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Your Ref: CAP001

Our Ref : IND/COD/CUSC/001

Dear NGC, Connected Parties, Customers and Other Interested Parties

Amendment to the connection and use of system code (“CUSC”) - Decision and Direction in relation to Amendment Proposal CAP001: “Frequency Response Imbalance Payments”

The Gas and Electricity Markets Authority (the “Authority”) has carefully considered the issues raised in Amendment Proposal CAP001 “Frequency Response Imbalance Payments”.

The National Grid Company plc (“NGC”) has recommended to the Authority that CUSC Amendment Proposal CAP001 be approved and implemented with effect from the 21 September 2001.

The Authority has decided to direct a modification to the CUSC.

This letter explains the background to the Amendment Proposal and sets out the Authority's reasons for its decision. In addition, the letter contains a direction to NGC to amend the CUSC as set out in Amendment Proposal CAP001.

Background to the proposal

As part of the Grid Code¹, all Users are required to provide and must be capable of providing mandatory balancing services if the system is to operate safely and reliably. Mandatory balancing services require generators to provide frequency response² and reactive power³ to specified capabilities.

¹ Stated in Connection Condition 8.1 of the Grid Code.

² Frequency response is used to balance the continuously changing system frequency that is determined and controlled by the balance between system demand and total generation. National Grid has a statutory obligation to maintain system frequency within 1% of 50Hz.

Generators can become in a position of electricity imbalance (i.e. where the BSC Parties' notified generation/demand does not equal their actual generation/demand) when called upon by NGC to provide frequency response. Generators are compensated for the imbalance charges incurred under the Balancing and Settlement Code (BSC) when providing mandatory balancing services. The payment mechanisms for mandatory frequency response, with which the Amendment Proposal is concerned, were implemented at "Go-Live"⁴ and comprise three elements:

De-load payments via Bid/Offer Acceptance

De-load payments cover the costs of moving a generator away from its preferred output (the Final Physical Notification), in order for it to have sufficient room to hold frequency response. The payment mechanism is via Bid/Offer Acceptances in the Balancing Mechanism.

Holding payments to cover the cost of a generator holding frequency response

Holding payments cover the cost of providing frequency response and include throttling losses, loss of boiler efficiency (for steam plant) and additional works power. The payment mechanism is via Mandatory Services Agreements⁵ (MSA) and rates in £/MWh are contained in the MSA and paid based on the generating unit's capability.

Delivery or imbalance exposure payment

Delivery costs are incurred when the generating unit is selected for and provides frequency response. A fall in frequency results in a generating unit increasing power output and a rise in frequency results in a generating unit decreasing power output. The payment mechanism is intended to cover increased or decreased production costs as a result of frequency response. In addition, this payment is made to cover exposure to imbalance charges in the Balancing Mechanism arising from the provision of these services.

A number of frequency response providers expressed concerns that the level of imbalance compensation received by generators through the imbalance compensation payment mechanism introduced within the MSA at Go-Live did not always reflect the costs incurred

³ The requirement for reactive power is primarily driven by the interaction of real power flows on the transmission system with the complex impedances of the various elements that make up the network together with the demand at the lower voltage system interfaces. NGC is required to maintain the real and reactive power balances between sources of generation and points of demand. Without the appropriate injections of reactive power at correct locations, the voltage profile of the transmission system will exceed statutory planning and operational limits.

⁴ NETA commenced on the 27 March 2001.

⁵ These are supplemental to the CUSC and contain site specific terms for provision to NGC of mandatory ancillary services.

under the BSC in providing mandatory frequency response. In order to address these particular concerns an Amendment Proposal to the CUSC was required to revise the imbalance exposure element of the existing payment mechanism.

The CUSC was designated on 25 June 2001 and was due to come into effect on 18 July 2001. However, as a result of concerns raised by certain generators and following a consultation by the DTI, the relevant licence obligations were modified so as to delay the implementation of the CUSC until 18 September 2001.

In response to the concerns raised by market participants about the level of imbalance exposure payments and to enable an Amendment Proposal to modify the compensation payment mechanism for mandatory frequency response to be raised upon the implementation of the CUSC, a pre-CUSC Working Group (the "Group") was established by NGC with Ofgem's agreement. The Group reviewed and developed an Amendment Proposal to the CUSC to be tabled by NGC.

The Group highlighted five aspects of the existing arrangements in relation to the imbalance exposure payments that it believed could be amended to address the concerns raised by market participants.

The first area of the existing arrangements highlighted by the Group concerned the calculation of response energy. Under the present arrangements, response energy is calculated within a settlement period based on the net frequency deviation within that period. The Group accepted that this is satisfactory where the response capability for a given generator is broadly symmetrical for low and high frequency response. However, the Group was concerned that in situations where symmetry does not apply, the existing method can lead to providers being exposed to energy imbalance charges that are not adequately reflected in the payment mechanism in the MSA.

The second aspect of the existing arrangements identified by the Group deals with a further aspect of response energy calculation. The response energy calculation uses a simple linear interpolation of the response capability matrix⁶ value at a 0.5Hz frequency deviation. When establishing the current mechanism it was recognised that the simple straight-line interpolation underestimates the assumed response energy. In order to compensate for this, the mechanism includes adjustment factors to scale up the calculated response energy. The adjustment factors used are calculated for a typical response-providing generator, and as such are not reflective of each individual generating unit. The Group believed that using these adjustment factors leads to an over or under estimation of the response energy within the imbalance payment mechanism depending on the actual response characteristic of the individual generating unit and the actual frequency deviation.

⁶ A response capability matrix is defined in contracts within the MSA.

The third area focussed upon by the Group related to the calculation of response energy in relation to specific categories of mandatory response services. Mandatory response services can be split into Primary, Secondary and High Frequency Services. The distinction between these categories depends on the time in which the frequency response will be available after an event and for how long it can be sustained. Primary Response is defined as additional active power that will be available 10 seconds after an event and can be sustained for a further 20 seconds. Secondary Response is defined as additional active power that will be available 30 seconds after an event and can be sustained for a further 30 minutes. High Frequency Response is defined as the reduction in active power that will be available 10 seconds after an event and can be sustained thereafter.

The imbalance calculation mechanism uses the values of Primary and High Frequency Response capability contained within the response capability matrix to calculate the volume of response energy. These values reflect the power delivered in response to a change in system frequency within 10 seconds from the time of the frequency deviation. The Group was concerned that while this may be appropriate when a generating unit is selected for Primary and High Frequency Response, this method can considerably underestimate the level of response energy provided when the generating unit is selected for Primary, Secondary and High Frequency Response.

The fourth aspect of the current arrangements that caused concern was the lack of compensation for non-delivery charges to which response-providing generators may be exposed. Following the acceptance by the System Operator of a generator's Bid or Offer, the generator may also be exposed to non-delivery charges whilst providing response. This occurs because the algebra for calculating non-delivery, as outlined in the BSC, ensures that generators are exposed to imbalance prices or their Bid/Offer price for a shortfall against a Bid/Offer acceptance. The Group highlight that under existing arrangements no account is given to the extent that the non-delivery arises as a result of providing response. As such, no compensation is currently paid for this non-delivery exposure.

The fifth area that the Group discussed was the reference price used in the calculation of response delivery. The reference price is intended to reflect the cost of energy production. The calculation of the existing reference price is based on a monthly average of SSP/SBP in the preceding month. It has been argued that the reference price has proved inadequate because it fails to reflect differing production costs across the various plant types on the system. The Group discussed two options in detail to address the suggested issues with the reference price mechanism. These were the use of Bids and Offers to value the energy delivered and the use of a table of costs by fuel type.

The Group published their recommendations in a Working Group Report on 17 September 2001. The Group recommended changing the frequency response imbalance payments to address the first four concerns described above. The Group did not reach a consensus on changing the reference price. The Group proposed that the Panel should consider how this issue should be progressed, with one option put forward being further discussion at the

proposed Balancing Services Standing Group. The Group recommended that the proposed changes be implemented with effect from CUSC Go Live (18 September 2001). These recommendations formed the basis of Amendment Proposal CAP001 to the CUSC, presented to the Panel by NGC on 21 September 2001. The Panel recommended that the Amendment Proposal should be treated as urgent. The Authority agreed with the Panel's recommendation that the Amendment Proposal should be treated as urgent and approved the proposed procedure and timetable.

