if they meet certain criteria e.g. size (either individually or in aggregation). For other forms of renewable generation such as hydro or cascade hydro and forms of generation with controllable fuel sources such as coal, oil, gas or nuclear the requirement for a Power Available signal is less clear cut, but would need to be supported by their ability to meet their declared PN's, be capable of achieving their declared MELs and demonstrated through past performance.

## International practice and approach taken in European Code development

10.16A presentation was given by a representative from the System Operator for Northern Ireland (SONI) who provided insight into how they manage wind generators through the use of a MW Availability signal. The definition of MW Availability is as follows:

*“The amount of Active Power that the Controllable WFPS could produce based on current wind conditions, network conditions and System conditions. The MW Availability shall only differ from the MW Output if the Controllable WFPS has been curtailed, constrained or is operating in a Curtailed Frequency Response mode, as instructed by SONI via the SCADA interface”*

10.17When a Power Park Module is constrained off (output 0MW) in the SONI and EirGrid regions they are considered as available and financial settlement is based on the active power the Power Park Module would have produced.

10.18In Northern Ireland, wind farms > 5MW are always in a frequency sensitive mode and will constantly modulate the active power in response to frequency changes. This can be run in 2 ways: With no curtailment (turbines free running) where high frequency response only is provided; or in MW curtailment mode when SONI will instruct the wind farm to run at a MW curtailment set point between 50% and 100% to provide both high and low frequency response (analogous to Frequency Sensitive Mode). The curtailment set point is set via an analogue input to the farm transmitted by SONI via SCADA.

10.19In summary the research and discussions held to date indicate that the requirement for a MW availability signal is based on the type of wholesale electricity market and the size of the power system. In GB for example where a forwards market is used (ie Generators and Suppliers strike contracts in advance and the System Operator simply balances the differences in real time – ie self despatch) certain information and data can be achieved through the signals of the wholesale market (ie PN's and MEL).

10.20On the other hand a number of other markets use the “Pool” type system in which Generation is scheduled at the day ahead stage on the basis of the total system demand and Transmission System Constraints. On this basis the requirements and operational metering signals required for managing wind generation are very different to that of the forwards market described above where trading position can be used to provide an indication of the Available Power.

10.21The size of the Power System, its interconnection with other nations and the plant mix all has an impact on the ability of an operator to manage wind generation. For example, Denmark was one of the first countries to embrace Wind Generation on a large scale against a comparatively modest demand. Owing to the large number of interconnectors to the wider European System and the large volume of hydro generation in Norway, integration of wind power into the Danish Power System has been possible. If these facilities had not been available, control of system frequency would have been more challenging.

## European Network Codes

- 10.22 As part of the Third Energy Package which became European Law in 2009, a new set of European Network Codes (ENCs) are being written with the intention of helping to meet the 3<sup>rd</sup> package objectives of enabling single European energy markets for gas and electricity, promoting the connection of renewable energy sources and enhancing security of supply.
- 10.23 The ENC Requirements for Generators (RfG) was the first network code on electricity developed by ENTSO-E. It is also the first of the connection codes (the others being the Demand Connection and HVDC codes) which together set out the technical requirements upon parties connecting to the transmission and distribution systems. The RfG code is seen as one of the main drivers for creating harmonized solutions and products necessary for an efficient pan-European (and global) market in generator technology. The purpose of the code is to bring forward a set of coherent requirements in order to meet these challenges of the future and to help provide crucial tools for all network operators to plan and operate the system against the background of a rapidly changing energy mix, while delivering security of supply for consumers.
- 10.24 The European Commission anticipate taking the code through the process of comitology and writing it into European Law during 2014. The code sets out that it is to apply to all new generators, defined as those which are not connected to the system 2 years after its entry into force (so probably during 2016) and for projects under construction that have at this point also not let contracts for major plant items. All parties will be required to comply with the code by 3 years after its entry into force.
- 10.25 So far as RfG is concerned, the issue of Power Available is not mentioned however this would not preclude a Power Available signal from being specified at National level as the current draft dated March 2013, Article 9 (4) (d) states "With regard to information exchange: 1) Power Generating Facilities shall be capable of exchanging information between the Power Generating Facility Owner and the Relevant Network Operator and/or the relevant TSO in real time or periodically with time stamping as defined by the Relevant Network Operator and/or the Relevant TSO whilst respecting the provisions of Article 4(3). In addition, the ENTSO-E RfG Code states the Relevant Network Operator in coordination with the Relevant TSO shall define while respecting the provisions of Article 4(3) the contents of information exchanges and the precise list and time of data to be facilitated.

## Significant Code Review for Balancing

- 10.26 The Workgroup noted that a Significant Code Review (SCR) was being carried out by Ofgem in the area of Electricity Balancing. As this Workgroup had discussed issues which may be covered by the SCR such as PN accuracy for settlement, it was worth keeping abreast of such developments. For example, potential charges for information imbalance. However, the Workgroup recognised that the discussions around a Power Available signal should still continue in parallel whilst being mindful of the SCR to avoid any duplication of work.

## 11 Conclusions

- 11.1 The Workgroup concluded that there is a need to undertake a change to the Grid Code to allow the System Operator to have better visibility of the headroom available from intermittent generators that could then be used for the provision of reserve or frequency response services.
- 11.2 This will allow better market participation of renewable generators by allowing them to provide such ancillary services and would also enhance system security. As the generation portfolio connected to the system changes to include more intermittent generation this will be of increasing importance.
- 11.3 While this view was not unanimous, a majority of the Workgroup members including National Grid concluded that option 3 (the Power Available Data Feed to the National Grid Control Centre via SCADA data connections) would best address the deficiencies identified. The Workgroup recommends that, other than in exceptional circumstances, this option would only apply to New Generators with a Completion Date on or after 1 April 2015.
- 11.4 An associated issue is the accuracy of BOA settlement. The Workgroup agreed that any of the proposed solutions could be used to improve this. While the governance of BOA settlement would need to involve the BSC panel, it is the view of National Grid that the Grid Code changes described in this report could be effected prior to the finalisation of any attendant BSC modification.

## 12 Assessment

### Impact on the Grid Code

12.1 GC0063 requires amendments to the following parts of the Grid Code:

- (i) Option 1
  - Glossary & Definitions
  - Balancing Code 1
- (ii) Option 2
  - Glossary & Definitions
  - Balancing Code 1
- (iii) Option 3
  - Glossary & Definitions
  - Connection Conditions
  - Balancing Code 1

12.2 The text required to give effect to the proposal is contained in Annex 1 of this consultation.

### Impact on Grid Code Users

12.3 The impact of Grid Code Users is covered in detail in section 9.

### Impact on National Electricity Transmission System (NETS)

12.4 The proposed changes will allow the System Operator to more efficiently manage the electricity system by enabling the efficient use of wind farms in balancing the system. Specifically, this will enable efficient management of reserve and frequency response that is not viable with the current data flows.

### Impact on Greenhouse Gas emissions

12.5 The proposed modification will facilitate the efficient growth of renewable generation which will reduce greenhouse gas emissions from alternative forms of generation.

## Assessment against Grid Code Objectives

12.6 National Grid considers that the proposed changes would better facilitate the Grid Code objective:

- (i) to permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity;

*Enabling wind farms to provide Balancing Services (e.g. reserve, BOAs and frequency response) will permit a more efficient and economic transmission system by avoiding the necessity of taking actions on out of merit alternatives. The proposed changes will also allow the System Operator to utilise the most economic provider of Balancing Services given the prevailing system conditions.*

- (ii) to facilitate competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity);

*The proposed changes will facilitate competition by supporting the efficient growth of renewable generation to supply electricity to GB consumers by providing the System Operator with access to a wider range of providers for Balancing Services given the prevailing system conditions.*

- (iii) subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole; and

*The reasons outlined in (i) are also applicable to the whole electricity system.*

- (iv) to efficiently discharge the obligations imposed upon the licensee by this license and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency.

*The proposal is neutral on this objective.*

## Impact on core industry documents

12.7 The proposed modification does not impact on any core industry documents

## Impact on other industry documents

12.8 The proposed modification may have an impact on Mandatory Service Agreements that describe the frequency response capability of BMUs. The capability is determined by calculating the difference between operating point and MEL.

## Implementation

12.9 The Workgroup proposes that, should the proposals be taken forward, the proposed changes be implemented 10 business days after an Authority decision.

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## 13 Workgroup Consultation

13.1 This Industry Consultation is being held subsequent to a Workgroup Consultation that ended on 27<sup>th</sup> January 2014. Five responses were received, an overview of which is described in the table below. Full copies of each of the responses are included in annex 4.

