WORKING GROUP REPORT

CUSC Amendment Proposal CAP009

Mandatory Frequency Response

Prepared by the Balancing Services Standing Group

Amendment Ref	CAP009
Issue	1.0
Date of Issue	08 February 2002
Prepared by	BSSG

DOCUMENT CONTROL

Version	Date	Author	Change Reference
0.1	11/01/02	BSSG Chair	Initial draft for BSSG consideration
0.2	24/01/02	BSSG Chair	Draft for BSSG comment
1.0	08/02/02	BSSG Chair	Formal version for submission to the CUSC Panel

DISTRIBUTION

Name	Organisation
Working Group Members	Various
CUSC Panel Members	Various

I. CONTENTS TABLE Page

1.0 Executive Summary and Recommendations of Working Group

1.1 All licensed generators are required to provide the service of mandatory frequency response as set out in CC.8.1 of the Grid Code. Prior to the introduction of NETA it was recognised that generators would incur imbalance charges under the BSC when mandatory frequency response was provided. A mechanism was introduced at NETA Go-live that was intended to compensate generators for this imbalance exposure due to providing response. This mechanism was implemented via the NETA Implementation Scheme in the Mandatory Services Agreements (MSA) and codified into the CUSC.

1.2 Under NETA, imbalance charges arise for a number of reasons, frequency response provision being just one of them. However, following the introduction of NETA, a number of providers raised concerns that the level of imbalance compensation as calculated by the mechanism did not adequately reflect the actual imbalance charges incurred as a result of providing frequency response. In order to address these concerns, these arrangements were reviewed by an informal, pre-CUSC Working Group and resulted in the submission of CUSC Amendment Proposal CAP001 by National Grid. The Amendment proposed changes to the calculation methodology in order to provide a better approximation of the assumed energy imbalance used to calculate compensation payments. CAP001 followed the Urgent Amendment Procedure and was approved by the Authority on 15 November 2001 with an effective implementation date of 21 September 2001.

1.3 Prior to Authority approval of CAP001, First Hydro Company submitted CUSC Amendment Proposal CAP009 that proposed further changes to the methodology used for calculating imbalance volume. The Amendment was proposed by First Hydro as they believed that neither the mechanism put in place at NETA go-live nor that proposed in CAP001 accurately reflected the actual volume of mandatory frequency response delivered.

1.4 The frequency response tables contained in Ancillary Services Agreements contain tested values of response capability relative to a ramped change in frequency. First Hydro suggested that for certain types of plant (whose output continues to increase after the 10 second cut-off in Primary and High frequency response tables) the Primary, Secondary and High frequency table approach was inappropriate for calculating the volume of energy delivery over a period a time. The amendment therefore proposed to include an additional set of tables in the Mandatory Services Agreement that describes the response delivery for generators during normal ‘frequency following’. This data would then be used in the calculation of delivered frequency response volume.

1.5 In accordance with the Terms of Reference provided by the Amendments Panel (see Annex 2), the Standing Group considered whether Amendment Proposal CAP009 better facilitates achievement of the Applicable CUSC Objectives when compared to the extant mechanism for calculating imbalance volumes (following implementation of CAP001). In undertaking this exercise, the BSSG also considered whether any Alternatives to CAP009 existed. Furthermore, the Standing Group also reviewed the implementation of CAP001 in line with the requirements of paragraph 8.21.8 of CUSC (due to the fact that CAP001 had followed the Urgent CUSC Amendment Proposal procedure).

1.6 Further to three Standing Group meetings and associated debate and correspondence, it is the combined view of the Standing Group that the current mechanism for frequency response imbalance compensation should be modified as follows:

(i) The response energy calculations set out in the CUSC should refer to a new set of Power Delivery tables to be included in the Mandatory Services Agreements (MSA's);

(ii) When used in the imbalance compensation calculations, the values in the new Power Delivery tables should aim to mimic response energy delivered by the generator; and

(iii) The values in the Power Delivery tables should be submitted by service providers and bilaterally agreed with National Grid. Changes to these Power Delivery values can be requested by either party in line with existing arrangements.

1.7 The BSSG recommends the CUSC Panel to:

(i) Endorse the Amendment Proposal CAP009 as detailed in this document and in the corresponding CUSC Amendment Proposal;

(ii) Approve that Amendment Proposal CAP009 proceeds to wider Industry consultation;

(iii) Note that the BSSG also considered a potential Alternative Amendment of using a metered volume approach to determine the response energy. The majority view of the BSSG was that this approach would not be formally proposed as a Alternative Amendment; and

(iv) Progress an Alternative Amendment Proposal for CAP001 which addresses an oversight in the legal drafting which removed certain adjustment factors from the imbalance calculations.

2.0 Introduction

2.1 The Balancing Service of mandatory frequency response is set out and described in Connection Condition 8.1 of the Grid Code. All licensed generators are required to provide mandatory frequency response.

2.2 A mechanism was introduced at NETA Go-live which was intended to compensate generators for imbalance charges incurred under the Balancing and Settlement Code (BSC) when mandatory frequency response was provided. The mechanism (known as imbalance compensation) was discussed and agreed at a sub-group of the Transmission Users' Group (TUG), and was subsequently implemented via the NETA Implementation Scheme in the Mandatory Services Agreements (MSA) and codified in the CUSC.