Amendment Proposal

Amendment Proposal CAP001 seeks to better facilitate the Applicable CUSC Objectives⁷ by ensuring a better approximation of assumed energy imbalance when calculating compensation payments by changing the imbalance compensation mechanism as follows:

Per minute average frequency calculations

The Amendment Proposal changes the calculation for response energy to be for each minute of each settlement period rather than the net frequency deviation within period. The assumed response energy volume would be calculated by using the average frequency deviation for each minute. Payment calculations would still be undertaken on a settlement period basis but be based on the sum of the response energy over the 30 minutes.

Detailed interpolation of the response matrix

This section of the Amendment Proposal aims to further amend the calculation of response energy, focussing on the current use of linear interpolation and scaling factors. The Amendment Proposal recommends the calculation, for each individual generating unit, of the assumed response energy by detailed linear interpolation of the response capability matrix contained within the MSA, removing the need for adjustment factors and the inaccuracies they can lead to. The proposed mechanism can take the average frequency in the minute and the de-load of the generator on a per minutes basis, and then perform a dual linear interpolation between data points within the matrix.

Use of secondary response values from the matrix

The Group concluded that using the Primary and High values contained within the matrix provides a fair approximation of the response delivered on a continuing basis when a generator is selected for Primary and High Frequency response. Therefore, the Amendment Proposal recommends that the imbalance compensation mechanism currently applied to provision of Primary and High Frequency response should continue to be calculated in the same way. However, when a generating unit is selected for Primary, Secondary and High Frequency Response, the low frequency response energy calculated can be considerably

⁷ Set out in paragraph 1 of Supplementary Condition C7F of the Transmission Licence.

underestimated by using the Primary value alone. To reflect the additional low frequency response power that is delivered after Primary Response time-scales (i.e. 10 seconds) the Amendment Proposal takes the average of Primary and Secondary values. This aims to more closely approximate the actual imbalance arising from the provision of frequency response.

Compensation for non-delivery charges

The Amendment Proposal replicates the algebra for calculating non-delivery contained in the BSC to calculate a suitable payment to compensate generators for the exposure arising from the provision of frequency response. The non-delivery charge will be recalculated based on an expected metered output including response power. This section of the Amendment Proposal seeks to address the absence of compensation for non-delivery when the non-delivery arises as a result of providing response.

Respondents' views

On 28 September 2001 NGC issued a consultation document in relation to the Amendment Proposal requesting views by the 5 October 2001. Although the Pre-CUSC Working Group had recommended that the change should be implemented from CUSC Go-Live, the Amendment Proposal did not include any specific implementation date. However, the consultation document proposed an implementation date of 21 September 2001, the date on which the Amendment Proposal was made.

In total, NGC received eleven responses to the consultation on CUSC Amendment Proposal CAP001. Of the respondents, seven fully supported the Amendment Proposal, one supported 3 of the 4 issues, one supported 2 of the 4 issues, and two did not support the Amendment Proposal.

Therefore, the majority of respondents supported the Amendment Proposal and agreed with the general principles of the Amendment. It was commented that the Amendment is an improvement in the calculation of frequency response imbalance payments and therefore it better facilitates the achievement of the applicable CUSC Objectives, in particular the efficient discharge by NGC of the obligations imposed upon it by its Transmission Licence. It was suggested that the Amendment Proposal improves the accuracy in the calculation of energy imbalance when calculating compensation payments. However, some of the respondents highlighted the need for further improvement, as the Amendment Proposal does not fully compensate generators for the costs involved in providing mandatory response. Many of the respondents commented on the issue of the derivation of reference price and the need to address this issue as soon as possible.

One respondent believed it to be fair and just to expect retrospection to be applied to all measures proposed. The respondent suggested that generators have, in good faith, continued to provide mandatory frequency response at the risk of financial loss and it is

therefore appropriate that solutions be applied retrospectively to ensure that service providers are adequately remunerated.

Of the respondents not in favour, one commented that the Amendment Proposal did not address the issues in relation to smaller generators. Another commented on the use of an average of Primary and Secondary response values to calculate the additional low frequency response power that is delivered after primary response time-scales. The respondent questioned whether primary and secondary response values could be modelled separately.

Some respondents commented that the timetable for the consultation period on this Urgent Amendment Proposal was too short. Some respondents additionally highlighted the interaction of this CUSC Amendment Proposal and Modification Proposals P34 and P36 to the BSC. It was suggested that due consideration needs to be given to this interaction by the Authority in making its decision.

Based on views expressed by respondents in relation to the draft Amendment Report, NGC issued a final Amendment Report to the Authority on 12 October 2001. However, the final Amendment Report contained a draft of the proposed text to modify the CUSC rather than a finalised version. Consequently, on 16 October 2001 the Authority requested that the Amendment Report be re-submitted to include the finalised text to accompany the proposed CUSC modification. In view of this, on 16 October 2001 NGC issued the final legal text pertaining to the Amendment Proposal to CUSC Parties and the Panel requesting views on the revised legal text by the 18 October 2001.

Respondents' views to revised legal text

One response was received in connection with the further consultation in relation to the revised legal text issued on 16 October 2001. The views expressed by the respondent were based on the content, style and structure of the legal text included within the resubmitted Amendment Report, as opposed to comments in relation to the intent of the Amendment Proposal itself.

The completed final Amendment Report was submitted to the Authority on 19 October 2001.

NGC's recommendation

NGC recommended that the Authority should approve the Amendment Proposal and that, if approved, the Amendment Proposal should be implemented with effect from 21 September 2001.

NGC recommended that the Amendment Proposal would better facilitate the efficient discharge of NGC's licence obligations⁸ of operating the transmission system in an efficient,

⁸ Special Condition AA4, paragraphs 1 and 2.

economic and co-ordinated manner by aligning more accurately payments made with actual costs incurred. Additionally, it produces greater transparency in the relative costs of service provision, thus ensuring that the most economic sources of mandatory frequency response continue to make their full capability available for despatch by NGC. Finally, NGC stated that, if approved, the measures within the Amendment Proposal would help to ensure that providers are not over compensated for providing mandatory frequency response.

The Panel considered that CUSC Amendment Proposal CAP001 should be implemented to the time-scales as recommended on the basis of the consultation and assessment undertaken in respect of the Amendment Proposal.

Ofgem's view

Ofgem⁹ considers that CUSC Amendment Proposal CAP001 will better facilitate the achievement of the Applicable CUSC Objectives.

Ofgem considers that the Amendment Proposal CAP001 provides a more accurate calculation of the response energy volume supplied by generators who provide mandatory frequency response. Ofgem's views on each of the three areas addressed in the Amendment Proposal relating to this issue and how the Amendment Proposal better achieves the relevant CUSC objectives are set out below.

Per minute average frequency calculations

Ofgem considers that changing the calculation of the volume of response energy provided by generators, to a method which considers each settlement period on a minute by minute basis will provide a more accurate calculation of the volume of response energy. Ofgem considers that this amendment will better facilitate the achievement of both of the relevant CUSC objectives by providing greater transparency in cost of the provision of mandatory frequency response. In addition, a more accurate calculation of the volume of response energy provided by generators will facilitate effective competition in the generation of electricity by providing more accurate signals of the cost of service provision.

Detailed interpolation of the response matrix

Ofgem considers that using adjustment factors for a typical response providing-generator does not reflect the dynamics of each individual generating unit. Using a detailed linear interpolation of the response capability matrix contained within the MSA should provide a more accurate calculation of the response energy volume for each individual generator.

⁹ Ofgem is the office of the Authority. The terms "Ofgem" and "the Authority" are used interchangeably in this letter.

Ofgem considers that this amendment will better facilitate the achievement the relevant CUSC objectives. The adoption of a calculation that better reflects the response energy volume of each generator will facilitate NGC in its discharge of its obligations imposed under the Electricity Act 1989 (as amended) and its Transmission Licence by providing more accurate signals to both the System Operator and the market.