Ref	Company	Supportive	Main Comments
CR-01	Scottish Power	Yes	<ul style="list-style-type: none"> <li>The Power Available proposals should only be progressed once the BSC arrangements have been put in place.</li> <li>No preference over the implementation options expressed – each could broadly deliver the benefits described.</li> <li>Some points of clarification on each of the options required.</li> </ul>
CR-02	DONG Energy UK Wind Power	Yes	<ul style="list-style-type: none"> <li>Any of the options will deliver benefits for Users and will result in more accurate data.</li> <li>Preference expressed for option 3 although benefits of either of options 1&amp;2 also recognised.</li> <li>Considers it appropriate to wait until the BSC Workgroup has concluded its review before implementation.</li> <li>Also considers that the use of balancing actions on intermittent generation in the future could be reviewed in either the BSC or a Cross Code working group.</li> </ul>

Ref	Company	Supportive	Main Comments
CR-03	RWE	Yes	<ul style="list-style-type: none"> <li>Option 3 is preferred as User systems are already largely in place and therefore this would provide the lowest cost option with the least User disruption.</li> <li>An associated change to the BSC arrangements is required to ensure that the GC0063 proposals better facilitate the Grid Code objectives.</li> <li>While any of the proposed solutions would provide the basis for more accurate BOA settlement, this is not a matter solely for BSC governance arrangements and defining the appropriate data to be used for both operational and settlement purposes can be done under Grid Code governance.</li> <li>Any of the proposed solutions need to ensure that the same data is used for BOA instruction and BOA settlement purposes rather than using PN data for BOA settlement.</li> <li>Therefore, the GC0063 proposals within the Grid code should be implemented only when corresponding BSC arrangements are concluded.</li> </ul>
CR-04	SSE Generation	Yes, broadly	<ul style="list-style-type: none"> <li>The proposed modification to the Grid Code could be carried out separately only where indicating headroom during a BOA to curtail a wind farm. For any other purpose a simultaneous change would be required with the BSC.</li> <li>Option 3 is preferred as if specified in the project design stage of new projects costs would be minimal and it best addresses the issue of confidence in the headroom available when a wind farm BMU is subject to BOA.</li> <li>If data accuracy under any of the options is not improved then replacing an inaccurate PN with an inaccurately derived PN doesn't make sense.</li> <li>Option 3 could be used for BOA settlement if the level of accuracy was subject to grid code compliance.</li> </ul>

Ref	Company	Supportive	Main Comments
CR-05	EON	Yes, broadly	<ul style="list-style-type: none"> <li>Any of the options could be taken forward independently of subsequent BSC changes.</li> <li>A consistent approach should be taken by all parties to calculating, and keeping up to date, MEL and PNs from Generators with an Intermittent Power Source and therefore Option 1 is supported. This is because in principle it sets the requirement for MEL to be calculated, submitted and updated on a consistent basis; also as it retains consistency of data items across all generation technology types.</li> <li>Option 2 is in practice similar to option 1. The SO has not sufficiently justified the need for an additional data item under option 3. It is also unclear how this data differs from the properly derived MEL under Option 1.</li> <li>The conclusion of the Workgroup to support option 3 was not unanimous and the benefits comparison table needs revision to ensure an even assessment of the options is enabled.</li> </ul>

### National Grid Comments on Responses

- 13.2 National Grid would like to thank all of the Workgroup respondents for their comments regarding GC0063 and their support during the Workgroup process.
- 13.3 The responses received are all broadly supportive of the need to improve the accuracy of PN data for intermittent generation via provision of a Power Available signal and from this to allow the System Operator to better assess the available headroom.
- 13.4 There is no consensus on the way forward; while a majority of respondents support option 3, the provision of a Power Available signal via SCADA, or have expressed no clear preference, EON support option 1 (standardisation of MEL) in the belief that this better achieves a more accurate and consistent calculation of MEL while not requiring any additional data items. RWE support option 3 as it would be the least cost option; SSE Generation also believe that this is the best option to take forward as it best addresses the requirements and is easy to achieve if specified in the project design phase.
- 13.5 All respondents agree that an associated change to the BSC is required. While EON believe that this can be taken forwards independently of Grid Code changes, and SSE believe that certain circumstances might allow this, National Grid notes that the other three respondents agree that any BSC changes should be concluded before any Grid Code change is implemented.

## 14 Consultation Responses

14.1 Views are invited upon the proposals outlined in this consultation, which should be received by 7<sup>th</sup> April 2014. A response proforma is available on the National Grid website at the following link:

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

Your formal responses may be emailed to:

[grid.code@nationalgrid.com](mailto:grid.code@nationalgrid.com)

14.2 Responses are invited to the following questions:

- (i) Do you support the proposed implementation approach of 10 business days following an Authority decision?
- (ii) Do you believe that GC0063 better facilitates the appropriate Grid Code objectives?
- (iii) Do you agree with the deficiencies identified? (i.e. lack of visibility of headroom for the purposes of holding reserve and frequency response when wind farms are curtailed and accuracy of PNs for the purposes of calculating BOA volumes)
- (iv) While this view was not unanimous, a majority of the respondents to the Workgroup consultation and National Grid concluded that the option as detailed in the report that will best address the deficiencies identified is:

**Option 3** - *Power Available Data via SCADA i.e. the submission of a Power Available signal as an operational metering signal which would be fed to the National Grid Control Centre via SCADA with the redefinition of MEL used to indicate electrically connected capacity.*

Do you have a view on this?

- (v) The Workgroup recommends that, other than in exceptional circumstances, this option would only apply to New Generators with a Completion Date on or after 1 April 2015. Do you have a view on this?
- (vi) The Workgroup report concludes that the proposed solution for operational data could equally apply to accurate BOA settlement if required, however this would need to be progressed through Balancing and Settlement Code governance arrangements if considered necessary by BSC parties. Do you have a view on whether the Power Available proposals within the Grid Code can be carried out separately, which is the view of National Grid and some of the previous respondents, or should they be progressed only when any BSC arrangements are concluded?

14.3 If you wish to submit a confidential response please note the following:

- (i) Information provided in response to this consultation will be published on National Grid's website unless the response is clearly marked "Private & Confidential", we will contact you to establish the extent of the confidentiality. A response marked "Private and Confidential" will be disclosed to the Authority in full but, unless agreed otherwise, will not be shared with the Grid Code Review Panel or the industry and may therefore not influence the debate to the same extent as a non confidential response.

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- (ii) Please note an automatic confidentiality disclaimer generated by your IT System will not, in itself, mean that your response is treated as if it had been marked "Private and Confidential".

## 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	National Grid
Robyn Jenkins	Technical Secretary	National Grid
Graham Stein	National Grid Representative	National Grid
Tony Johnson	National Grid Representative	National Grid
Steve Lam	National Grid Representative	National Grid
Andrew Kensley	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
  - Assess whether other renewables should be taken into account
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.

## Annex 2 - Proposed Legal Text

This section contains the proposed legal text to give effect to the Workgroup proposed three options. The proposed new text is in red and is based on Grid Code Issue 5 Revision 5.

### Option 1– Legal Text PA via Standardised MEL – Option 1

#### Glossary and Definitions

**Power Available** A value prepared in accordance with good industry practice, representing the instantaneous sum of the potential **Active Power** available from each individual **Power Park Unit** within the **BM Unit** calculated using any applicable combination of meteorological (including wind speed), electrical or mechanical data measured at each **Power Park Unit** at a specified time. **Power Available** shall be a value of between 0MW and **Registered Capacity** which is the sum of the potential **Active Power** available of each **Power Park Unit** within the **BM Unit**. A turbine that is not generating will be considered as not available.

#### Balancing Codes

##### BC1.A.1.3.1 Maximum Export Limit (MEL)

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 - taking all **Plant** and weather related conditions into account) to the **National Electricity Transmission System** at the **Grid Entry Point** or **Grid Supply Point**, as appropriate.

For a **Power Park Module** such as a wind farm, the Maximum Export Limit should reflect the maximum **Active Power** output from each **Power Park Module** based on a profile derived from **Power Available**. The availability of any **Power Park Unit** within a **BM Unit** shall be declared by the **Generator** under BC1.A.1.8.

**Option 2– Legal Text**  
**PA via Dynamic MEL – Option 2**

**Glossary and Definitions**

**Power Available** A value prepared in accordance with good industry practice, representing the instantaneous sum of the potential **Active Power** available from each individual **Power Park Unit** within the **BM Unit** calculated using any applicable combination of meteorological (including wind speed), electrical or mechanical data measured at each **Power Park Unit** at a specified time. **Power Available** shall be a value of between 0MW and **Registered Capacity** which is the sum of the potential **Active Power** available of each **Power Park Unit** within the **BM Unit**. A turbine that is not generating will be considered as not available.

**Balancing Codes**

BC1.A.1.3.1 Maximum Export Limit (MEL)

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 - taking all **Plant** and weather related conditions into account) to the **National Electricity Transmission System** at the **Grid Entry Point** or **Grid Supply Point**, as appropriate.

For a **Power Park Module** such as a wind farm, the Maximum Export Limit should reflect the maximum **Active Power** output from each **Power Park Module** based on a profile derived from **Power Available** which is updated at 10 minute time intervals. The availability of any **Power Park Unit** within a **BM Unit** shall be declared by the **Generator** under BC1.A.1.8.