2.3 Under NETA, imbalance charges arise for a number of reasons, frequency response provision being just one of them. However, a number of providers raised concerns that the level of imbalance compensation as calculated by the mechanism, did not, in certain circumstances, adequately reflect the actual imbalance charges incurred under the BSC as a result of actual provision of frequency response. As a consequence, some generators indicated their concern in continuing to provide this mandatory service when the costs of provision were not necessarily adequately compensated.

2.4 Following an informal pre-CUSC working group, National Grid submitted Amendment Proposal CAP001 (Frequency Response Imbalance Payments) which proposed a number of improvements to the volume part of the mechanism. CAP001 followed the Urgent Amendment Procedure and was approved by the Authority on the 15 November 2001 with an implementation date of 21 September 2001.

2.5 Amendment Proposal CAP009 (Mandatory Frequency Response) was submitted by First Hydro and proposes further changes to the imbalance compensation mechanism. At their meeting on 9 November 2001, the CUSC Amendments Panel considered CAP009 and determined that the Balancing Services Standing Group (BSSG) should be actioned to act as a Working Group to consider the Amendment Proposal.

2.6 The CUSC Panel also noted the close relationship between Amendment Proposals CAP009 and CAP001 (which at the time was under consideration by the Authority). In view of this, the Panel thought that in the event CAP001 was implemented, the CAP001 Review (which would be required under paragraph 8.21.8 of CUSC due to the fact that CAP001 had followed the Urgent CUSC Amendment Proposal procedure) could potentially be combined with the consideration of CAP009.

2.7 Subsequently, at their meeting on 7 December 2001 (following the Authority's approval of CAP001), the CUSC Panel agreed that CAP009 could be viewed as an Alternative to CAP001. In view of the fact that the BSSG had already been actioned to act as a Working Group to consider CAP009 and any Alternatives, the requirements of 8.21.8 of the CUSC (to review CAP001) would be satisfied. This report is intended to meet the requirements of both 8.17.10 (in respect of CAP009) and 8.21.8 (in respect of CAP001).

3.0 Purpose and Scope of Report

3.1 At the CUSC Amendments Panel meeting of 9 November 2001, the CUSC Panel determined that the Balancing Services Standing Group (BSSG) should be actioned to act as a Working Group to consider the Amendment Proposal. The BSSG was issued with an additional set of Terms of Reference in respect of CAP009 (see Annex 2).

3.2 In accordance with the Terms of Reference provided by the Amendments Panel, the BSSG has considered whether Amendment Proposal CAP009 better facilitates achievement of the Applicable CUSC Objectives when compared to the extant mechanism for calculating imbalance volumes (following implementation of CAP001). In undertaking this exercise, the BSSG has also considered whether any Alternatives to CAP009 exist.

3.3 This report summarises the findings and recommendations of the BSSG in respect of their consideration of Amendment proposal CAP009 and in respect of the CAP001 Review. The report has been prepared in accordance with the terms of the CUSC. An electronic copy of this document can be found on the National Grid website, at http://www.nationalgrid.com/uk/indinfo/cusc/index.html.

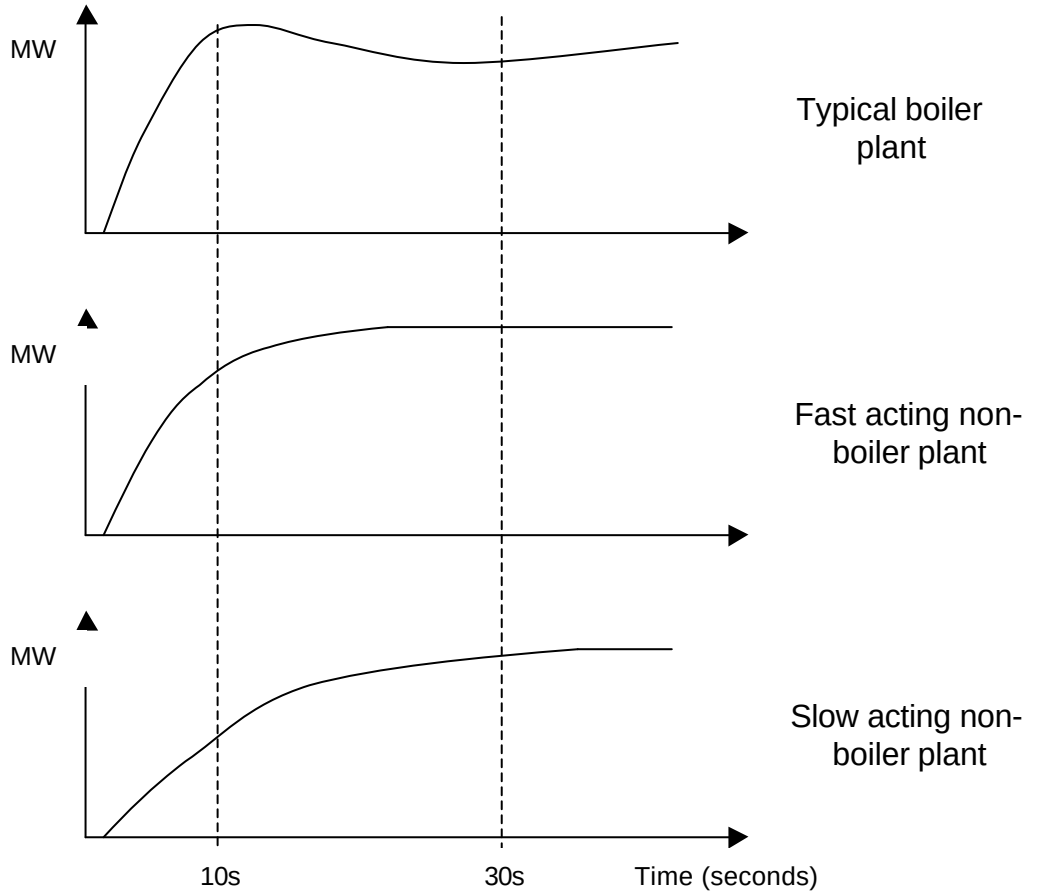
4.0 Description and Assessment Against CUSC Objectives