Use of Secondary response values from the matrix

Ofgem considers that using the average of Primary and Secondary values when a generating unit is selected for Primary, Secondary and High Frequency Response will more closely approximate the actual imbalance arising from the provision of frequency response by generators. Ofgem considers this amendment will better facilitate NGC in its discharge of its obligations imposed under the Electricity Act 1989 (as amended) and its Transmission Licence by providing more accurate signals to the System Operator of the cost of balancing the system.

Compensation for non-delivery charges

Ofgem considers that recalculating the compensation for non-delivery based on an expected metered output will provide a more accurate compensation of the costs incurred in the provision of mandatory frequency response. This amendment will better facilitate the relevant CUSC objectives by providing more accurate cost signals to the System Operator and remunerating service providers according to the costs incurred in providing the service.

For these reasons, Ofgem agrees with NGC and the Panel that the Amendment Proposal improves the mechanism by which costs are calculated for the provision of mandatory frequency response, and in doing so improves the accuracy of payments to service providers.

Ofgem considers that the provision of mandatory balancing services should be remunerated according to the costs incurred in the provision of the service. By making the compensation payments more accurately reflect the costs to generators of providing frequency response this will help to guarantee that there will be sufficient generation available in the future that is required to operate a safe, reliable and efficient system. In addition, making frequency response imbalance payments mechanism more cost reflective better enables NGC to make efficient decisions when deciding which generators to call upon to provide frequency response. Therefore Ofgem considers that the Amendment Proposal will better facilitate the achievement of the Applicable CUSC Objectives, in particular the achievement of the efficient discharge by NGC of its Transmission Licence.

Retrospection

In examining the retrospective element of the Amendment Proposal, Ofgem considers that it is relevant to refer to the guidance it has given in previous decisions concerning retrospective changes to BSC governing the operation of the New Electricity Trading Arrangements.¹⁰

In general, Ofgem is not supportive of retrospective changes to the market rules. There are commonly understood legal reasons why retrospective rule changes are to be avoided, except in certain limited circumstance.

For example, Ofgem considers that retrospective changes to market rules, particularly those that relate to the calculation of energy imbalance prices, is likely to damage confidence in the stability of the trading arrangements and the predictability of the form of the trading arrangements if they cannot be reasonably anticipated. Participants trade on the basis of the prices reported and may have closed out positions and/or traded on the basis of an understanding of the rules in place at that time.

Ofgem therefore believes that it is appropriate for Amendment Proposals that seek retrospective implementation to be determined on a case by case basis.

Ofgem has outlined certain criteria as examples of factors that are considered when evaluating whether retrospectivity should apply. Three particular circumstances are provided as examples of factors to be considered in this situation. These are:

- a situation where the fault or error occasioning the loss was directly attributable to central arrangements;
- combinations of circumstances that could not have reasonably been foreseen; and
- where the possibility of a retrospective action had been clearly flagged to the participants in advance, allowing the detail and process of the change to be finalised with retrospective effect.

It must be noted that these examples are not intended as an exhaustive list and in all circumstances the materiality of the alleged defect will be taken into account.

Ofgem considers that these circumstances are relevant in the consideration of the Amendment Proposal.

As outlined above, the payment mechanism through which generators are remunerated for the provision of mandatory frequency is formulated in CUSC. Given the limitations associated with the current system, Ofgem considers that the Amendment Proposal addresses a situation where the current central arrangements are inappropriate.

¹⁰ The Authority's Decision on BSC Modification Proposal P19, 1 August 2001.

The issue identified in this Amendment Proposal had been identified prior to the implementation of the CUSC and an informal Pre-CUSC Working Group had been established to address this issue with a wide involvement from industry. Ofgem also notes that if CUSC had gone live as originally proposed on 18 July 2001, and the Amendment Proposal been made at that point, the Amendment Proposal could have been processed for implementation by 21 September 2001. Moreover, no change could be made to CUSC after it was designated on 25 June 2001 by the Secretary of State until after it went live on 18 September 2001. Due to the identification of inadequacies in the payment mechanism prior to implementation of CUSC, Ofgem considers that Amendments to the payment mechanism were foreseeable and that there was a reasonable expectation that Amendments would be proposed.

In addition, the Amendment Proposal seeks to improve arrangements connected to the provision of a mandatory service. In response to the consultation it was noted that service providers have continued to ensure provision of the service in the expectation that an Amendment Proposal would be implemented that would improve the accuracy of the payments made in relation to the costs incurred. While that expectation was not created by, and is not binding on, Ofgem, its existence can be taken into account in considering the Amendment Proposal.

The costs for mandatory frequency response are included within NGC's incentive scheme under its Transmission Licence. In the Assessment Report, NGC estimated that the additional payments to generators from implementing the proposed changes to frequency response imbalance payments would be an increase by some £4-6m per annum. Ofgem considers that losses of revenue to generators under the existing arrangements are directly attributable to a deficiency in the payment mechanism as it is currently written in the CUSC and that these losses would be material and persistent in the absence of this Amendment Proposal.

A further relevant consideration is that the Amendment Proposal does not have an impact upon the calculation of energy imbalance prices. Therefore implementing the Amendment Proposal retrospectively will not have an impact on the prices that participants have based trading decisions on. The Amendment Proposal makes changes to improve the payment mechanism used in bilateral contracts between NGC and generators for the provision of mandatory frequency response. Ofgem considers that this Amendment Proposal will improve the accuracy of payments made to service providers without affecting information which market participants may have used in commercial decision making.

For these reasons, Ofgem considers that it is appropriate to approve this Amendment Proposal with effect from 21 September 2001.

Ofgem agrees with the recommendation of the Pre-CUSC Working Group that there is a need for further work to be carried out in order to derive a more appropriate reference price,

and acknowledges the establishment of the Balancing Services Standing Group by the Panel.

The Authority's decision

The Authority has therefore decided to direct that Amendment Proposal CAP001 should be made and implemented.

Direction under Supplemental Condition C7F.7(a) of NGC's Transmission Licence

Having regard to the above, the Authority, in accordance with Supplemental Condition C7F.7(a) of the licence to transmit electricity granted to NGC under Section 6 of the Electricity Act 1989 as amended (the "Transmission Licence"), hereby directs NGC to modify the CUSC as set out in Amendment Proposal CAP001. A copy of the text of the modification to the CUSC is attached to this letter.

The modification is to take effect from the 21 September 2001.

In accordance with Supplemental Condition C7F.7(b) of NGC's Transmission Licence, NGC shall modify the CUSC in accordance with this direction of the Authority.

If you have any queries in relation to the issues raised in this letter, please feel free to contact me on the above number.

Yours sincerely,

Sonia Brown
Head of Electricity Operations

Signed on behalf of the Authority and authorised for that purpose by the Authority

LEGAL TEXT TO ACCOMPANY PROPOSED CUSC MODIFICATION

4.1.3 Frequency Response

Introduction

4.1.3.1 Each applicable **User** is obliged to provide (for the avoidance of doubt, as determined by any direction in force from time to time and issued by the **Authority** relieving that **User** from the obligation under its **Licence** to comply with such part or parts of the **Grid Code** or any **Distribution Code** or, in the case of **NGC**, the **Transmission Licence**, as may be specified in such direction) the **Mandatory Ancillary Service of Frequency Response** referred to in **Grid Code CC 8.1** by means of **Frequency** sensitive generation in accordance with the terms of this Paragraph 4.1.3 and a **Mandatory Services Agreement** but subject always to and in accordance with the relevant part or parts of the **Grid Code** applicable thereto.