**Option 3– Legal Text**  
**PA via SCADA, Redefined MEL – Option 3**

**SCADA Data**

**Glossary and Definitions**

**Power Available** A signal prepared in accordance with good industry practice, representing the instantaneous sum of the potential **Active Power** available from each individual **Power Park Unit** within the **Power Park Module** calculated using any applicable combination of meteorological (including wind speed), electrical or mechanical data measured at each **Power Park Unit** at a specified time. **Power Available** shall be a value between 0MW and **Registered Capacity** which is the sum of the potential **Active Power** available of each **Power Park Unit** within the **Power Park Module**. A turbine that is not generating will be considered as not available. For the avoidance of doubt, the **Power Available** signal would be the **Active Power** output that a **Power Park Module** could reasonably be expected to export at the **Grid Entry Point** or **User System Entry Point** taking all the above criteria into account including **Power Park Unit** constraints such as optimisation modes but would exclude a reduction in the **Active Power** export of the **Power Park Module** instructed by **NGET** (for example) for the purposes selecting a **Power Park Module** to operate in **Frequency Sensitive Mode** or when an **Emergency Instruction** has been issued.

**Headroom** The **Power Available** (in MW) less the actual **Active Power** exported from the **Power Park Module** (in MW).

**Connection Conditions**

CC.6.5.6 Operational Metering

CC.6.5.6 (d) In the case of a **Power Park Module**, ~~an~~ additional energy input signals (e.g. wind speed, and wind direction and **Power Available**) may be specified in the **Bilateral Agreement**. For **Power Park Modules** with a **Completion Date** on or after 1 April 2015, a **Power Available** signal may also be specified in the **Bilateral Agreement**. Where **NGET** can reasonably demonstrate that a **Power Park Module** with a **Completion Date** prior to the 1st April 2015 has a significant effect on the **National Electricity Transmission System**, a **Power Available** signal may be specified pursuant to the terms of the **Bilateral Agreement**. The signals ~~would~~ may be used to establish the potential level of energy input from the **Intermittent Power Source** for monitoring pursuant to CC.6.6.1 and **Ancillary Services** and will, in the case of a wind farm, be used to provide **NGET** with advanced warning of excess wind speed shutdown and to determine the level of **Headroom** available from **Power Park Modules** for the purposes of calculating response and reserve. For the avoidance of doubt, the **Power Available** signal would be automatically provided to **NGET** and represent the sum of the potential output of all available and operational **Power Park Units** within the **Power Park Module**. The refresh rate of the **Power Available** signal shall be specified in the **Bilateral Agreement**.

## Balancing Codes

### BC1.A.1.3.1 Maximum Export Limit (MEL)

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.

For a **Power Park Module** such as a wind farm, the Maximum Export Limit should reflect the maximum possible **Active Power** output from each **Power Park Module** consistent with the data submitted within the **Power Park Module Availability Matrix** as defined under BC.1.A.1.8. For the avoidance of doubt, in the case of a **Power Park Module** this would equate to the **Registered Capacity** less the unavailable **Power Park Units** within the **Power Park Module** and not include weather corrected MW output from each **Power Park Unit**.

**Extract from Bilateral Agreement**

Appendix F5 - Schedule 2

Site Specific Technical Conditions - Operational Metering (CC.6.5.6)

Description	Units	Type	Provided by	Notes
MW and MVA <sub>r</sub> for each Balancing Mechanism Unit and Station Supplies derived from Boundary Point Settlement Metering System	MW MVA <sub>r</sub>	Signals to have 0.5 second update rate or better and provide input to the Ancillary Services Monitoring equipment	User.	The functionality, performance, availability, accuracy, dependability, security, delivery point, protocol and repair times of the equipment generating and supplying the signals (ie the meters and communication links) shall be agreed with The Company at least 12 months before the Completion Date.  User to provide Single Line Diagram showing location of CT/VT equipment and nomenclature of HV Apparatus. The Company will use this information to notify the User of which HV circuit breaker and disconnecter positions (ie status indications) are required. The nomenclature of Users equipment should be in accordance with OC11 of the Grid Code.
Voltage for each generator bay connection to The Company [XXXX] kV substation.	kV	Signals to have 0.5 second update rate or better	User. Note the User shall also make this signal available at its own Control Point for responding to Voltage Control Instructions from The Company	
Frequency	Hz	Signals to have 0.5 second update rate or better and provide input to the Ancillary Services Monitoring equipment	User	
Generator circuit HV circuit breaker(s) and disconnecter(s) as agreed with The Company	Open / Closed Indication	Status Indication	User.	
Each User transformer Tap Position Indication (TPI) at the Grid Entry Point	TPI	Tap Position Indication	User.	
Representative wind speed and direction of each Power Park Module	m/s Degrees from North in a clockwise direction	Signals to have a 5 second update rate or better	User.	
Power Available	MW	Signals to have [5 second] update rate or better	User	

### Electronic Data Transfer (EDT)

CC.6.5.8 (a) of the Grid Code places an obligation on BM Participants to ensure appropriate electronic data communication facilities are in place to permit the submission of data required by the Grid Code to NGET for use in the Balancing Mechanism. The principle method by which this is achieved is through Electronic Data Transfer (EDT) which is specified in the Bilateral Connection Agreement and enables key settlement data to be submitted such as PN's and BOA's. For full details of EDT, additional information can be obtained from National Grid's website which is available at:-

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

### Electronic Data Logging (EDL)

CC.6.5.8 (b) of the Grid Code places an obligation on i) any User who intends to participate in the Balancing Mechanism or ii) any BM Participant who is required to provide all part 1 Ancillary Services specified in CC.8.1 of the Grid Code to have appropriate automatic logging devices installed at the Control Point of its BM Units to submit and receive instructions from NGET as required by the Grid Code. The principle method by which this is achieved is through Electronic Data Logging (EDL) which is specified in the Bilateral Connection Agreement and enables instructions to be issued from NGET to the Generator, for example BOA's or Ancillary Services Instructions. Equally the User will need to respond to instructions from NGET in addition to submitting dynamic parameters such as run up / run down rates or Maximum Import Limits (MIL) or Maximum Export Limits (MEL). For full details of EDL, additional information can be obtained from National Grid's website which is available at:-

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

### Supervisory Control and Data Acquisition (SCADA)

Supervisory Control and Data Acquisition (SCADA) is the principle way in which NGET receives operational metering data at its control centre for the purposes of operating the Transmission System in real time. In general, User's of the Transmission System will need to provide operational metering signals (in respect of their plant) in accordance with the terms of the Bilateral Agreement. For a wind farm this would include data such as MW's, MVAR's, voltage, tap position, wind speed and wind direction. These signals will then interface to the nearest Transmission substation from where the Transmission Owner will provide the SCADA outstation interface equipment. These operational metering signals, together with additional transmission system data signals are then routed back to the National Electricity Control Centre.

## Operational Metering Schedule

Appendix F5 - Schedule 2

Site Specific Technical Conditions - Operational Metering (CC.6.5.6)

Description	Units	Type	Provided by	Notes
MW and MVA <sub>r</sub> for each Balancing Mechanism Unit and Station Supplies derived from Boundary Point Settlement Metering System	MW MVA <sub>r</sub>	Signals to have 0.5 second update rate or better and provide input to the Ancillary Services Monitoring equipment	User.	The functionality, performance, availability, accuracy, dependability, security, delivery point, protocol and repair times of the equipment generating and supplying the signals (ie the meters and communication links) shall be agreed with The Company at least 12 months before the Completion Date.  User to provide Single Line Diagram showing location of CT/VT equipment and nomenclature of HV Apparatus. The Company will use this information to notify the User of which HV circuit breaker and disconnecter positions (ie status indications) are required. The nomenclature of Users equipment should be in accordance with OC11 of the Grid Code.
Voltage for each generator bay connection to The Company [XXXX] kV substation.	kV	Signals to have 0.5 second update rate or better	User. Note the User shall also make this signal available at its own Control Point for responding to Voltage Control Instructions from The Company	
Frequency	Hz	Signals to have 0.5 second update rate or better and provide input to the Ancillary Services Monitoring equipment	User	
Generator circuit HV circuit breaker(s) and disconnecter(s) as agreed with The Company	Open / Closed Indication	Status Indication	User.	
Each User transformer Tap Position Indication (TPI) at the Grid Entry Point	TPI	Tap Position Indication	User.	
Representative wind speed and direction of each Power Park Module	m/s Degrees from North in a clockwise direction	Signals to have a 5 second update rate or better	User.	

Note: For the avoidance of doubt the term 'Boundary Point Metering System' is that as defined in the Balancing and Settlement Code. In the event that any part of the User's Operational Metering equipment, including the communications links to The Company's [XXXX]kV substation fails, then the User will be required to repair such equipment within 5 working days of notification of the fault from The Company unless otherwise agreed. The User shall also provide facilities to allow The Company to monitor the health of the Operational Metering equipment up to the Grid Entry Point

## CR-01 ScottishPower

### Grid Code Workgroup Consultation Response Proforma

#### GC0063 Power Available

Industry parties are invited to respond to this consultation expressing their views and supplying the rationale for those views, particularly in respect of any specific questions detailed below.

Please send your responses by 27<sup>th</sup> January 2014 to [Grid.Code@nationalgrid.com](mailto:Grid.Code@nationalgrid.com). Please note that any responses received after the deadline or sent to a different email address may not receive due consideration.