4.1 The Proposed Amendment Proposal

4.1.1 The current methodology for calculating the actual volume of energy delivered by a generator when it is providing mandatory frequency response is based on the Primary, Secondary and High frequency matrix values contained in the Mandatory Services Agreements (MSAs). The matrix values are determined by 'Compliance' testing, witnessed by National Grid in accordance with the Grid Code. These values are based on the response capability of generating units at a period of 10 seconds and 30 seconds after a low frequency incident (referred to as Primary and Secondary Response) and 10 seconds after a high frequency incident (referred to simply as High Frequency Response).

4.1.2 The compliance tests and resultant matrix tables included in the MSAs were devised to enable National Grid to determine the total quantity of frequency response that was needed on the system at any one time. This enables National Grid to instruct enough frequency response to cater for the instantaneous loss of the largest infeed of generation or demand i.e. to contain and recover large frequency deviations.

4.1.3 It is a Grid Code requirement that all generation is capable of operating in frequency sensitive mode. However, the output characteristics from different types of generating plant can vary quite significantly according to its primary fuel type and control system design. Typically, conventional 'boiler-plant' has a capability for storing significant quantities of energy that can be delivered in a short duration (i.e. primary response from coal or oil fired generating plant). However, in contrast, delivery from Hydro and CCGT generating plant is dependent on the rate of increase of primary fuel flow, meaning that for 'non-boiler-plant', any response energy is typically delivered in a more gradual manner. These typical response delivery characteristics are shown graphically below:



4.1.4 This means that the use of primary and secondary response values to calculate the response energy delivered over a period of time can be inappropriate for certain plant types. From the graphs above it can be seen that the Primary response value can be significantly lower than the steady state response output for slow acting non-boiler plant.

4.1.5 The matrix tables were not designed for the purpose of accurately calculating the volume of response energy produced by a generator over a period of time when it is operating in frequency sensitive mode and responding continuously to minor frequency fluctuations. To overcome this issue it is proposed that an additional set of Power Delivery tables are contained in the MSA and used in the imbalance compensation calculations. These values should aim to mimic the energy delivered by the generating unit when following frequency deviations (Annex 3 illustrates the new Power Delivery tables). The mechanism will continue to use the per-minute, dual linear interpolation methodology as introduced by CAP001.

4.1.6 The values are to be proposed by the service provider and agreed with National Grid. The CAP009 methodology also allows for the service provider or National Grid to propose revisions to the matrix values, in light of experience, in accordance with the existing amendment provisions set out in the CUSC.

4.2 Alternative Amendments

4.2.1 In accordance with the Terms of Reference for the Standing Group, the BSSG also considered whether any Alternatives to CAP009 exist. Although no 'direct' Alternative Amendments were put forward by the BSSG members, National Grid did table a CAP009 'add-on' proposal that builds on the work already carried out in respect of CAP001 and CAP009. This proposal is known as the 'Metered Volume Approach'.

4.2.2 National Grid explained that to accurately calculate the delivered response energy volume over a period of time is a difficult task. A generator's actual responsive output is dependent on not only the frequency deviation at a point in time, but also the duration of the deviation and the size of deviations that have previously occurred. Although it may be possible to accurately model this characteristic over relatively short time periods, to do this over the longer periods of time required for settlement purposes is not feasible.

4.2.3 The proposed method compares the BMU's actual imbalance (metered output - expected output) to the calculated response energy volume (subject to a tolerance). This 'add-on' attribute could be applied alongside the current methodology or with the CAP009 methodology. National Grid argued that by creating a link to the actual metered imbalance a further degree of accuracy could be achieved. The proposal is explained in greater detail in Annex 5.

4.2.4 In accordance with the Terms of Reference of the group, the BSSG also reviewed CAP001 (required under paragraph 8.21.8 of CUSC due to the fact that CAP001 had followed the Urgent CUSC Amendment Proposal procedure). One member of the BSSG highlighted an issue with the legal drafting of the CUSC due to implementation of CAP001. This member explained that the way the calculations for imbalance volumes had been revised had led to the adjustment factors K_T and K_{GRC} and the shortfall factors SF_P, SF_S and SF_H being no longer applied to the imbalance calculation. These factors are set out in paragraph 4.1.3.9 of the CUSC and serve the following purposes:

- K_T is the ambient temperature adjustment factor and is currently set at 1 until such time that an appropriate methodology for use is developed and agreed;
- K_{GRC} is the plant configuration factor where the BM unit is a CCGT and values are contained in the MSA; and
- SF_P, SF_S and SF_H are shortfall factors relating to Primary, Secondary and High frequency response and currently set at zero until such time that an appropriate methodology for use is developed and agreed.

4.2.5 National Grid stated that the oversight was not material, as K_T, SF_P, SF_S and SF_H are not currently active. The plant configuration factor (K_{GRC}), although active, is rarely used in practice.