Definitions

4.1.3.2 For the purposes of this Paragraph 4.1.3:

- (i) “**Frequency Response Service**” means the **Mandatory Ancillary Service of Frequency Response** and any **Commercial Ancillary Service of Frequency Response** as may be agreed to be provided by a **User** from time to time;
- (ii) the **Mandatory Ancillary Service of Frequency Response** shall constitute operation of a **BM Unit** in accordance with **Grid Code CC 6.3.7** and **BC 3.5** (with the exception of **BC 3.5.2**), including, without limitation, under normal operating conditions with the speed governor set so that it operates with an overall speed droop of between 3% and 5% so as to provide the applicable levels of **Response** referred to in Paragraph 4.1.3.7;
- (iii) the term "instruction" means a communication whether by telephone or automatic logging device or facsimile from **NGC** to the **User** instructing a **User** in accordance with **Grid Code BC 2.8** and this Paragraph 4.1.3 to

provide any **Frequency Response Service**, and derivations of the term shall be construed accordingly;

- (iv) the amendment of an existing instruction shall be deemed to be a new instruction;
- (v) an instruction will prevail until either it is countermanded by **NGC** or until the **BM Unit** to which the instruction relates is **De-synchronised** (whichever is first to occur).

NGC's Instructions to provide Mode A Frequency Response

4.1.3.3 For the purposes of instructions and calculation of payments, the **Mandatory Ancillary Service of Frequency Response** as described in this Paragraph 4.1.3 shall be referred to as "**Mode A Frequency Response**".

4.1.3.4 **NGC** may at any time instruct a **User** to operate any one or more **BM Unit(s)** so as to provide the following components of **Mode A Frequency Response**:-

- (a) **Primary Response**;
- (b) **Secondary Response**;
- (c) **High Frequency Response**,

in any of the permissible combinations set out in the relevant table in the **Mandatory Services Agreement**.

4.1.3.5 **NGC** shall not instruct a **User** to provide **Mode A Frequency Response** and any **Commercial Ancillary Service of Frequency Response** simultaneously.

4.1.3.6 In the event that any instruction to provide **Frequency Response** does not state whether the instruction is to provide **Mode A Frequency Response** or any **Commercial Ancillary Service of Frequency Response**, such instruction shall be deemed to be an instruction to provide **Mode A Frequency Response**.

User's Obligation to Provide Response

4.1.3.7 When a **User** is instructed in accordance with Paragraphs 4.1.3.4 and/or 4.1.3.6 to operate a **BM Unit** so as to provide any component(s) of **Mode A Frequency Response**, that **User**

shall operate that **BM Unit** so as to provide, for any **Frequency Deviation** and at any level of **De-Load**, at least the amount of **Primary Response** and/or **Secondary Response** and/or **High Frequency Response** set out respectively in the relevant tables in the **Mandatory Services Agreement** (as such tables are to be interpreted in accordance with Paragraph 4.1.3.11).

Calculation of Payments

4.1.3.8 **The payments to be made by NGC to a User hereunder in respect of the provision of any Mode A Frequency Response from a BM Unit shall be comprised of Holding Payments and Imbalance Compensation Payments and shall be determined in accordance with the formulae in, respectively, Paragraphs 4.1.3.9 and 4.1.3.9A and in accordance with Paragraphs 4.1.3.10 to 4.1.3.12 inclusive.**

Payment Formulae - Holding Payments

4.1.3.9 **The Holding Payments for a BM Unit to be made by NGC to a User referred to in Paragraph 4.1.3.8 shall be calculated in accordance with the following formula:-**

$$HP_M = P_M + H_M + S_M$$

Where:

HP_M is the **Holding Payment** to be made to the **User** calculated in £ per minute.

P_M is the payment per minute to be made by **NGC** to the **User** for the **Ancillary Service of Primary Response** provided by the **User** from the **BM Unit** concerned pursuant to an instruction from **NGC** to provide **Mode A Frequency Response**, and is calculated as follows:-

$$P_M = (P_{PR} \times P_{MW} (1 - SF_p)) \times K_T \times K_{GRC} \times \left[\frac{1}{60} \right]$$

H_M is the payment per minute to be made by **NGC** to the **User** for the **Ancillary Service of High Frequency Response** provided by the **User** from the **BM Unit** concerned pursuant to an instruction from **NGC** to provide **Mode A Frequency Response**, and is calculated as follows:-

$$H_M = (H_{PR} \times H_{MW} (1 - SF_H)) \times K_T \times K_{GRC} \times \left[\frac{1}{60} \right]$$

S_M is the payment per minute to be made by **NGC** to the **User** for the **Ancillary Service of Secondary Response** provided by the **User** from the **BM Unit** concerned pursuant to an instruction from **NGC** to provide **Mode A Frequency Response**, and is calculated as follows:-

$$S_M = (S_{PR} \times S_{MW} (1 - SF_S)) \times K_T \times K_{GRC} \times \left[\frac{1}{60} \right]$$

In this Paragraph 4.1.3.9, the following terms shall have the following meanings:-

- P_{PR} = the appropriate payment rate for **Primary Response** set out in the **Mandatory Services Agreement**;
- P_{MW} = the **Primary Response** capability (expressed in MW) for the level of **De-Load** of the **BM Unit** concerned at the end of the minute in which the service is provided;
- H_{PR} = the appropriate payment rate for **High Frequency Response** set out in the **Mandatory Services Agreement**;
- H_{MW} = the **High Frequency Response** capability (expressed in MW) for the level of **De-Load** of the **BM Unit** concerned at the end of the minute in which the service is provided;
- S_{PR} = the appropriate payment rate for **Secondary Response** set out in the **Mandatory Services Agreement**;
- S_{MW} = the **Secondary Response** capability (expressed in MW) for the level of **De-Load** of the **BM Unit** concerned at the end of the minute in which the service is provided;

- K_T = the ambient temperature adjustment factor. **NGC** and each **User** acknowledge and agree, as between **NGC** and that **User**, that K_T shall be deemed to be 1 for the purposes of calculating payments until such time as they agree upon an appropriate formula and a suitable method of measuring the ambient temperature on a minute by minute basis which shall be set out in the **Mandatory Services Agreement**. In the event that any agreed method of measuring the ambient temperature on a minute by minute basis should fail following its implementation, then **NGC** and each **User** acknowledge and agree, as between **NGC** and that **User**, that K_T shall be deemed to be 1 until the method of measuring the ambient temperature on a minute by minute basis is restored;
- K_{GRC} = where the **BM Unit** is a **CCGT Module**, the plant configuration adjustment factor set out in the relevant table in the **Mandatory Services Agreement** for the configuration of the **BM Unit** concerned at the time at which the capability to provide the service is carried, otherwise 1;
- SF_P = 0, subject to Paragraph 4.1.3.25 (e);
- SF_S = 0, subject to Paragraph 4.1.3.25 (e);
- SF_H = 0, subject to Paragraph 4.1.3.25 (e).

Payment Formulae - Imbalance Compensation Payment

- 4.1.3.9A (a) The **Imbalance Compensation Payments** for **BM Unit i** in **Settlement Period j** to be made by **NGC** to a **User** referred to in Paragraph 4.1.3.8 shall be comprised of an **Imbalance Energy Payment** and a **Non-Delivery Payment**, and shall be calculated in accordance with the following formulae:-

$$ICP_{ij} = IEP_{ij} + RNDC_{ij}$$

But so that where ICP_{ij} is negative such amount shall be paid by the **User** to **NGC**.

Where:

ICP_{ij} is the **Imbalance Compensation Payment** to be made to or, as the case may be, by the **User**;

IEP_{ij} is the **Imbalance Energy Payment** for **BM Unit i**, in **Settlement Period j**, calculated in accordance with Paragraph 4.1.3.9A (b) below; and

$RNDC_{ij}$ is the **Non-Delivery Payment** for **BM Unit i**, in **Settlement Period j**, calculated in accordance with Paragraph 4.1.3.9A (c) below.