<b>Respondent:</b>	<i>Simon Reid, <a href="mailto:simonreid@scottishpower.com">simonreid@scottishpower.com</a> +44 7702 664 236</i>
<b>Company Name:</b>	<i>ScottishPower</i>
<b>Do you support the proposed implementation approach of 10 business days following an Authority decision?</b>	
<b>Do you believe that GC0063 better facilitates the appropriate Grid Code objectives?</b>	<p>Yes</p> <p><i>For reference the applicable Grid Code objectives are:</i></p> <p><i>(i) to permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity;</i></p> <p><i>(ii) to facilitate competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity);</i></p> <p><i>(iii) subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole; and</i></p> <p><i>(iv) to efficiently discharge the obligations imposed upon the licensee by this license and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency.</i></p>

<p>Do you agree with the deficiencies identified?</p> <p>(I.e. lack of visibility of headroom for the purposes of holding reserve and frequency response when wind farms are curtailed and accuracy of PNs for the purposes of calculating BOA volumes)</p>	<p>Yes</p>
<p>Do you agree with the conclusions of the report that any of the proposed solutions (options 1, 2 &amp; 3) for operational data could equally apply to accurate BOA settlement if required, however this would need to be progressed through Balancing and Settlement Code governance arrangements if this was considered necessary by BSC parties?</p>	<p><i>Yes with appropriate industry consultation.</i></p>
<p>Do you have a view on whether the Power Available proposals within the Grid Code can be carried out separately or should be progressed only when any BSC arrangements are concluded?</p> <p><i>(Note that the SO believes that these can be done separately if deemed appropriate, however a Workgroup consensus was not achieved on this point)</i></p>	<p><i>The power available proposals should only be progressed when BSC arrangements are in place.</i></p>
<p>Of the three options outlined again below and detailed in the Workgroup report, which do you think best addresses the deficiencies identified, considering both mitigation of these and implementation?</p> <p>Can you give reasons for your preference?</p> <p>Option 1 - Standardisation of MEL which would require a value that would be expected to vary with forecast wind output, where the update frequency was a variable to be determined by the User;</p> <p>Option 2 - Dynamic MEL (Power Available used to calculate MEL), with an update frequency of [10</p>	<p><i>All options address the deficiency identified through a combination of cost, ease of implementation, transparency and overall benefits.</i></p> <p><i>Option 1 I believe that the SO will gain substantial benefits in terms of calculation of headroom from this option and that these may only be dampened by the refresh rate and triggers for resubmission being inconsistent.</i></p> <p><i>Option 2 requires an increase in data flows and the management of them, I do not know if this is significant. However the regularity may not bring any benefits in its own right. Confidence in Option 1 or 2 will be earned and cannot be taken for granted.</i></p>

<p>minutes); and</p> <p><b>Option 3 - Power Available Data via SCADA</b> i.e. the submission of a Power Available signal as an operational metering signal which would be fed to the National Grid Control Centre via SCADA with the redefinition of MEL used to indicate electrically connected capacity.</p>	<p><i>Option 3 With Option 3 it is not clear reading the legal text how distribution or transmission constraints would be factored into the calculation of Power Available using the availability of the individual turbines? Would an alternative IT platform like Tib Messaging or something else rather than from SCADA system be a choice for this option?</i></p>
<p><b>For Option 1: (Standardisation of MEL option)</b></p> <ul style="list-style-type: none"> <li>• What costs do you envisage this imposing?</li> <li>• Can you provide an indication of the steps and costs needed to apply this option? If necessary, indicate whether this is site/asset age specific.</li> <li>• What process do you envisage to implement this option? For example, how frequently would MEL be updated, or what would initiate a Generator to update?</li> </ul>	<p><i>No costs information available at this time.</i></p>
<p><b>For Option 2: (Dynamic MEL option)</b></p> <ul style="list-style-type: none"> <li>• What costs do you envisage this imposing?</li> <li>• Can you provide an indication of the steps and costs needed to apply? If necessary, indicate whether this is site/asset age specific.</li> <li>• What frequency of update would you consider to be appropriate?</li> </ul>	<p><i>No costs information available at this time.</i></p> <p><i>Frequency of update appears from the consultation information to be appropriate at 10 minutes.</i></p>
<p><b>For the SCADA based option 3:</b></p> <ul style="list-style-type: none"> <li>• What costs do you envisage this imposing?</li> <li>• Can you provide an indication of the steps and costs needed to apply? If necessary, indicate whether this is site/asset age specific.</li> <li>• What frequency of update do you think appropriate given the existing SCADA data flow update to the system operator and the report assessment of a 10 minute data update frequency?</li> </ul>	<p><i>No costs information available at this time.</i></p> <p><i>Frequency of update appears from the consultation information to be appropriate at 10 minutes.</i></p>

<ul style="list-style-type: none"> <li>• Can you provide an indication of the steps and costs needed to apply a retrospective Power Available signal via SCADA and the costs that this might involve? If necessary, indicate whether this is site/asset specific?</li> </ul>	<p><i>This would need to be considered in light of specific individual site costs and benefits derived</i></p>
<p>Do you agree with the benefits proposed below?</p> <p>Do they apply equally (or at all) to each option? If not, please elaborate.</p> <p><b>Proposed Benefits</b></p> <p>At a high level, the proposals discussed as part of this Power Available Workgroup would help to facilitate:</p> <ul style="list-style-type: none"> <li>• The efficient integration, participation and operation of renewable generation into the energy market;</li> <li>• The opportunity for renewable generation to earn additional revenues from the provision of Balancing Services, for example reserve, Bid Offer Acceptances (BOAs) and frequency response;</li> <li>• Reduction in the need to take actions from out of merit alternatives;</li> <li>• Enhanced system security by providing more options for the provision of balancing services, particularly in regions where less generation with controllable fuel sources is available;</li> <li>• Improved system resilience as penetration of renewable generation increases and therefore capacity for renewable generation; and.</li> <li>• More efficient operation of the system allowing all BSUoS payers to benefit from reduced costs of the balancing mechanism.</li> </ul>	<p><i>Yes, as a broad statement, all of the options could deliver benefits in the areas stated.</i></p> <p><i>It is the responsibility is on the SO to utilise the additional information as designed.</i></p>

Do you have any additional comments?	<a href="#">None at this time</a>
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**Grid Code Workgroup Consultation Response Proforma**

**GC0063 Power Available**

Industry parties are invited to respond to this consultation expressing their views and supplying the rationale for those views, particularly in respect of any specific questions detailed below.

Please send your responses by 27<sup>th</sup> January 2014 to [Grid.Code@nationalgrid.com](mailto:Grid.Code@nationalgrid.com). Please note that any responses received after the deadline or sent to a different email address may not receive due consideration.

<b>Respondent:</b>	<i>Hannah McKinney 07818654037</i>
<b>Company Name:</b>	<i>DONG Energy UK Wind Power</i>
<b>Do you support the proposed implementation approach of 10 business days following an Authority decision?</b>	<i>For DONG Energy this timeframe would seem achievable on initial assessment. However, we would reserve the right to reconsider this aspect following more detailed analysis of the costs and the implementation practicalities involved (this is currently underway).</i>
<b>Do you believe that GC0063 better facilitates the appropriate Grid Code objectives?</b>	<i>For reference the applicable Grid Code objectives are:  (I) to permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity; We support National Grid's comments as described in the consultation.  (II) to facilitate competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity); We support National Grid's comments as described in the consultation.  (III) subject to sub-paragraphs (I) and (II), to promote the security and efficiency of the electricity generation, transmission and distribution systems.</i>

	<p>In the national electricity transmission system operator area taken as a whole; and We support National Grid's comments as described in the consultation.</p> <p>(iv) to efficiently discharge the obligations imposed upon the licensee by this license and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency. We support National Grid's comments as described in the consultation.</p>
<p><b>Do you agree with the deficiencies identified?</b></p> <p><b>(I.e. lack of visibility of headroom for the purposes of holding reserve and frequency response when wind farms are curtailed and accuracy of PNs for the purposes of calculating BOA volumes)</b></p>	<p>Overall we agree with the deficiencies identified. Firstly, this is on the basis of gaining a more accurate view of MEL, whether this is achieved via a standardisation methodology, as per Option 1 or Option 2, or an explicit Power Available signal direct to NGET; as per Option 3. Either of these would appear to be an improvement on the current situation.</p> <p>A secondary benefit of this would be the potential for more accurate forecasting of operational data such as PNs. Although PN accuracy is perhaps subordinate here, the historical mean PN following error for wind BMUs of 15.9% clearly demonstrates a need for assessment of potential measures for improvement.</p> <p>Please see related comments in this respect under the following two questions.</p>
<p><b>Do you agree with the conclusions of the report that any of the proposed solutions (options 1, 2 &amp; 3) for operational data could equally apply to accurate BOA settlement if required, however this would need to be progressed through Balancing and Settlement Code governance arrangements if this was considered necessary by BSC parties?</b></p>	<p>As above, we agree that a subsidiary impact of the proposed solutions could result in more accurate operational data such as PNs. This should in turn facilitate more accurate BOA settlement and minimise the potential of under or over payment for balancing actions undertaken by intermittent generators.</p> <p>Assuming, as suggested, that the System Operator will increase its use of balancing actions on intermittent generation in the future, and importantly, the implications this may have for PPAs, it would seem appropriate for this to be reviewed via the BSC or a Cross Code working group.</p>