4.2.6 The BSSG agreed that this was an oversight in the legal drafting for CAP001 due to the tight time-scales in which this urgent modification was progressed. The BSSG concluded that an Alternative Amendment Proposal for CAP001 should be proposed which addresses this issue, and reflects the intention of CAP001.

4.3 Working Group Views and Discussion

Assessment

4.3.1 The BSSG agreed that to assess the merits of CAP009 it was necessary to undertake some analysis to compare the accuracy of the CAP009 methodology with that of CAP001 (the extant position). In view of this, some of the BSSG generator representatives provided the additional 'Power Delivery' matrix information required under CAP009 to National Grid who calculated the frequency response imbalance volume for the different power stations under both the CAP001 and CAP009 methodologies. These results were then plotted against the metered output of the power stations together with a system frequency trace to allow comparisons of the two different methodologies to be made.

4.3.2 It should be noted that this was a limited exercise covering only a small number of generating units over a relatively short period of time. Clearly, the accuracy of the CAP009 methodology is dependent on the accuracy of the values in the Power Delivery tables, submitted by service providers. However, the Working Group concluded from this limited exercise that CAP009 has the potential to provide a better approximation of response energy volume than CAP001. Furthermore, CAP009 can utilise default arrangements which have exactly the same effect as CAP001. Annex 4 shows some of the graphs produced from this exercise with comments and narrative.

Implementation

4.3.3 CUSC Amendment Proposal CAP009 will also require changes to MSA's. National Grid legal advice indicates that these changes can be effected if CAP009 is implemented. Sub-Clause 7.2 of the MSA indicates that National Grid and the User shall effect any amendment required to the made to the MSA as a result of a change to the CUSC.

4.3.4 Upon implementation of CAP009, it should be possible for service providers to default to the extant methodology (i.e. using the existing response values within the MSA). This could be achieved by initially populating the new Power Delivery tables (see Annex 3) with values

derived from the existing frequency response capability tables. For the avoidance of doubt:

- The new Primary Response Power Delivery table shall initially be populated with Primary Response data values (for corresponding frequency deviation and generator de-load) from the existing Low Frequency Response table;
- The new Primary & Secondary Response Power Delivery table shall initially be populated with the average of the Primary and corresponding Secondary Response data values (for corresponding frequency deviation and generator de-load) from the existing Low Frequency Response table; and
- The new High Frequency Response Power Delivery table shall initially be populated with the High Frequency Response data values (for corresponding frequency deviation and generator de-load) from the existing High Frequency Response table.

4.3.5 The BSSG agreed that the values contained within the new Power Delivery tables should be subject to the same procedure for amending levels of response as that currently described in CUSC. This states that National Grid or the User shall have the right to request levels of response be reviewed/amended. This is set out in CUSC paragraphs 4.1.3.13 to 4.1.3.16. These paragraphs will require amending to reflect the introduction of these new tables.

4.3.6 National Grid and another member expressed concerns that the values contained in the new Power Delivery tables would be untested values, submitted by service providers. They argued that the submitted values could be difficult to validate and could lead to a number of disputes being raised. In addition, use of untested values would not place the correct incentives on either service providers or National Grid to agree accurate values. Under a mechanism whereby imbalance exposure is refunded to service providers by National Grid, providers would be encouraged to overstate the levels of response in the Power Delivery tables whilst National Grid would be encouraged to minimise the values. However, BSSG members noted that results obtained from Grid Code compliance testing could be used by National Grid as a 'check' that any submitted values were broadly in line with plant characteristics.

4.3.7 Notwithstanding the above, National Grid and another member of the BSSG suggested that correct incentives could be created if CAP009 was approved coincident with the approval of BSC Modification P34 or P36. Without such coincident approval, they stated that they would not support CAP009. Despite these concerns, the majority of BSSG members stated their support for CAP009 (with or without any coincident BSC Modifications) as they believed that the CUSC Objectives were better achieved under CAP009 when compared to the extant position.

Metered Volume Approach

4.3.8 The BSSG debated the Metered Volume Approach as an add-on to the CAP009 methodology. National Grid argued that to accurately calculate the delivered response energy volume over a period of time is a difficult task. National Grid suggested that the mechanism should reflect this difficulty by creating a link to the actual metered imbalance. This view was supported by a number of BSSG members.

4.3.9 However, some members of the BSSG did not support the approach. These members argued that the tolerance band would disadvantage good providers of response and provide the wrong incentives. Furthermore, the introduction of such an approach would over-complicate the mechanism. National Grid disagreed with these views and suggested that the tolerance band could be made small enough such that good providers were not disadvantaged. In addition, introducing such an approach would be relatively simple to implement within Settlement Systems.

4.3.10 National Grid also argued that the approach would further reduce the risk of exposure to imbalance due to providing mandatory frequency response. In addition, National Grid stated that this metered volume approach would also work with BSC Modification P34 and reduce the volume risk, associated with over or under delivery, that P34 might introduce. Some members of the BSSG did not support this argument and suggested that service providers should be allowed to reflect this risk in their Bid/Offer prices (i.e. implementation of CAP010 or P36 to value response energy at Bid/Offer prices).