- (b) The **Imbalance Energy Payment** (IEP_{ij}) shall be calculated as follows:-

$$IEP_{ij} = LFIEP_{ij} + HFIEP_{ij}$$

Where:

$LFIEP_{ij}$ is the low frequency response imbalance energy payment for **BM Unit i**, in **Settlement Period j**, and $HFIEP_{ij}$ is the high frequency response imbalance energy payment for **BM Unit i**, in **Settlement Period j**, and are calculated as follows:-

if $IE_{ij} > 0$, then

$$LFIEP_{ij} = |IE_{ij}| * (\text{reference price} - SSP_j)$$

and

$$HFIEP_{ij} = 0$$

otherwise

$$LFIEP_{ij} = 0$$

and

$$HFIEP_{ij} = |IE_{ij}| * (SBP_j - \text{reference price})$$

Where IE_{ij} is the expected imbalance energy for **BM Unit i** in **Settlement Period j** calculated as follows:-

$$IE_{ij} = \int_0^{SPD} FR_{ij}(t)dt$$

Where:

$\int_0^{SPD} dt$ is the integral at times t, over the **Settlement Period** duration.

$FR_{ij}(t)$ is the expected change in **Active Power** output for **BM Unit i**, at time t (resolved to the nearest integer minute), expressed in MW derived from the relevant table set out in the **Mandatory Services Agreement** (as such table is interpreted in accordance with Paragraph 4.1.3.11) by reference to the level of **De-Load** of the **BM Unit** concerned at the end of the minute and the mean **Frequency Deviation** over that minute when that **BM Unit** is providing **Mode A Frequency Response** and zero at all other times.

For this purpose:-

- (i) for a positive **Frequency Deviation** the expected change in **Active Power** output of **BM Unit i** shall be derived from the high frequency response table set out in the **Mandatory Services Agreement** and shall be signed negative; and
- (ii) for a negative **Frequency Deviation**, the expected change in **Active Power** output of **BM Unit i** shall be derived from:
 - A) the **Primary Response** data in the case of a **BM Unit** being instructed to deliver **Primary Response** without **Secondary Response**; or
 - B) the mean of the **Primary Response** and **Secondary Response** data in the case of a **BM Unit** being instructed to deliver **Primary Response** and **Secondary Response**,

in each case shown in the low frequency response tables set out in the **Mandatory Services Agreement** and shall be signed positive.

$$\text{reference price} = \frac{(\overline{SBP}_{month} + \overline{SSP}_{month})}{2}$$

Where:

\overline{SBP}_{month} and \overline{SSP}_{month} are the calculated time weighted average of SBP_j and SSP_j respectively (each as defined in the **Balancing and Settlement Code**) for the preceding calendar month in which the service is provided.

- (c) The **Non-Delivery Payment** ($RNDC_{ij}$) shall be calculated as follows:-

$$RNDC_{ij} = CND_{ij} - CNDR_{ij}$$

Where:

$CNDR_{ij}$ is a quantity referred to in this Paragraph 4.1.3.9A (c) as the **BM Unit Period Non-Delivery Charge (Revised)** determined as follows:-

In respect of each **Settlement Period** j , for each **BM Unit** i , a quantity referred to in this Paragraph 4.1.3.9A (c) as the **Period BM Unit Non-Delivered Offer Volume (Revised)** ($QNDOR_{ij}$) will be determined as follows:-

$$QNDOR_{ij} = \min(\max(QME_{ij} + IE_{ij} - QM_{ij}, 0), \sum_n QAO_{ij}^n)$$

where \sum_n represents the sum over all **Bid-Offer Pair Numbers** for the **Accepted Offer Volumes** for the **BM Unit**.

In respect of each **Settlement Period** j , for each **BM Unit** i , a quantity referred to in this Paragraph 4.1.3.9A (c) as the **Period BM Unit Non-Delivered Bid Volume (Revised)** ($QNDBR_{ij}$) will be determined as follows:-

$$QNDBR_{ij} = \max\left(\min(QME_{ij} + IE_{ij} - QM_{ij}, 0), \sum_n QAB_{ij}^n\right)$$

where \sum_n represents the sum over all **Bid-Order Pair Numbers** for the **Accepted Bid Volumes** for the **BM Unit**.

Now, in respect of each **Settlement Period j**, for each **BM Unit i**, if the **Period BM Unit Non-Delivered Offer Volume (Revised)** is greater than zero then to determine values of a quantity referred to in this Paragraph 4.1.3.9A (c) as the **Offer Non-Delivery Volume (Revised)** ($QNDOR_{ij}^n$), the **Period BM Unit Non-Delivered Offer Volume (Revised)** will be apportioned across accepted **Offers**, in the following way:-

In respect of each **Settlement Period j**, for each **BM Unit i**, the set of all accepted **Offers** will be ranked in order of decreasing price. The accepted **Offer** with the highest price will be allocated **Non-Delivery Order Number 1**, the next highest priced accepted **Offer** will be allocated **Non-Delivery Order Number 2** and so on until all accepted **Offers** for the **Settlement Period** have been allocated a **Non-Delivery Order Number**. The set of accepted **Offers** $\{QAO_{ij}^{n1}, QAO_{ij}^{n2}, \dots, QAO_{ij}^{nn}, \dots\}$ is then a ranked set of accepted **Offers**.

The **Offer Non-Delivery Volume (Revised)** will be allocated to the first accepted **Offer** in the list first, then, once the first accepted **Offer** has been wholly accepted, to the second accepted **Offer** and so on until the **Period BM Unit Non-Delivered Offer Volume (Revised)** is fully apportioned.

Then the **Offer Non-Delivery Volume (Revised)** for accepted **Offer n**, is:

$$QNDOR_{ij}^n = \min(QAO_{ij}^{nu}, RQNDOR_{ij}^{u-1})$$

where $RQNDOR_{ij}^{u-1}$ is a quantity referred to in this Paragraph 4.1.3.9A (c) as the **Remaining Period BM Unit Non-Delivered Offer Volume (Revised)** determined as:

$$RQNDOR_{ij}^u = RQNDOR_{ij}^{u-1} - QNDOR_{ij}^{u-1}$$

and $RQNDOR_{ij}^0 = QNDOR_{ij}$

and $QNDOR_{ij}^{u_0} = 0$.

Now, in respect of each **Settlement Period j**, for each **BM Unit i**, if the **Period BM Unit Non-Delivered Bid Volume (Revised)** is less than zero then to determine values of a quantity referred to in this Paragraph 4.1.3.9A (c) as the **Bid Non-Delivery Volume (Revised)** ($QNDBR_{ij}^n$), the **Period BM Unit Non-Delivered Bid Volume (Revised)** will be apportioned across accepted **Bids**, in the following way:-

In respect of each **Settlement Period j**, for each **BM Unit i**, the set of all accepted **Bids** will be ranked in order of increasing price. The accepted **Bid** with the lowest price is allocated **Non-Delivery Order Number 1**, the next lowest priced accepted **Bid** is allocated **Non-Delivery Order Number 2** and so on until all accepted **Bids** for the **Settlement Period** have been allocated a **Non-Delivery Order Number**. The set of accepted **Bids** $\{QAB_{ij}^{n_1}, QAB_{ij}^{n_2}, \dots, QAB_{ij}^{n_u}, \dots\}$ is then a ranked set of accepted **Bids**.

The **Bid Non-Delivery Volume (Revised)** will be allocated to the first accepted **Bid** in the list first, then, once the first accepted **Bid** has been wholly accepted, to the second accepted **Bid** and so on until the **Period BM Unit Non-Delivered Bid Volume (Revised)** is fully apportioned.

Then the **Bid Non-Delivery Volume (Revised)** for accepted **Bid n**, is:

$$QNDBR_{ij}^n = \max(QAB_{ij}^{n_u}, RQNDBR_{ij}^{u-1})$$

where $RQNDBR_{ij}^{u-1}$ is a quantity referred to in this Paragraph 4.1.3.9A (c) as the **Remaining Period BM**

Unit Non-Delivered Bid Volume (Revised) determined as:

$$RQNDBR_{ij}^u = RQNDBR_{ij}^{u-1} - QNDBR_{ij}^{n_{u-1}}$$

and $RQNDBR_{ij}^0 = QNDBR_{ij}$

and $QNDBR_{ij}^{n_0} = 0$.