	<i>Please see related comments below.</i>
<p>Do you have a view on whether the Power Available proposals within the Grid Code can be carried out separately or should be progressed only when any BSC arrangements are concluded?</p> <p><i>[Note that the SO believes that these can be done separately if deemed appropriate, however a Workgroup consensus was not achieved on this point]</i></p>	<p><i>We believe it would seem appropriate to wait until the BSC workgroup has concluded its review. This is because operational data and settlement data is inevitably linked and this proposal seeks to introduce new data utilised in balancing actions. Another option may be to run this proposal (as much as can be e.g., leaving out settlement considerations) in parallel to the BSC. Either option should fully consider the implications for those wind projects that have PPAs in place.</i></p>
<p>Of the three options outlined again below and detailed in the Workgroup report, which do you think best addresses the deficiencies identified, considering both mitigation of these and implementation?</p> <p>Can you give reasons for your preference?</p> <p>Option 1 - Standardisation of MEL which would require a value that would be expected to vary with forecast wind output, where the update frequency was a variable to be determined by the User;</p> <p>Option 2 - Dynamic MEL (Power Available used to calculate MEL), with an update frequency of [10 minutes]; and</p> <p>Option 3 - Power Available Data via SCADA i.e. the submission of a Power Available signal as an operational metering signal which would be fed to the National Grid Control Centre via SCADA with the redefinition of MEL used to indicate electrically connected capacity.</p>	<p><i>From a small wind farm operator perspective Option 1 as it is currently proposed would seem to best address the deficiencies identified because it appears the most flexible of the options for generators. It allows the provision of MEL updates to be re-submitted manually as and when appropriate. This flexibility could therefore meet the needs of different sized wind farms. It also doesn't restrict the number of updates such that this can be at the discretion or capability/need of the individual wind farm.</i></p> <p><i>However, we do recognise that Option 1 does not explicitly obligate generators to consider resubmitting their MEL at certain intervals following a change in forecast output. We do believe there should be such a requirement which could take the following form. For example, the wind generator would be obligated to consider resubmitting their MELs at a defined minimum interval but no requirement to update/refresh if there is no significant change to the output in line with good industry practice. We believe this could provide a figure which is sufficiently robust to be reliable but not overly burdensome.</i></p> <p><i>In terms of the costs of implementation we believe that option 1 would appear not to impose disproportionate costs on those smaller wind farm operators whilst providing or allowing larger wind operators to update and/or install automated systems.</i></p> <p><i>For DONG Energy specifically, Option 3 would be the option we would support as this both addresses the deficiencies identified (as noted above) and doesn't appear (based on initial review) to impose</i></p>

	<p>additional costs or systems necessarily. This is on the basis that we would seek to integrate this with the existing data-exchange services between us and the SO for example. Therefore, we believe this should be reasonably straightforward - please also see our comments to question 9.</p> <p>We would however, reserve the right to reconsider this aspect following more detailed analysis of the costs involved (this is currently underway).</p>
<p>For Option 1: (Standardisation of MEL option)</p> <ul style="list-style-type: none"> <li>• What costs do you envisage this imposing?</li> <li>• Can you provide an indication of the steps and costs needed to apply this option? If necessary, indicate whether this is site/asset age specific.</li> <li>• What process do you envisage to implement this option? For example, how frequently would MEL be updated, or what would initiate a Generator to update?</li> </ul>	
<p>For Option 2: (Dynamic MEL option)</p> <ul style="list-style-type: none"> <li>• What costs do you envisage this imposing?</li> <li>• Can you provide an indication of the steps and costs needed to apply? If necessary, indicate whether this is site/asset age specific.</li> <li>• What frequency of update would you consider to be appropriate?</li> </ul>	
<p>For the SCADA based option 3:</p> <ul style="list-style-type: none"> <li>• What costs do you envisage this imposing?</li> <li>• Can you provide an indication of the steps and costs needed to apply? If necessary, indicate whether this is site/asset age specific.</li> <li>• What frequency of update do you think appropriate given the existing SCADA data flow update to the system operator and the report</li> </ul>	<p><i>DONG Energy has in principle an Available Power Estimator (APE) Signal from Siemens on all running turbines. The tag is calculated on a running basis and could be made available on the OPC data stream from the park plot. The quality of the signal is currently not fully understood but on recent park evaluations (Anholt) we found a very good performance of ~2-5% error on average.</i></p> <p><i>Currently, for our Danish operations, we are required to deliver APE once a day with 5min resolution to the TSO. The delivery of the signal</i></p>

<p>assessment of a 10 minute data update frequency?</p> <ul style="list-style-type: none"> <li>• Can you provide an indication of the steps and costs needed to apply a retrospective Power Available signal via SCADA and the costs that this might involve? If necessary, indicate whether this is site/asset specific?</li> </ul>	<p>could be done more frequently as we already exchange data with the TSO providing direct access to the park pilot OPC data and the data exchanges every 5 minute. The typical park pilots logs data every 10minute. However, the APE signal is currently not logged in the 10min scada system across all software versions.</p> <p>On the basis of the above and in particular the level of data accuracy currently we can provide this in the UK.</p> <p>To minimize cost related to exchange this should be integrated with an existing data-exchange services between us as a generator and SO, therefore the system the OFTO SCADA system would require reconfiguring to pick up the online signal and integrate into the applicable real-time system.</p> <p>Post appropriate tag identification it is estimated (very approx.) that 10-15hrs of IT from Siemens would be required per site/asset to secure the APE signal into the OPC stream of the real-time operation system. We currently do not have a quotes for this work from Siemens - therefore cost information TBC.</p> <p>Please note that this is our high level preliminary assessment and we are currently collating more detail in terms of costs and implementation considerations for the UK. We therefore reserve the right to reconsider this aspect following more detailed analysis of the costs involved and will provide this to you when complete.</p>
<p>Do you agree with the benefits proposed below?</p> <p>Do they apply equally (or at all) to each option? If not, please elaborate.</p> <p><u>Proposed Benefits</u></p> <p>At a high level, the proposals discussed as part of this Power Available Workgroup would help to facilitate:</p> <ul style="list-style-type: none"> <li>• The efficient integration,</li> </ul>	<p>This benefit could be achieved under all options assuming the redefinition of MEL, including refresh</p>

<p>participation and operation of renewable generation into the energy market;</p> <ul style="list-style-type: none"> <li>▪ The opportunity for renewable generation to earn additional revenues from the provision of Balancing Services, for example reserve, Bid Offer Acceptances (BOAs) and frequency response;</li> <li>▪ Reduction in the need to take actions from out of merit alternatives;</li> <li>▪ Enhanced system security by providing more options for the provision of balancing services, particularly in regions where less generation with controllable fuel sources is available;</li> <li>▪ Improved system resilience as penetration of renewable generation increases and therefore capacity for renewable generation; and</li> <li>▪ More efficient operation of the system allowing all BSUoS payers to benefit from reduced costs of the balancing mechanism.</li> </ul>	<p><i>Interval rates, provide a sufficiently robust signal and information to the System Operator.</i></p> <p><i>As above, the materiality of this opportunity will of course depend on the System Operator needs in terms of balancing actions over time, in particular utilising intermittent generation for reserve and frequency response in addition to managing specific system constraints, as per the current practice. Please see our related views in the 'Additional Comments' section below</i></p> <p><i>This benefit could be recognised under all options assuming the redefinition of MEL, including refresh interval rates, provide a sufficiently robust signal and information to the System Operator.</i></p> <p><i>As above. We note however, the lack of further information on this perceived benefit (and the others listed) means it is difficult to accurately assess and will rely mainly on the System Operator to feedback this information to industry. Please see our related views in the 'Additional Comments' section below</i></p> <p><i>As above</i></p> <p><i>As above</i></p>
<p><b>Do you have any additional comments?</b></p>	<p><i>It would be helpful to understand how the PA signals (revised MEL) and operational data such as forecast PNs would be utilised by the System Operator in terms of those decisions and actions taken in respect of the BM. For example, for frequency response and differences with actions taken for constraint management reasons.</i></p>

## Grid Code Workgroup Consultation Response Proforma

### GC0063 Power Available

Industry parties are invited to respond to this consultation expressing their views and supplying the rationale for those views, particularly in respect of any specific questions detailed below.

Please send your responses by **27<sup>th</sup> January 2014** to [Grid.Code@nationalgrid.com](mailto:Grid.Code@nationalgrid.com). Please note that any responses received after the deadline or sent to a different email address may not receive due consideration.