CAP001 Review

4.3.11 The BSSG discussed the inclusion of the adjustment factors K_T and K_{GRC} and the shortfall factors SF_P, SF_S and SF_H in the imbalance calculation (described in paragraph 4.2.4 above). The BSSG agreed that this was an oversight in the legal drafting for CAP001 arising due to the tight time-scales in which CAP001 was progressed as an urgent modification. The BSSG concluded it was appropriate that the factors continue to be included in the calculations for frequency response imbalance compensation.

Conclusion

4.3.12 There was general agreement within the BSSG that the methodology as proposed by CAP009 would provide a better methodology for approximating the actual imbalance incurred when providing mandatory frequency response. Furthermore, any generator that is of the view that the current CAP001 methodology is accurate may still use the same data for the purposes of the calculation of imbalance volume (i.e. the CAP001 methodology remains the default position).

4.3.13 On the basis of the views of the majority, the BSSG agreed that the Metered Volume Approach (in addition to the CAP009 methodology) would not be put forward as an Alternative Amendment Proposal by the Standing Group, although it was agreed to highlight this alternative to the panel.

4.3.14 The BSSG debated the interaction of CAP009 (and alternative) with other relevant modifications (i.e. CAP010, P34 & P36). The BSSG agreed that although it is important that these interactions are fully debated and understood, it should be noted that the CAP009 proposal (and alternative) has been assessed against the CUSC objectives in isolation.

4.3.15 The BSSG concluded that an Alternative Amendment Proposal for CAP001 should be proposed which addresses an oversight in the legal drafting and reflects the intention of CAP001.

4.4 Assessment against Applicable CUSC Objectives

4.4.1 The BSSG considered whether the Amendment Proposal as tabled would better meet the achievement of the Applicable CUSC Objectives, and concluded that it would. In reaching this conclusion, the group took due account of the views of the original proposer, all representations received from interested parties and the views of the Standing Group itself. These views are reflected in the assessment below.

4.4.2 The applicable CUSC Objectives are set out in paragraph 1 of Condition C7F of the Transmission Licence. CUSC Amendments should better facilitate achievement of the Applicable CUSC Objectives. These can be summarised as follows:

(a) the efficient discharge by NGC of the obligations imposed on it by the Act and the Transmission Licence; and

(b) facilitating effective competition in the generation and supply of electricity, and (so far as consistent therewith) facilitating such competition in the sale, distribution and purchase of electricity.

Original Proposer's Views

4.4.3 The proposer (First Hydro Company) originally put forward the view that the Amendment Proposal better facilitated achievement of the Applicable CUSC Objectives set out in Condition C7F. This was on the grounds that the Transmission Licence obligates National Grid to purchase ancillary services from the most economical sources available to it having regard to the quantity and nature of the ancillary services. The proposed amendment would better facilitate the efficient discharge of this Licence Obligation by aligning more accurately

payments made with costs incurred, as the volume would now be more accurately calculated. This in turn would ensure that the most economic sources of mandatory response continue to make their full capability available for despatch by National Grid.

Respondent's Views

4.4.4 No representations were received outside of the Standing Group regarding the Proposed Amendment.

Working Group's Views

4.4.5 The BSSG believe that Amendment Proposal CAP009 better facilitates achievement of Applicable CUSC Objectives set out in Condition C7F. This is on the same grounds as detailed in paragraph 4.4.3 above.

4.4.6 National Grid and another member of the BSSG believed that Amendment Proposal CAP009 could only better facilitate achievement of the Applicable CUSC Objectives if implemented coincident with BSC Modification P34/P36. These members suggested without P34/P36 the incentives upon service providers and National Grid would not be correct (as described in paragraph 4.3.6) and therefore compensation payments would not align with costs incurred by providers.

5.0 Proposed Implementation and Timescales

5.1 As discussed in paragraph 4.3.3, CAP009 will also require a change to the bilateral MSAs between National Grid and each service provider. Prior to CAP009 becoming effective it is therefore required that revised MSA's be drafted.

5.2 As discussed in paragraph 4.3.4, the BSSG considered it was appropriate that CAP009 be implemented by defaulting numbers in the new Power Delivery tables from the existing matrix values. The BSSG agreed that, should the Authority decide to approve CAP009, the determination should include appropriate wording such that National Grid is directed to make such amendments to the extant MSA's. Service providers can then request changes to these tables (should they wish to) in line with the existing provisions of the CUSC following implementation of CAP009. These changes would then be bilaterally agreed between National Grid and the service provider.

5.3 The BSSG also agreed that, should the Authority decide to approve CAP009, the effective implementation date should allow a short period of time to allow National Grid to draft revised MSAs. National Grid has indicated that this period be no less than 10 business days.

6.0 Impact on CUSC

6.1 The proposed amendment will require modification of certain clauses within Section 4.1.3 of the CUSC (calculation of payments and payment formulae). The relevant legal wording is currently being drafted and will be provided in the consultation document. In addition, all Mandatory Services Agreements will need to include an additional matrix (see Annex 4) to contain the new Power Delivery values. Such matrix values will need to be agreed between the generators and National Grid on a bilateral basis.

7.0 Impact on Core Industry Documents

7.1 This Amendment Proposal will impact on Ancillary Services Agreements i.e. the MSA that is listed as a Core Industry Document. This impact is described in paragraphs 4.3.3, 5.1 and 6.1.

7.2 It is envisaged that the Amendment Proposal will have no impact on any other key industry documentation.

8.0 Impact on Industry Computer Systems

8.1 National Grid has undertaken an impact assessment of Amendment Proposal CAP009 and the metered volume approach on its Balancing Services Settlement Systems. The cost and time-scales for implementation are summarised in the table below:

	Cost	**Time**
CAP009	£65k	4 months
Metered Volume Add On	£10k	-

8.2 It is also expected that changes are required to the validation systems of service providers. This has not been considered in the report.