In respect of each **Settlement Period j**, for each **BM Unit i**, for each accepted **Offer**, a quantity referred to in this Paragraph 4.1.3.9A (c) as the **Non-Delivered Offer Charge (Revised)** will be determined as follows:-

$$CNDOR_{ij}^n = QNDOR_{ij}^n \times \max((PO_{ij}^n - SBP_j), 0) \times TLM_{ij}$$

In respect of each **Settlement Period j**, for each **BM Unit i**, for each accepted **Bid**, a quantity referred to in this Paragraph 4.1.3.9A (c) as the **Non-Delivered Bid Charge (Revised)** will be determined as follows:-

$$CNDBR_{ij}^n = QNDBR_{ij}^n \times \min((PB_{ij}^n - SSP_j), 0) \times TLM_{ij}$$

In respect of each **Settlement Period j**, for each **BM Unit i**, the **BM Unit Period Non-Delivery Charge (Revised)** ($CNDR_{ij}$) will be determined as follows:-

$$CNDR_{ij} = \sum_n (CDNOR_{ij}^n + CNDBR_{ij}^n)$$

where \sum_n represents the sum over all **Bid-Offer Pair Numbers** for the **BM Unit**.

- (d) In this Paragraph 4.1.3.9A, the following terms shall have the meanings ascribed to them in the **Balancing and Settlement Code**:-

“Accepted Offer Volumes”

“Accepted Bid Volumes”

“Bid”

“**Bid-Offer Pair Numbers**”
“**BM Unit Period Non-Delivery Charge**”
“**CND_{ij}**”
“**Non-Delivery Order No.1**”
“**Non-Delivery Order No.2**”
“**Offer**”
“**QABⁿ_{ij}**”
“**QAOⁿ_{ij}**”
“**QM_{ij}**”
“**QME_{ij}**”
“**SSP_j**”
“**SBP_j**”
“**SPD**”

- 4.1.3.10 **NGC** and each **User** acknowledge and agree, as between **NGC** and that **User**, that no **Holding Payment** or **Imbalance Compensation Payment** shall be payable except in relation to periods in respect of which instructions have been issued by **NGC** pursuant to this Paragraph 4.1.3.

*Interpretation of Tables – Levels of **Response***

- 4.1.3.11 The figures for **Response** set out in the response tables in the **Mandatory Services Agreements** shall be given in relation to specific **Frequency Deviations** and to specific levels of **De-Load** for a **BM Unit**. Such tables shall, for the purposes of Paragraph 4.1.3.7, be construed in accordance with this Paragraph 4.1.3.11. Subject to Paragraphs 4.1.3.11(d) and (e):-

- (a) for a **Frequency Deviation** at a given time differing from the figures given in the relevant response tables in the **Mandatory Services Agreement**, the level of **Response** required shall be calculated by linear interpolation from the figures specified in the relevant table(s) in respect of **Frequency Deviations**;
- (b) for a level of **De-Load** at a given time differing from the figures given in the relevant response tables in the **Mandatory Services Agreement**, the level of **Response** required shall be calculated by linear interpolation from the figures in the relevant table(s) in respect of levels of **De-Load**. For the avoidance of doubt, **Frequency Sensitive Mode** shall not be instructed for any **De-Load** greater than the maximum level of **De-Load** given in the response tables;

(c) in respect of any time in relation to which both Paragraphs 4.1.3.11(a) and (b) apply, the level of **Response** required shall be calculated by dual linear interpolation from the figures specified in the relevant table(s) in respect of **Frequency Deviations** and in respect of levels of **De-Load**;

and

(d) for any **Frequency Deviation** greater than the greatest **Frequency Deviation** given in the relevant response tables in the **Mandatory Services Agreement** (whether positive or negative), the level of **Response** required shall be calculated by reference to the greatest **Frequency Deviation** (positive or negative, as the case may be) given in the relevant table(s); and

(e) for the purposes of calculating levels of **Response** to be provided in response to **Frequency Deviations** lower than those specified in the response tables in the **Mandatory Services Agreement**, the relevant table(s) shall be deemed to specify that zero **Response** is to be provided for a **Frequency Deviation** of zero.

Interpretation of Tables – Levels of Holding Payment

4.1.3.12 The summary response table in the **Mandatory Services Agreement** shall set out figures in respect of given levels of **De-Load** for the purposes of calculating payment in accordance with the formulae in Paragraph 4.1.3.9. Where the level of **De-Load** of the **BM Unit** is other than one of the levels given in such table, then, for the purposes of the payment table in the **Mandatory Services Agreement**, the figure for P_{MW} , S_{MW} or H_{MW} as the case may be, shall be calculated by linear interpolation from the figures in such table in respect of levels of **De-Load**.

User's Request to Amend Levels of and/or Payment Rates for Response

4.1.3.13 Each **User** shall have the right, as between **NGC** and that **User**, not more than once every two months (or otherwise at any time with the specific agreement of **NGC**) to request in writing an amendment to the levels of **Response** set out in the response tables in the **Mandatory Services Agreement** and/or, provided such request is made in accordance with the relevant charging principles set out in Paragraph 4.4, the payment rates referred to in the payment table(s) in the **Mandatory Services Agreement**. **NGC's** agreement to such a request shall not be unreasonably withheld or delayed.

NGC's Requests to Amend Levels of Response

4.1.3.14 Where **NGC** reasonably considers in light of operating experience that the levels of **Response** set out in the response tables in the **Mandatory Services Agreement** do not represent the true operating capabilities of a **BM Unit(s)**, **NGC** shall have the right not more than once every two months (or otherwise at any time with the specific agreement of the relevant **User**) to request (provided always that such request be accompanied by a reasonable justification therefor) that the levels of **Response** set out in the response tables in the **Mandatory Services Agreement** be reviewed and, if appropriate, amended by agreement with such **User** such agreement not to be unreasonably withheld or delayed.

Procedure for Amendments to Levels of and/or Payment Rates for Response

4.1.3.15 Any amendments agreed by **NGC** and a **User** pursuant to Paragraphs 4.1.3.13 or 4.1.3.14 or determined by an arbitrator or panel of arbitrators under the **Dispute Resolution Procedure** in the circumstances referred to in Paragraph 4.1.3.16 shall not become effective until (in the case of agreed amendments) a date at least five **Business Days** after an amending agreement is entered into between **NGC** and the **User** in accordance with the **Mandatory Services Agreement** or, in the case of determined amendments, such other date as may be determined by an arbitrator or panel of arbitrators under the **Dispute Resolution Procedure** subject always to Paragraphs 4.1.3.17 and 4.1.3.19.

Failure to Agree Amendments

4.1.3.16 If **NGC** and a **User** are unable to agree any amendments requested pursuant to Paragraphs 4.1.3.13 or 4.1.3.14 within 28 days of either of them serving on the other notice of its

intention to invoke the **Dispute Resolution Procedure** then either party may initiate the procedure for resolution of the issue as an **Other Dispute** in accordance with Paragraph 7.4.

Dispute Resolution Procedure

- 4.1.3.17 **NGC** and each **User** acknowledge and agree, as between **NGC** and that **User**, that rule 12.1(p) of the **Electricity Arbitration Association** shall apply to any arbitration proceedings initiated pursuant to Paragraph 7.4 in the circumstances referred to in Paragraph 4.1.3.16, but that the changes determined by any arbitrator or panel of arbitrators shall not apply in respect of any period prior to the date on which the **Dispute Resolution Procedure** is invoked.

Implementation of Determinations

- 4.1.3.18 Subject to Paragraph 4.1.3.17, any changes to payment rates determined by an arbitrator or panel of arbitrators under the **Dispute Resolution Procedure** in the circumstances referred to in Paragraph 4.1.3.16 shall apply with effect from the date specified in the determination and consequential adjustments shall be made in the next practicable **Provisional Monthly Statement** issued following the date of the determination. If any such changes are so determined to apply in respect of any period prior to the date of determination then in respect of such period until actual payment (or, as the case may be, repayment) **NGC** shall pay to the **User** (where such payment rates are determined to be greater than current payment rates) the excess together with interest thereon at the **Base Rate** and the **User** shall repay to **NGC** (where such payment rates are determined to be less than current payment rates) the amount by which **NGC** has overpaid the **User** together with interest thereon at the **Base Rate**.