<b>Respondent:</b>	John Norbury Network Connections Manager RWE Supply & Trading GmbH Windmill Hill Business Park Whitehill Way Swindon SN5 6PB T +44 (0)1793 89 2667 M +44 (0)7795 354 382 <a href="mailto:john.norbury@rwe.com">john.norbury@rwe.com</a>
<b>Company Name:</b>	RWE group of UK companies, including RWE Npower plc, RWE Npower Renewables Limited and RWE Supply & Trading GmbH
<b>Do you support the proposed implementation approach of 10 business days following an Authority decision?</b>	We agree with the recommendation given in Paragraph 11.9 that the text of the Grid Code changes be implemented within 10 business days following an Authority decision. However our support for this is subject to the recommendation given in Paragraph 10.11 that the date of applicability will depend on the adopted solution and that the likely time frame would be 12 to 24 months.
<b>Do you believe that GC0063 better facilitates the appropriate Grid Code objectives?</b>	For reference the applicable Grid Code objectives are:  <i>(i) to permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity;</i>  <i>(ii) to facilitate competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity</i>

	<p><i>on terms which neither prevent nor restrict competition in the supply or generation of electricity;</i></p> <p><i>(ii) subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole; and</i></p> <p><i>(iv) to efficiently discharge the obligations imposed upon the licensee by this license and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency.</i></p> <p>In the absence of an associated change to the BSC arrangements we are not satisfied that the proposed change GC0063 better facilitates the Grid Code objectives.</p>
<p><b>Do you agree with the deficiencies identified?</b></p> <p><b>(Le. lack of visibility of headroom for the purposes of holding reserve and frequency response when wind farms are curtailed and accuracy of PNs for the purposes of calculating BOA volumes)</b></p>	<p>We agree with the deficiencies identified in Paragraph 6. We also consider that the inherent difficulty in achieving correlation between PN data and output generation (and not lack of "accuracy") for intermittent generation results in PN data, as treated under the Grid Code, that is not always likely to be fit for purpose in terms of the User Informing National Grid of predicted output and as a basis for BOA settlement.</p>
<p><b>Do you agree with the conclusions of the report that any of the proposed solutions (options 1, 2 &amp; 3) for operational data could equally apply to accurate BOA settlement if required, however this would need to be progressed through Balancing and Settlement Code governance arrangements if this was considered necessary by BSC parties?</b></p>	<p>We assume that this question refers to Paragraph 1.8 (Executive Summary) as we are unable to find reference to any conclusions in the report.</p> <p>This being the case, we agree that any of the proposed solutions would provide the basis for more accurate BOA settlement, to a greater or lesser extent. However, we do not necessarily consider that this is a matter solely for BSC governance arrangements. The identified deficiencies demonstrate that PN data is unlikely to be always fit for purpose in respect of intermittent generation and, as such, it is probably appropriate to identify and define the appropriate data to be used for both operational and settlement purposes under Grid Code governance.</p>
<p><b>Do you have a view on whether</b></p>	<p>We are concerned that all the proposed solutions</p>

<p><b>the Power Available proposals within the Grid Code can be carried out separately or should be progressed only when any BSC arrangements are concluded?</b></p> <p><i>[Note that the SO believes that these can be done separately if deemed appropriate, however a Workgroup consensus was not achieved on this point]</i></p>	<p>produce data to be used by National Grid for BOA instruction purposes whilst PN data continues to be used for BOA settlement purposes. We consider it essential that the same data is used for both purposes. Whilst we are unclear of the extent to which National Grid currently uses PN data for intermittent generation, it is difficult to understand how the preparation and treatment of PN data and efficiency of BOA payments under the BSC would improve should the use of PN data be further marginalised by National Grid.</p> <p>We are therefore of the view that the Power Available proposals within the Grid code should be implemented out only when corresponding BSC arrangements are concluded.</p>
<p><b>Of the three options outlined again below and detailed in the Workgroup report, which do you think best addresses the deficiencies identified, considering both mitigation of these and implementation?</b></p> <p><b>Can you give reasons for your preference?</b></p> <p><b>Option 1 - Standardisation of MEL</b> which would require a value that would be expected to vary with forecast wind output, where the update frequency was a variable to be determined by the User;</p> <p><b>Option 2 - Dynamic MEL (Power Available used to calculate MEL), with an update frequency of [10 minutes]; and</b></p> <p><b>Option 3 - Power Available Data via SCADA</b> i.e. the submission of a Power Available signal as an operational metering signal which would be fed to the National Grid Control Centre via SCADA with the redefinition of MEL used to indicate electrically connected capacity.</p>	<p>Of the three options proposed, we would prefer Option 3 – Power Available via SCADA. We note the current lack of clarity regarding weather correction of MEL data and welcome the proposal that the MEL submission represents the available capacity only.</p> <p>Compared to Options 1 and 2, User systems are already largely in place to provide the necessary data and therefore Option 3 would provide the lowest cost option with least User disruption.</p>
<p><b>For Option 1: (Standardisation of MEL option)</b></p> <ul style="list-style-type: none"> <li>• <b>What costs do you envisage this imposing?</b></li> <li>• <b>Can you provide an indication of the steps and costs needed to apply this option? If necessary,</b></li> </ul>	<p>Cost information not available at this time but expected to be greater than that for Option 3</p>

<p>Indicate whether this is site/asset age specific.</p> <ul style="list-style-type: none"> <li>• What process do you envisage to implement this option? For example, how frequently would MEL be updated, or what would initiate a Generator to update?</li> </ul>	
<p>For Option 2: (Dynamic MEL option)</p> <ul style="list-style-type: none"> <li>• What costs do you envisage this imposing?</li> <li>• Can you provide an indication of the steps and costs needed to apply? If necessary, indicate whether this is site/asset age specific.</li> <li>• What frequency of update would you consider to be appropriate?</li> </ul>	<p>Cost information not available at this time but expected to be significantly greater than that for Option 3</p>
<p>For the SCADA based option 3:</p> <ul style="list-style-type: none"> <li>• What costs do you envisage this imposing?</li> <li>• Can you provide an indication of the steps and costs needed to apply? If necessary, indicate whether this is site/asset age specific.</li> <li>• What frequency of update do you think appropriate given the existing SCADA data flow update to the system operator and the report assessment of a 10 minute data update frequency?</li> <li>• Can you provide an indication of the steps and costs needed to apply a retrospective Power Available signal via SCADA and the costs that this might involve? If necessary, indicate whether this is site/asset specific?</li> </ul>	<p>Cost information not available at this time but expected to be less than that for Option 1 or 2.</p>
<p>Do you agree with the benefits proposed below?</p> <p>Do they apply equally (or at all) to each option? If not, please elaborate.</p> <p><u>Proposed Benefits</u></p> <p>At a high level, the proposals</p>	<p>We agree that the identified benefits may be realised by the proposed change but any such benefits are likely to be offset by further inefficiencies created in the BOA payment mechanism, which would continue to be based on submitted PN data.</p>

<p>discussed as part of this Power Available Workgroup would help to facilitate:</p> <ul style="list-style-type: none"> <li>• The efficient integration, participation and operation of renewable generation into the energy market;</li> <li>• The opportunity for renewable generation to earn additional revenues from the provision of Balancing Services, for example reserve, Bid Offer Acceptances (BOAs) and frequency response;</li> <li>• Reduction in the need to take actions from out of merit alternatives;</li> <li>• Enhanced system security by providing more options for the provision of balancing services, particularly in regions where less generation with controllable fuel sources is available;</li> <li>• Improved system resilience as penetration of renewable generation increases and therefore capacity for renewable generation; and.</li> <li>• More efficient operation of the system allowing all BSUoS payers to benefit from reduced costs of the balancing mechanism.</li> </ul>	
<p><b>Do you have any additional comments?</b></p>	<p>It would be helpful to understand the current / potential usefulness within the balancing mechanism of PN and MEL data submitted for intermittent generation and whether the use of this data category is and is likely to remain fit for purpose with an increasing volume of intermittent generation. It would also be helpful to better understand National Grid's role in forecasting intermittent generation and whether a more formal role of central forecasting would provide a more efficient solution for the industry.</p>

**Grid Code Workgroup Consultation Response Proforma**

**GC0063 Power Available**

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<b>Respondent:</b>	Campbell McDonald, 01738 453424, 07767 852614, <a href="mailto:campbell.mcdonald@sse.com">campbell.mcdonald@sse.com</a>
<b>Company Name:</b>	SSE Generation Ltd, Keadby Generation Ltd, Medway Power Ltd, Uskmouth Power Company Ltd and SSE Renewable Holdings Ltd
<b>Do you support the proposed implementation approach of 10 business days following an Authority decision?</b>	No. With respect to Options 1 and 2 the required changes or additions to operational IT systems will take time to go through a change control processes. In that it will need time to specify, procure, implement and commission new or amended systems. Should this requirement be applied retrospectively, implementation time frame should be at least 12 months? With respect to Option 3 we consider this obligation should be applied to new generators connecting after a specified date, suggestion April 2015, allowing time to specify the new requirement in the turbine supply contract.
<b>Do you believe that GC0063 better facilitates the appropriate Grid Code objectives?</b>	<p>We believe that only part of the objective of GC 0063 better facilitates the grid code objectives improving the confidence of the System Operator in the headroom available to hold frequency response when wind farms are curtailed by the provision of the Power Available data should allow wind farms to compete in the frequency response market and balancing market thus subsequently improving the economics of the system operation and promoting the security of the system.</p> <p>We do not believe the objective to substitute Power Available for PNs for the purposes of calculating BOA volumes in GC0063 better facilitates Grid code objectives as it reduce the emphasis on accuracy of PN for operational purposes and introduces discrimination in market settlement for a group of generators.</p>