Annex 1 – Amendment Proposal

Amendment Proposal Form

Those wishing to propose an Amendment to the CUSC should do so by filling in this "Amendment Proposal Form" that is based on the provisions contained in Section 8.15 of the CUSC. The form seeks to ascertain details about the Amendment Proposal so that the CUSC Panel can determine more clearly whether the proposal should be considered by a Working Group or go straight to wider National Grid Consultation.

The Panel Secretary will check that the form has been completed, in accordance with the requirements of the CUSC, prior to submitting it to the Panel. If the Panel Secretary accepts the Amendment Proposal form as complete, then he will write back to the Proposer informing him of the reference number for the Amendment Proposal and the date on which the Proposal will be considered by the Panel. If, in the opinion of the Panel Secretary, the form fails to provide the information required in the CUSC, then he may reject the Proposal. The Panel Secretary will inform the Proposer of the rejection and report the matter to the Panel at their next meeting. The Panel can reverse the Panel Secretary's decision and if this happens the Proposer will be informed by the Panel Secretary.

The completed form should be returned to:

Mark Cox
Panel Secretary
Commercial Development
National Grid Company plc
National Grid House
Kirby Corner Road
Coventry, CV4 8JY

Or via e-mail to:

CUSC.Team@uk.ngrid.com

(Participants submitting this form by email will need to send a statement to the effect that the proposer acknowledges that on acceptance of the proposal for consideration by the Amendments Panel, a proposer which is not a CUSC Party shall grant a licence in accordance with Paragraph 8.15.7 of the CUSC. A Proposer which is a CUSC Party shall be deemed to have granted this Licence.)

Proposers Name:
(Name of party making the proposal. An Amendment Proposal may be made by a CUSC Party, a BSC Party or by "energywatch")

First Hydro Company

Proposers Representative:
(The name of the person representing the Proposer (and his alternate) for the purposes of the Amendment Process)

Simon Lord (Alternate - Libby Glazebrook)

Organisations Name and Address:
(Organisation on whose behalf the Amendment is proposed)

First Hydro Company
Bala House
St Davids Park
Deeside
Flintshire
CH5 3XJ

Capacity in which the Organisation Proposes to make an Amendment:
(i.e. CUSC Party, BSC Party or "energywatch")

CUSC Party

Description of the issue or defect which the proposed Amendment seeks to address:
(This should be in reasonable, but not excessive detail)

Neither the current mechanism nor that proposed in CAP001 accurately reflect imbalance volume that occurs as a result of the provision of mandatory frequency response.

For certain types of plant the output of the plant continues to increase after the 10s cut off in the Primary and High frequency response tables. It is these tables that this proposal seeks to modify by cutting the link between the Primary and High frequency response tables and the payment volume. A new set of tables would be produced that would more accurately reflect the energy produced when providing mandatory frequency response.

Description of the proposed Amendment and of its nature and purpose:
(This should be in reasonable but not excessive detail)

Two methods could be used to determine the volume:

1) The characteristic curve of the BMU could be used that tracks output with changing frequency.

2) An approximation for 1) could be used that produces for each BMU a new pair of tables (for each mode of operation) based on the format of the High Frequency Response table. These tables (High Frequency Volume and Low Frequency Volume) would initially contain the same data as the current Primary and High Frequency Response tables.

The tables would then be re-populated with data based on the stable output that is achieved by the BM unit following a change in frequency. The effect of this would be to move the 10-second cut off for Primary and High Frequency Response to a different time, based on the time to achieve stable output.

It is suggested that method **2)** could be used as a step towards the ideal solution detailed in **1)**.

An indication of those parts of the CUSC which would require amendment in order to give effect to (or would otherwise be affected by) the proposed amendment and an indication of the nature of those amendments or effects.
(This should be given where possible)

Section 4.1.3 – calculation of volume's formulae. Amendment required to reflect revised tables that will be used for calculating the volumes for delivery of energy as outlined above.

Modification of the CUSC Mandatory Services agreement to reflect the inclusion of High Frequency Volume and Low Frequency Volume tables.

Reasons why the Proposer believes that the proposed Amendment would better facilitate achievement of the Applicable CUSC Objectives as compared with the current version of the CUSC with background information in support thereof.

The Transmission Licence obligates National Grid to purchase ancillary services from the most economical sources available to it having regard to the quantity and nature of the ancillary services.

This proposed amendment would better facilitate the efficient discharge of this licence obligation by aligning more accurately payments made with costs incurred, as the volume would now be more accurately calculated.

This in turn will ensure that the most economic sources of mandatory frequency response continue to make their full capability available for despatch by National Grid.

An indication of the impact of the proposed Amendment on Core Industry Documents.
(This should be given where possible)

No impact on BSC, Grid Code or any other core industry document is foreseen.

An indication of the impact of the proposed Amendment on relevant computer systems and processes used by CUSC Parties.
(This should be given where possible)

The proposed amendment will require modification to the payment calculation system (GENRES) used by National Grid to calculate the Frequency Response payments.