- 4.1.3.19 Any amendments to levels of **Response** determined by an arbitrator or panel of arbitrators under the **Dispute Resolution Procedure** in the circumstances referred to in Paragraph 4.1.3.16 shall take effect from the date five **Business Days** following the relevant determination.

Triennial Review

- 4.1.3.20 Without prejudice to Paragraphs 4.1.3.13 to 4.1.3.19 inclusive, **NGC** and each **User** shall review the payment rates for the **Mandatory Ancillary Service of Frequency Response** set out in each relevant **Mandatory Services Agreement** and shall

adjust such payment rates by such amount or in such manner as shall be fair and reasonable (on the basis of the charging principles set out in Paragraph 4.4) on the date specified for such purpose in the **Mandatory Services Agreement** and on each third successive anniversary thereof during the currency of that **Mandatory Services Agreement** ("**Triennial Review Date**").

4.1.3.21 **NGC** and the **User** shall meet to discuss and endeavour to agree any such adjustment to the payment rates (which shall be calculated on the basis of the charging principles set out in Paragraph 4.4) no later than five months prior to the **Triennial Review Date**. If **NGC** and the **User** have not agreed the amount of any such adjustment by the date which is one month prior to the **Triennial Review Date**, either of them may initiate the procedure for resolution of the issue as an **Other Dispute** in accordance with Paragraph 7.4. **NGC** and the **User** acknowledge and agree that rule 12.1(p) of the **Electricity Arbitration Association** shall apply to any arbitration proceedings initiated in consequence thereof.

4.1.3.22 If any adjustment to the payment rates has not been ascertained (by agreement or determination) by the **Triennial Review Date** in accordance with the provisions of Paragraphs 4.1.3.20 and 4.1.3.21, **NGC** and the **User** shall pay to the other for any interval between the **Triennial Review Date** and the date when such payment rates have been ascertained as aforesaid any sums due to that other party for the **Mandatory Ancillary Service of Frequency Response** calculated at the corresponding payment rates applicable during the period immediately preceding the **Triennial Review Date** without indexation. Upon any adjustment to the payment rates (or any of them) being ascertained as aforesaid, any additional amount or reduced amount payable or repayable for the period commencing on the **Triennial Review Date** and ending on the date when the payment rates shall have been ascertained, shall be paid or repaid by the party liable for such payment or repayment together with interest on the additional amounts which would have been payable (or the amounts by which the payments would have been reduced as the case may be) had the adjustment been ascertained at the **Triennial Review Date** at the rate applicable to overdue payments provided in Paragraph 4.3.

Implementation of Continuous Monitoring System

- 4.1.3.23 To the extent the same shall be acceptable to **NGC** and a **User** on the basis of a cost benefit analysis, **NGC** and a **User** agree, as between **NGC** and that **User**, to the implementation of a continuous monitoring system as soon as is reasonably practicable. The continuous monitoring system shall be in accordance with the relevant principles set out in Paragraph 4.1.3.25 for the purposes of confirming performance of the **BM Units** and adjusting payments pursuant to this Paragraph 4.1.3.

Incident Based Monitoring System

- 4.1.3.24 Pending implementation of the continuous monitoring system, **NGC** and each **User** agree, as between **NGC** and that **User**, to implement an incident based monitoring scheme for the purpose of confirming the performance of the **BM Units** pursuant to this Paragraph 4.1.3. Such incident based monitoring scheme shall be in accordance with the relevant principles set out in Paragraph 4.1.3.25. Neither **NGC** nor the **User** shall unreasonably withhold or delay such agreement and/or implementation.

Genset Response Monitoring

Introduction

- 4.1.3.25 (a) This Paragraph 4.1.3.25 sets out the principles relating to:
- (i) the proposed continuous monitoring system to be implemented pursuant to Paragraph 4.1.3.23; and
 - (ii) the incident based monitoring system to apply until such time as implementation of the continuous monitoring system takes place.

Some elements of the continuous monitoring system are currently undergoing testing and development and it is accepted that if final testing of these elements proves unsatisfactory alternatives will need to be developed. Further, implementation of the continuous monitoring system shall be subject to its acceptability to **NGC** and **Users** on the basis of a cost benefit analysis.

Wherever possible the technical specification of both the incident based monitoring system and the continuous monitoring system will be designed so as to enable future development or enhancement.

Aims of Project

- (b) The aim of the monitoring project (which includes, without limitation, the development of the incident based monitoring system and the continuous monitoring system) is to develop a response monitoring system which will measure the response performance of generators against the levels of **Frequency Response** required to be provided under **Mandatory Services Agreements**.

Incident Based Monitoring Scheme

- (c) Details of the incident based monitoring scheme (including without limitation the definitions of Shortfall Period and Incident, the calculation of service delivery and the determination of Incident start and end times) will be more particularly set out in a document entitled "Procedure for Incident Based Response Monitoring" ("the PIRM Document") to be produced by **NGC** and agreed by all relevant **Users** (such agreement not to be unreasonably withheld or delayed).

For the avoidance of doubt during the period during which the incident based monitoring scheme applies, and prior to the implementation of the continuous monitoring system, for the purposes of the formulae in Paragraph 4.1.3.9, the values of SF_P , SF_S and SF_H shall be zero, such that no payment reduction shall apply during such period in respect of shortfall.

Continuous Based Monitoring Scheme – Confirmation of Response Delivery

- (d) The main objective of the continuous monitoring scheme is to provide a quantitative measure of **Frequency Response** delivery against which payment can be justifiably made and to reduce payments if delivery does not comply with the **CUSC** and the **Mandatory Services Agreement**. As the capability of a **BM Unit** to provide the level of **Response** required pursuant to this Paragraph 4.1.3 for any change in

System Frequency occurring during the period of delivery of Response pursuant to a prior change in **System Frequency** will be affected by the level of **Response** then being delivered, relevant fluctuations in **System Frequency** should to this extent be taken into account by the continuous monitoring scheme for the purpose of calculating payment levels.

Determination of Response Shortfall

(e) For the purposes of the continuous monitoring system, the **Response** shortfall may take three forms:-

- (i) average **Primary Response** under-delivery;
- (ii) average **Secondary Response** under-delivery;
- (iii) average **High Frequency Response** under-delivery,

in each case over a Shortfall Period (such term to be defined prior to implementation of the continuous monitoring system).

Upon the implementation of the continuous monitoring system, for the purposes of determining any such average under-delivery, SF_P , SF_S and SF_H shall be the average under-delivery of **Primary Response**, **Secondary Response** and **High Frequency Response** respectively during the Shortfall Period in which the **Ancillary Service** was, or should have been, provided. For the purposes of the formulae in Paragraph 4.1.3.9, such average under-delivery will be determined using a continuous plant response assessment algorithm which is under development and which will be agreed with the **User** prior to its implementation and expressed in terms of $0 \leq SF \leq 1$.

Measurement of System Variables

- (f) In relation to the continuous monitoring system measurement of **System Frequency** and generator output power will be required local to the **BM Unit**. **Synchronised** time tagging of both power and **Frequency** will be required.

Frequency is required as the fundamental driving variable of the contract model software. Access to a voltage source to enable **Frequency** to be measured is not expected to cause any difficulty. The measurement of generator output power will also be required every second. Cost effective access to this measurement is, however, less straight forward. Covered below are two options describing how this will be achieved. It is expected that normally the FMS interface unit will be the method used; however, where the **BM Unit** concerned has derogations from FMS, method two may be used.

FMS Interface Unit

- (g) The use of the Final Metering System (FMS) represents a logical method of measurement since it eliminates the high cost associated with running cables to access CTs and VTs.

The high accuracy integrated data from FMS will be used to re-generate a power profile and curve fitting techniques will be applied to improve accuracy. This instantaneous power curve will then be sampled every second to obtain the required values.

Direct Measurement

- (h) Where for the reasons detailed in Paragraph 4.1.3.25(f) it is not possible to use the FMS interface unit, the use of 'ISAT' type transducers will be employed to interface between the monitoring equipment and the measurement transformers' secondary circuit.

It is envisaged that generators seeking derogations from FMS will be supportive in establishing convenient VT and CT secondary connections for this purpose.