<p>Do you agree with the deficiencies identified?</p> <p>(Le. lack of visibility of headroom for the purposes of holding reserve and frequency response when wind farms are curtailed and accuracy of PNs for the purposes of calculating BOA volumes)</p>	<p>We agree with the identified deficiency relating to the lack of visibility of headroom from curtailed wind farms for the provision of holding reserve and frequency response. This deficiency impacts on the ability of wind farms BMUs to participant in these markets. We disagree with the identified deficiency relating to the accuracy of PNs for the purpose of calculating BOA volumes. The settlement process for all BMUs is based on the submitted PN. We do not agree that wind farm BMUs should be singled out when the accuracy of other BMUs such as Demand BMUs have similar challenges. The accuracy of the PN from wind farms due to the length of the gate closure period imposed contributes significantly to any inaccuracy.</p>
<p>Do you agree with the conclusions of the report that any of the proposed solutions (options 1, 2 &amp; 3) for operational data could equally apply to accurate BOA settlement if required, however this would need to be progressed through Balancing and Settlement Code governance arrangements if this was considered necessary by BSC parties?</p>	<p>No. We disagree with this conclusion. Data submitted as set out in Options 1 &amp; 2 will still be as inaccurate to a degree; therefore to replace an inaccurate PN with an inaccurately derived PN doesn't make sense. Settlement from periodic or 10 minute updates of MEL may not deliver perceived benefits. MEL updates as per Options 1 &amp; 2 will be required 24/7 only to be used very occasionally for settlement when the BMU is curtailed by BOA. We believe there are inherent problems with these options and considerable administrative burden to continually update MEL. No other BMU would have this cost and liability to constantly track an intermittent power source for settlement of BOA and in addition have the requirement to submit accurate PN for efficient operation of the NETS.</p> <p>Option 3 for the settlement of BOA could be used for BOA settlement if the level of accuracy was subject to grid code compliance. If not governed the level of accuracy is not guaranteed to be better than the PN submission. Similarly with Options 1 &amp; 2 the requirement to submit accurate PNs for the optimisation of the NETS would remain and using Power Available for settlement could detract from the requirement for PN accuracy.</p>
<p>Do you have a view on whether the Power Available proposals within the Grid Code can be carried out separately or should</p>	<p>The proposed power available modification to the Grid Code could be carried out separately only where they were to be used for the purpose of indicating headroom during a BOA to curtail a wind</p>

<p>be progressed only when any BSC arrangements are concluded?</p> <p><i>[Note that the SO believes that these can be done separately if deemed appropriate, however a Workgroup consensus was not achieved on this point]</i></p>	<p>farm.</p> <p>For any other purpose a simultaneous change would be required with the BSC.</p> <p>A change to the settlement of BOAs for wind farms to anything other than PN could be viewed as discriminatory. Especially we believe as the current BSC rules stand other generators would have BOAs settled to their PN even when their MEL was lower than PN.</p>
<p>Of the three options outlined again below and detailed in the Workgroup report, which do you think best addresses the deficiencies identified, considering both mitigation of these and implementation?</p> <p>Can you give reasons for your preference?</p> <p><b>Option 1</b> - Standardisation of MEL which would require a value that would be expected to vary with forecast wind output, where the update frequency was a variable to be determined by the User;</p> <p><b>Option 2</b> - Dynamic MEL (Power Available used to calculate MEL), with an update frequency of [10 minutes]; and</p> <p><b>Option 3</b> - Power Available Data via SCADA i.e. the submission of a Power Available signal as an operational metering signal which would be fed to the National Grid Control Centre via SCADA with the redefinition of MEL used to indicate electrically connected capacity.</p>	<p>We believe Option 3 best addresses the issue of confidence in the headroom available when a wind farm BMU is subject to BOA allowing the NETSO to commit to ancillary services provision from wind farms.</p> <p>The Available Power signal delivered via a Scada interface would allow the NETSO refer to data as and when they need it. The implementation of the Available Power signal requirement when included in the functional specification of a turbine supply contract would be relatively inexpensive and manageable. Existing Wind farm BMU operators could chose to implement Option 3 voluntarily where the cost and opportunity to participate in the reserve and frequency markets is acceptable. Full retrospective application of this requirement would be costly to generators.</p>
<p><b>For Option 1: (Standardisation of MEL option)</b></p> <ul style="list-style-type: none"> <li>• What costs do you envisage this imposing?</li> <li>• Can you provide an indication of the steps and costs needed to apply this option? If necessary, indicate whether this is site/asset age specific.</li> <li>• What process do you envisage to implement this option? For example, how frequently would MEL be updated, or what would</li> </ul>	<p>Costs would be incurred to develop a mechanism to provide the operator with the defined Available Power figure and significant resource cost of an operator to make the submissions via EDL or the cost of automating the EDL update process. If this is a manual import, there is risk of human error. There would be a cost associated with setting up a database along with the associated maintenance to automate the calculation.</p> <p>The frequency of MEL update would have to be a function of % change of previously submitted MEL; this may require updates very frequently in some</p>

<p>Initiate a Generator to update?</p>	<p>instances.</p>
<p><b>For Option 2: (Dynamic MEL option)</b></p> <ul style="list-style-type: none"> <li>• What costs do you envisage this imposing?</li> <li>• Can you provide an indication of the steps and costs needed to apply? If necessary, indicate whether this is site/asset age specific.</li> <li>• What frequency of update would you consider to be appropriate?</li> </ul>	<p>We believe an automated system would be required for every BMU to be in a position to provide the defined Available Power figure required to update MEL every ten minutes. Therefore this option may require additional hardware as well as software and timely to construct on existing and new projects alike. Training, maintenance and on going operation will need to be included in the costs. In some instances gathering the necessary information will be more challenging as the turbine manufactures SCADA systems are not developed to the same level, so the solution and associated costs would be very dependant of the turbine make and model.</p> <p>A dynamic MEL every ten minutes is harder to deliver as it requires a routine / data manipulation to generate a Power Available MEL. The Power Available MEL would be much more realistic than Option 1, as the information would be sampled every 10mins as opposed to 60-90mins. This option would if automated would remove the majority of risk associated with human error.</p> <p>The frequency of update required would need to be relative to a specified percentage change to the previous submission. Every ten minutes would be a practical position for an automated process but not for a manual update process.</p>
<p><b>For the SCADA based option 3:</b></p> <ul style="list-style-type: none"> <li>• What costs do you envisage this imposing?</li> <li>• Can you provide an indication of the steps and costs needed to apply? If necessary, indicate whether this is site/asset age specific.</li> <li>• What frequency of update do you think appropriate given the existing SCADA data flow update to the system operator and the report assessment of a 10 minute data update frequency?</li> <li>• Can you provide an indication of the steps and costs needed to apply a retrospective Power Available signal via SCADA and the costs that this might involve? If necessary,</li> </ul>	<p>The cost of Option 3 if specified in the project design stage of new projects would be minimal.</p> <p>Power Available via SCADA is believed to be the easiest option going forwards to implement on new projects. The normal sampling time for the SCADA would be 1min. The frequency of update should be the same as the rate specified for the other Scada signals required from a wind farm to avoid confusion and for ease of configuration.</p> <p>New projects it will be much easier to set-up the SCADA requirements to ensure the necessary information is collected. Retro-fitting onto an existing operational project would be exposed to the same challenges as identified for Option 2.</p> <p>Most, if not all turbine suppliers would have to reconfigure the Wind Farm Scada on existing wind farms to produce a signal to meet the definition specified in this proposal at a considerable cost. Any change to a wind farm control system need to</p>

<p>Indicate whether this is site/asset specific?</p>	<p>be carefully managed to ensure Grid Code compliance is not compromised.</p> <p>In Ireland to facilitate a change to the definition of Available Power, SSE agreed a contract with the turbine supplier to reconfigure the wind farm Scada, upgrade software and hardware to deliver the signal on 11 wind farms at a cost of £400K. The internal cost providing resource for testing and submission of data was other £250K.</p>
<p>Do you agree with the benefits proposed below?</p> <p>Do they apply equally (or at all) to each option? If not, please elaborate.</p> <p><u>Proposed Benefits</u></p> <p>At a high level, the proposals discussed as part of this Power Available Workgroup would help to facilitate:</p> <ul style="list-style-type: none"> <li>• The efficient integration, participation and operation of renewable generation into the energy market;</li> <li>• The opportunity for renewable generation to earn additional revenues from the provision of Balancing Services, for example reserve, Bid Offer Acceptances (BOAs) and frequency response;</li> <li>• Reduction in the need to take actions from out of merit alternatives;</li> <li>• Enhanced system security by providing more options for the provision of balancing services, particularly in regions where less generation with controllable fuel sources is available;</li> <li>• Improved system resilience as penetration of renewable generation increases and therefore capacity for renewable generation; and.</li> <li>• More efficient operation of the system allowing all BSUoS payers to benefit from reduced costs of the balancing mechanism.</li> </ul>	<p><i>No not all of them</i></p> <p>Yes if the NETSO use the information efficiently</p> <p>Yes, hopefully as long as the NETSO have a willingness to contract for time periods achievable by wind farm BMUs</p> <p>Yes, hopefully as long as the NETSO have a willingness to contract for time periods achievable by wind farm BMUs</p> <p>Yes</p> <p>Yes</p> <p>Yes in part, by allowing Wind Farms to access ancillary service markets not currently available to them</p> <p><i>No. the substitution of PN for Power available need</i></p>

	<i>to be considered by the BSC panel before any impact on BSUsS could be evaluated</i>
<b>Do you have any additional comments?</b>	SSE has indicated its preference for Option 3, however it should be noted that this is on the assumption that it is not a requirement to be applied to existing wind farms but instead for new connections after a certain date.