A statement to the effect that the Proposer acknowledges that on acceptance of the proposal for consideration by the Amendments Panel a Proposer shall grant a Licence in accordance with Clause 8.15.7 of the CUSC.
(A signature to this effect must be given by a proposer which is not a CUSC Party)

Annex 2 – Working Group Terms of Reference

CAP009: Mandatory Frequency Response
Balancing Services Standing Group - Terms of Reference Paper

Introduction

1. CUSC Amendment Proposal CAP009 puts forward an alternative mechanism to calculate the Imbalance Volume that occurs as a result of the provision of Mandatory Frequency Response. At the 9th November 2001 Amendments Panel meeting, the Amendments Panel decided that the Balancing Services Standing Group (BSSG) should be actioned to consider whether Amendment Proposal CAP009 better facilitates achievement of the Applicable CUSC Objectives when compared to the current mechanism (following implementation of CAP001).

2. This paper outlines the terms of reference that the BSSG should work to regarding CAP009.

Relationship with Amendments Panel

3. The Standing Group shall seek the views of the Amendments Panel before taking on any significant amount of work. Where the Standing Group requires instruction, clarification or guidance from the Amendments Panel, particularly in relation to their Scope of Work, the Standing Group Chairman should contact the CUSC Panel Secretary.

Meetings

4. The Standing group shall develop and adopt its own internal working procedures and provide a copy to the Panel Secretary for each of its Amendment Proposals.

Terms of Reference

5. The BSSG has been actioned to act as a Working Group to consider CAP009 in line with the Amendment Procedures described in Section 8 of the CUSC.

6. Consideration of CAP009 will also include the consideration of any Alternative Amendment to Urgent Amendment Proposal CAP001 in accordance with 8.21.8 of the CUSC.

7. In progressing the Amendment Procedures in respect of CAP009, the BSSG should be cognizant of the Standing Terms of Reference of the BSSG.

8. The BSSG Chairman should, in line with the CUSC be responsible for producing a Working Group Report with recommendations. The report should be submitted to the Panel Secretary by 9th February 2002 for circulation to Panel Members and the Conclusions of such report should be presented to the Amendments Panel meeting scheduled for 22nd February 2002. The report should be written with reference to Section 8.17 of The CUSC.

Annex 3 – Sample Power Delivery Tables

As described in paragraph 4.1.5, the Amendment Proposal requires generators and National Grid to agree on a new set of Power Delivery tables and values to be used for the purposes of calculating imbalance volumes. The imbalance calculations will continue to be based upon the per-minute, dual linear interpolation methodology as introduced by CAP001. A blank pro-forma outlining the additional data that is required under CAP009 is shown below. Such a table will need to be incorporated into each generator's Mandatory Services Agreement (MSA). By default these tables will be populated with values from the existing response capability tables.

Three sets of values are required to cover the possible combinations of frequency response holding (Primary & High or Primary, Secondary & High).

Sample Power Delivery Table

BM Unit(s):						

Primary Response Power Delivery – Mode A						
Frequency Deviation (Hz)	Genset De-load (MW)					
-0.1						
-0.2						
-0.3						
-0.4						
-0.5						

Primary & Secondary Response Power Delivery – Mode A						
Frequency Deviation (Hz)	Genset De-load (MW)					
-0.1						
-0.2						
-0.3						
-0.4						
-0.5						

High Frequency Response Power Delivery – Mode A						
Frequency Deviation (Hz)	Genset De-load (MW)					
+0.1						
+0.2						
+0.3						
+0.4						
+0.5						

Annex 4 – Results of Analysis

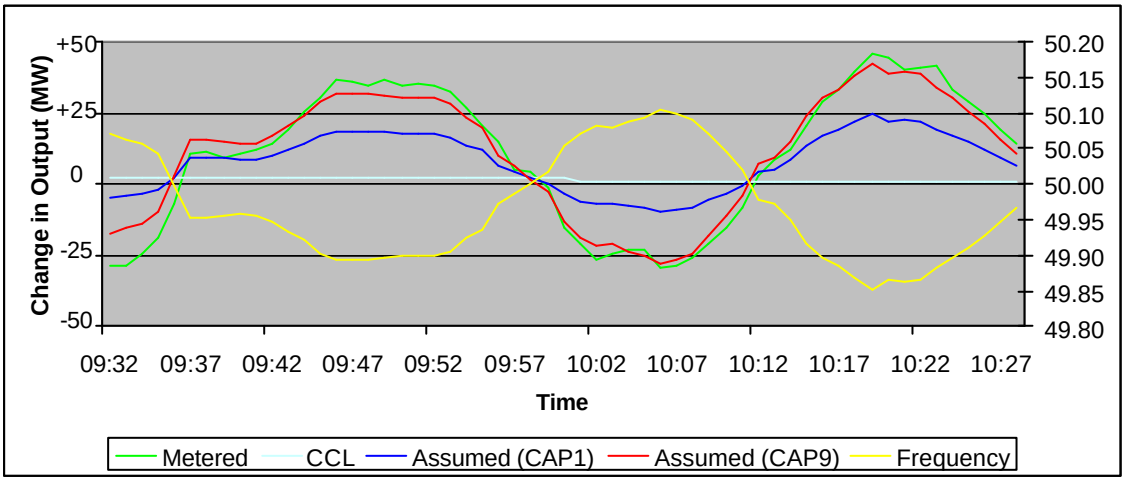
Introduction

As outlined in paragraph 4.3.1, some limited analysis was undertaken in order to investigate and assess the accuracy of the CAP009 methodology against that of CAP001. Please note that although the generator plant type is identified (i.e. coal, CCGT or hydro), the identity of the specific power station is not identified for confidentiality reasons.