Contract Model

- (i) The contract model is the heart of the continuous monitoring system and it is crucial to the philosophy

behind the system, namely that of modelling the **Mandatory Services Agreement** and not the **BM Unit** itself.

Given the difficulty in measuring **Frequency Response** directly on loaded plant, the need to compare changes in power delivery against expectation is evident. Comparison against this model output, which in turn is based on agreed and legally binding contracts, permits an identifiable quantity of non conformity to be measured and payments to be suitably reduced.

Therefore, since the **Mandatory Services Agreement** itself is the quantifying factor, there can be no redress due to assumptions regarding the technical attributes of the **BM Unit** other than those taken into account in setting the levels of **Response**.

Functional Objective

- (j) In relation to the continuous monitoring system, the model will comprise software which uses system and instructed variables to access the contract look-up tables. The look-up tables used will precisely mimic the response tables set out in **Mandatory Services Agreements**. These variables in turn will be processed using an algorithm to determine the levels of **Response** expected at any instant in time.

It is intended that this process will be effective during both small and large **Frequency Deviations**. Indeed with regard to reduction in payment and estimated **Response** capability, response to small **Frequency Deviations** is extremely important.

Input Data

- (k) In relation to the continuous monitoring system, inputs to the contract model will include **Frequency**, all contract table data, target load, **Target Frequency**, the latest genset availability, the response instruction, LF setting (if electronically despatched) and any other information required which may be specified in the **Mandatory Services Agreement**.

Comparator

- (l) In relation to the continuous monitoring system, the comparator will determine the difference between the measured change in the level of **Output** from the **BM Unit** by way of **Frequency Response** and the change in **Output** level that is specified in the **Mandatory Services Agreement**.

Additional Costs

4.1.3.26 Save where expressly provided otherwise in the **CUSC** or any **Mandatory Services Agreement** if:-

- (a) a **User** is of the opinion that in order to comply with any change in or amendment to the **Grid Code** (other than the withdrawal of or reduction in the scope of a **Derogation**) or any statutory or regulatory obligation coming into force after the **Commencement Date** of the relevant **Mandatory Services Agreement** that **User** is obliged to incur costs and expenses for the purpose of carrying out modifications to any **BM Unit** or **CCGT Unit** or otherwise for the purposes of changing the manner of operation of a **BM Unit** or **CCGT Unit** in relation to the provision of the **Mandatory Ancillary Service of Frequency Response**; or
- (b) **NGC** is of the opinion that by reason of any change in or amendment to the **Grid Code** or any statutory or regulatory obligation coming into force after the **Commencement Date** of the relevant **Mandatory Services Agreement** a **User** is able to make savings in the cost and expense of providing the **Mandatory Ancillary Service of Frequency Response** from any **BM Unit** or **CCGT Unit**,

then either the **User** or **NGC** as the case may be may by notice in writing require the other to agree any adjustment in the rates and prices for the **Mandatory Ancillary Service of Frequency Response** and the **BM Unit** or **CCGT Unit** concerned as set out in the relevant **Mandatory Services Agreement** having regard to the charging principles set out in Paragraph 4.4. If **NGC** and that **User** cannot agree to an adjustment in such rates and prices within a month of receipt by either of them of the other's written notice, either of them may initiate the

procedure for resolution of the issue as an **Other Dispute** in accordance with Paragraph 7.4.

- 4.1.3.27 If, at any time during the term of a **Mandatory Services Agreement**, there is a variation in the security standards with which **NGC** is obliged to comply and such variation would, in a **User's** reasonable opinion, materially affect the operation of the services to be provided under that **Mandatory Services Agreement**, **NGC** and that **User** shall negotiate in good faith with a view to agreeing and implementing appropriate amendments to any relevant **Mandatory Services Agreement**. If they are unable to reach agreement within 28 days of either of them serving on the other notice of its intention to invoke the **Dispute Resolution Procedure**, either of them may initiate the procedure for resolution of the issue as an **Other Dispute** in accordance with Paragraph 7.4.

4.4 CHARGING PRINCIPLES

4.4.1 Application

The provisions of this Paragraph 4.4 shall apply to payments made by **NGC** to a **User** pursuant to **Mandatory Services Agreements** in respect of the provision of the **Mandatory Ancillary Service of Frequency Response**, and (if agreed between **NGC** and a **User**) may also be incorporated by reference into any other **Ancillary Services Agreement** as a term thereof so as to apply in respect of payments made by **NGC** to that **User** in respect of the provision of other **Ancillary Services** (but for the avoidance of doubt not so as to thereby create any obligations on **NGC** and that **User** under the **CUSC** in respect thereof).

4.4.2 Charging Principles - General

- 4.4.2.1 These principles are to be used to establish the basic arrangements but are not intended to stifle innovation in the development of new services or the giving of appropriate economic signals.
- 4.4.2.2 The charges shall be "cost reflective" ie. based and founded upon the actual or estimated costs directly incurred or to be incurred by the **User** for the purpose of providing the service or capability concerned.
- 4.4.2.3 Where a capability to provide an **Ancillary Service** is required by the **Grid Code** from all **BM Units** or **CCGT Units** (as opposed to a capability made available by agreement between **NGC** and a **User** from some only of the **User's BM Units** or **CCGT Units**), no **Ancillary Service** capability payment shall be made.
- 4.4.2.4 The cost of "Grandfathering" **User's** Equipment (i.e. bringing equipment owned by the **User** on 30th March 1990 to a condition of compliance with the **Grid Code**) shall not be included in **Ancillary Services** payments. Where a **Derogation** is withdrawn or reduced in scope then, except in relation to **Frequency Response**, the **User** shall be entitled to take the cost of meeting the withdrawal or reduction in the scope of the **Derogation** into account in its charges.

- 4.4.2.5 Subject to the other provisions of this Paragraph 4.4.2, the charges shall take due account of any change in or amendments to the **Grid Code** or any other statutory or regulatory obligation coming into force after 30th March 1990 affecting the provision of **Ancillary Services**.
- 4.4.2.6 If as a result of any changes to the **Balancing and Settlement Code** the **User** ceases to be entitled to receive payment under the **Balancing and Settlement Code** in respect of any elements of **Ancillary Services** provided by it which are expressed in this Paragraph 4.4 to be paid for under the **Balancing and Settlement Code**, the **User** shall be entitled to charge for such elements under an **Ancillary Services Agreement**. Where, however, such change entitles the **User** to be paid for any elements of **Ancillary Services** which are expressed in this Paragraph 4.4 to be paid for under an **Ancillary Services Agreement** the **User** shall cease to be entitled to charge for such elements under an **Ancillary Services Agreement**.

4.4.3 Charging Principles – Frequency Response

- 4.4.3.1 The variable cost of producing **Primary Response**, **Secondary Response**, **High Frequency Response** shall include sums in respect of the additional inefficiency costs incurred in providing these services but shall not include any sums payable in respect of any costs which are the subject of Paragraph 4.4.3.3.
- 4.4.3.2 Part-loading of a **BM Unit** at a level other than that specified in a **Physical Notification** in order to provide **Frequency Response** will normally be achieved by the issue of a **Bid-Offer Acceptance**.
- 4.4.3.3 In recognition of the costs likely to be incurred under the **Balancing and Settlement Code** when providing **Frequency Response**, an additional amount based upon an expected exposure to energy imbalance and non-delivery charges when providing these services shall be payable under Paragraph 4.1.3.9A.

Related Additional Definitions for CUSC Paragraph 11.3

“Holding Payment”	that component of the payment for Mode A Frequency Response calculated in accordance with Paragraph 4.1.3.9;
“Imbalance Compensation Payment”	that component of the payment for Mode A Frequency Response referred to in Paragraph 4.1.3.9A comprising the Imbalance Energy Payment and the Non-Delivery Payment ;
“Imbalance Energy Payment”	that component of the Imbalance Compensation Payment calculated in accordance with Paragraph 4.1.3.9A(b);
“Non-Delivery Payment”	that component of the Imbalance Compensation Payment calculated in accordance with Paragraph 4.1.3.9A(c);