## Grid Code Workgroup Consultation Response Profoma

## GC0063 Power Available

Industry parties are invited to respond to this consultation expressing their views and supplying the rationale for those views, particularly in respect of any specific questions detailed below.

Please send your responses by 27<sup>th</sup> January 2014 to [Grid.Code@nationalgrid.com](mailto:Grid.Code@nationalgrid.com). Please note that any responses received after the deadline or sent to a different email address may not receive due consideration.

Respondent:	Guy Phillips ( <a href="mailto:guy.phillips@eon-uk.com">guy.phillips@eon-uk.com</a> )
Company Name:	E.ON UK plc
Do you support the proposed implementation approach of 10 business days following an Authority decision?	<i>With the exception of option 1, no. Option 1 can be implemented following 10 business days as it is limited to a change to the legal text of the Grid Code to improve the definition of the requirement. Option 2 involves an information systems lead time, to implement the automated update to MEL, which needs to be considered in more detail. In absence of a more defined requirement, we would suggest this would need to be at least two years following an Authority decision. Option 3 should only apply to generation contracting for its plant or connecting after a specified date. For both options 2 and 3 these aspects are not referenced in the draft legal text contained in the consultation document. If this was clarified in the draft legal text it may be possible to support an implementation approach of 10 business days following an Authority decision.</i>
Do you believe that GC0063 better facilitates the appropriate Grid Code objectives?	<i>We do not think it appropriate to reply to this question until a final recommendation on which option to take forward is made.</i>
Do you agree with the deficiencies identified?  (i.e. lack of visibility of headroom for the purposes of holding reserve and frequency response when wind farms are curtailed and accuracy of PNs for the purposes of calculating BOA volumes)	<i>In our view there is scope to improve the information provision to the system operator to enable it to better determine the available headroom for holding reserve and frequency response from wind farms. We also believe that there is scope to improve accuracy of PN submissions from wind farms.</i>
Do you agree with the conclusions of the report that any of the proposed solutions (options 1, 2 & 3) for operational data could equally apply to accurate BOA settlement if required, however this would need to be progressed through	<i>Options 1 and 2 may improve the current arrangements for BOA settlement through more consistent and accurate data, however it is not clear how any of the options in of themselves alter the way in which BOA volumes are calculated. Although there is a perceived issue with PN accuracy for the purpose of determining BOA</i>

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<p>Balancing and Settlement Code governance arrangements if this was considered necessary by BSC parties?</p>	<p>volumes we note that the working group has concluded that this is outside of its scope.</p>
<p>Do you have a view on whether the Power Available proposals within the Grid Code can be carried out separately or should be progressed only when any BSC arrangements are concluded?</p> <p><i>[Note that the SO believes that these can be done separately if deemed appropriate, however a Workgroup consensus was not achieved on this point]</i></p>	<p><i>In our view the Power Available proposals, whichever is selected, could be taken forward independently of any subsequent BSC change a Party may seek to bring forward.</i></p>
<p>Of the three options outlined again below and detailed in the Workgroup report, which do you think best addresses the deficiencies identified, considering both mitigation of these and implementation?</p> <p>Can you give reasons for your preference?</p> <p><b>Option 1 - Standardisation of MEL</b> which would require a value that would be expected to vary with forecast wind output, where the update frequency was a variable to be determined by the User;</p> <p><b>Option 2 - Dynamic MEL (Power Available used to calculate MEL),</b> with an update frequency of [10 minutes]; and</p> <p><b>Option 3 - Power Available Data via SCADA</b> i.e. the submission of a Power Available signal as an operational metering signal which would be fed to the National Grid Control Centre via SCADA with the redefinition of MEL used to indicate electrically connected capacity.</p>	<p><i>In our view the specific issues for the System Operator described in Chapter 4 of the consultation arise from different approaches taken by different parties to calculating, and keeping up to date, MEL and PN's from Generators with an Intermittent Power Source. If these data items were calculated and submitted on a consistent basis then the System Operator would have more confidence in the data to be able to better use it to address the specific issues it describes.</i></p> <p><i>We therefore support Option 1. This is because in principle its sets the requirement for MEL to be calculated, submitted and updated on a consistent basis by different Users. We also support this option as it retains consistency of data items across all generation technology types. Allied with a common understanding of Good Industry Practice in formulating and updating PN submissions to the System Operator, Option 1 should be given time to determine if it delivers improvements to the data submitted to the System Operator. The System Operator should consider managing individual parties that are outside the scope of the revised interpretation initially through bilateral meetings. This would be to educate parties on their obligations and requirements upon them. However if this does not lead to an improvement from an individual party the System Operator should consider options such as reporting to the regulator and naming and shaming consistent poor performance. Parties should then ultimately consider their wider Industry Code and regulatory rights and duties.</i></p> <p><i>We have discounted Option 2 as we do not see how an automated update differs from Option 1</i></p>

	<p>and that the generator is best placed to determine when MEL would need to be re-declared. It is also not clear under Option 2 what the requirements are, aside from the suggested persistence modelling, for revisions to MEL such that the data is taken forward from real time through the BM. We do not think that the case for Option 3 is sufficiently robust at this time. The System Operator has not been able to quantify or articulate the materiality of their specific issues to justify a new data item to be provided by Generators with an Intermittent Power Source. We are also not clear how the data under Option 3 differs from a properly derived MEL that Option 1 provides.</p>
<p>For Option 1: (Standardisation of MEL option)</p> <ul style="list-style-type: none"> <li>• What costs do you envisage this imposing?</li> <li>• Can you provide an indication of the steps and costs needed to apply this option? If necessary, indicate whether this is site/asset age specific.</li> <li>• What process do you envisage to implement this option? For example, how frequently would MEL be updated, or what would initiate a Generator to update?</li> </ul>	<p>We do not believe this option would impose any additional cost to us as we already take in to account the prevailing wind forecast and turbine availability when calculating MEL. It is possible that other parties may incur some costs in adding this data when formulating and updating their MEL submissions.</p>
<p>For Option 2: (Dynamic MEL option)</p> <ul style="list-style-type: none"> <li>• What costs do you envisage this imposing?</li> <li>• Can you provide an indication of the steps and costs needed to apply? If necessary, indicate whether this is site/asset age specific.</li> <li>• What frequency of update would you consider to be appropriate?</li> </ul>	<p>We would incur costs to add specific functionality to our IT infrastructure to process the required automated update. We are not in a position to confirm the specific cost and lead time to do this.</p>
<p>For the SCADA based option 3:</p> <ul style="list-style-type: none"> <li>• What costs do you envisage this imposing?</li> <li>• Can you provide an indication of the steps and costs needed to apply? If necessary, indicate whether this is site/asset age specific.</li> <li>• What frequency of update do you think appropriate given</li> </ul>	<p>We are not able to state the specific costs or lead times necessary to implement option 3. Much will depend on what additional cost OEM's will apply for this additional component and data item, alongside the communication infrastructure needed to send the data to the System Operator. In the case of existing sites, if this data item is not readily available then we would expect the implementation cost to increase further.</p>

<p>the existing SCADA data flow update to the system operator and the report assessment of a 10 minute data update frequency?</p> <ul style="list-style-type: none"> <li>• Can you provide an indication of the steps and costs needed to apply a retrospective Power Available signal via SCADA and the costs that this might involve? If necessary, indicate whether this is site/asset specific?</li> </ul>	
<p>Do you agree with the benefits proposed below?</p> <p>Do they apply equally (or at all) to each option? If not, please elaborate.</p> <p><u>Proposed Benefits</u></p> <p>At a high level, the proposals discussed as part of this Power Available Workgroup would help to facilitate:</p> <ul style="list-style-type: none"> <li>• The efficient integration, participation and operation of renewable generation into the energy market;</li> <li>• The opportunity for renewable generation to earn additional revenues from the provision of Balancing Services, for example reserve, Bid Offer Acceptances (BOAs) and frequency response;</li> <li>• Reduction in the need to take actions from out of merit alternatives;</li> <li>• Enhanced system security by providing more options for the provision of balancing services, particularly in regions where less generation with controllable fuel sources is available;</li> <li>• Improved system resilience as penetration of renewable generation increases and therefore capacity for renewable generation; and.</li> <li>• More efficient operation of the system allowing all BSUoS payers to benefit from reduced</li> </ul>	<p><i>At a high level yes, however we do not recognise many of the statements made when assessing the options in the table starting on page 29 of the consultation. Many of the statements and comparisons made are subjective and not supported by robust analysis. The comparison also leads the reader to believe that Option 3 is the best outcome, which, given the veracity of the statements made, is misleading and, in our view, incorrect. This has been constructed by the System Operator to support its conclusion. Given the timescales for working group members to discuss and review the document prior to publication the table has not been properly scrutinised.</i></p>

costs of the balancing mechanism.	
Do you have any additional comments?	We do not support the statement in paragraph 1.16 of the consultation. It is not correct to say that the working group concluded that option 3 would best address the deficiencies identified. As a member of the working group, I would highlight that this was not a unanimous view of the working group.