Results

Plots from the analysis for three different power stations are provided. Time periods were chosen fairly randomly but in each case the generator in question was selected for frequency sensitive operation and the generators' expected output (without frequency response) or Capped Committed Level (CCL) was reasonably constant. Clearly, there are a number of reasons why a generator will deviate away from it's expected output, frequency response being just one. Therefore, when assessing these plots, the reader should consider whether the generator would have following it's CCL if it were not in frequency sensitive mode e.g. by looking at metered output at times when frequency deviation was zero. A brief commentary is provided for each plot.

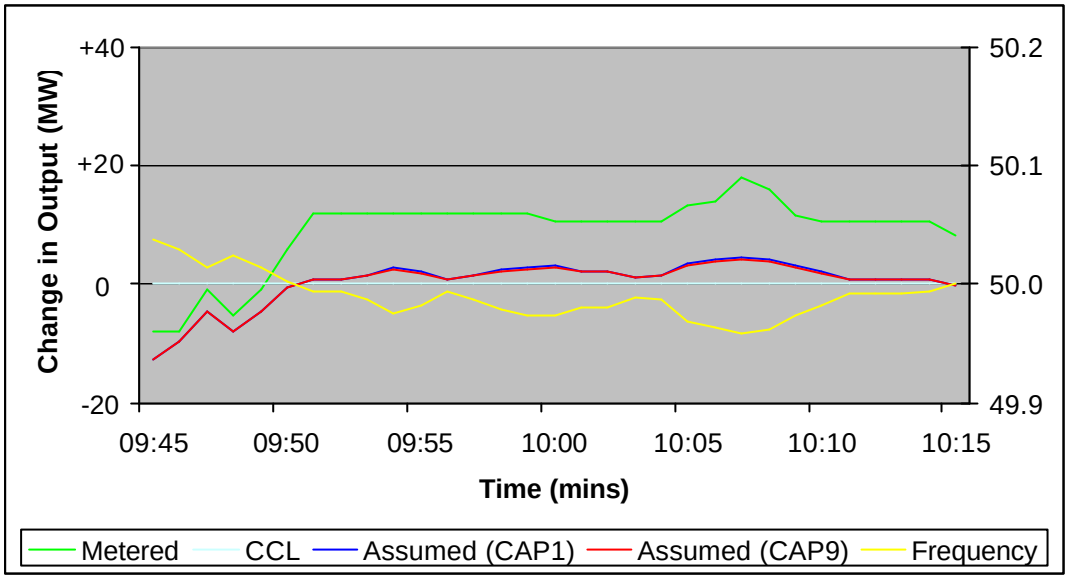
(i) CCGT Station



Comments:

Generator appears as if it would have followed CCL if it were not frequency sensitive. CAP001 methodology seems to understate volumes of both low and high frequency response. CAP009 methodology tracks metered output much more closely.

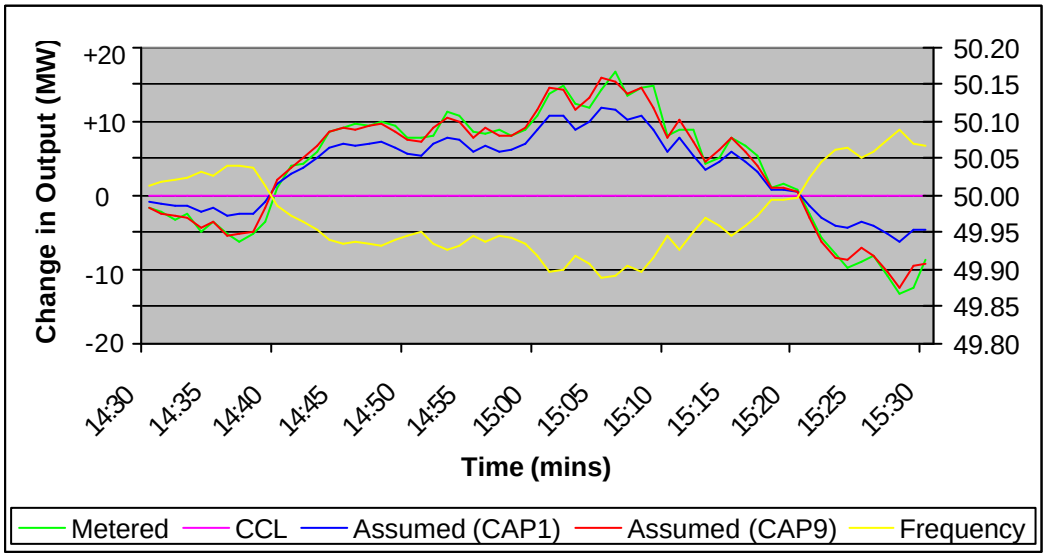
(ii) Coal Station



Comments:

Generator looks as if it may not have followed CCL even if not frequency sensitive. CAP001 and CAP009 methodologies give similar results, probably because Primary, Secondary and steady state response values are about the same.

(iii) Hydro Station



Comments:

This generator appears as if it would have followed CCL if it were not frequency sensitive. The plot clearly shows the CAP009 calculated output closer to the metered output than CAP001.

Annex 5 – National Grid's 'Metered Volume Approach' Proposal

Proposal to determine Response Energy based on BMU metered output

Paper by National Grid

18 December 2001

Introduction

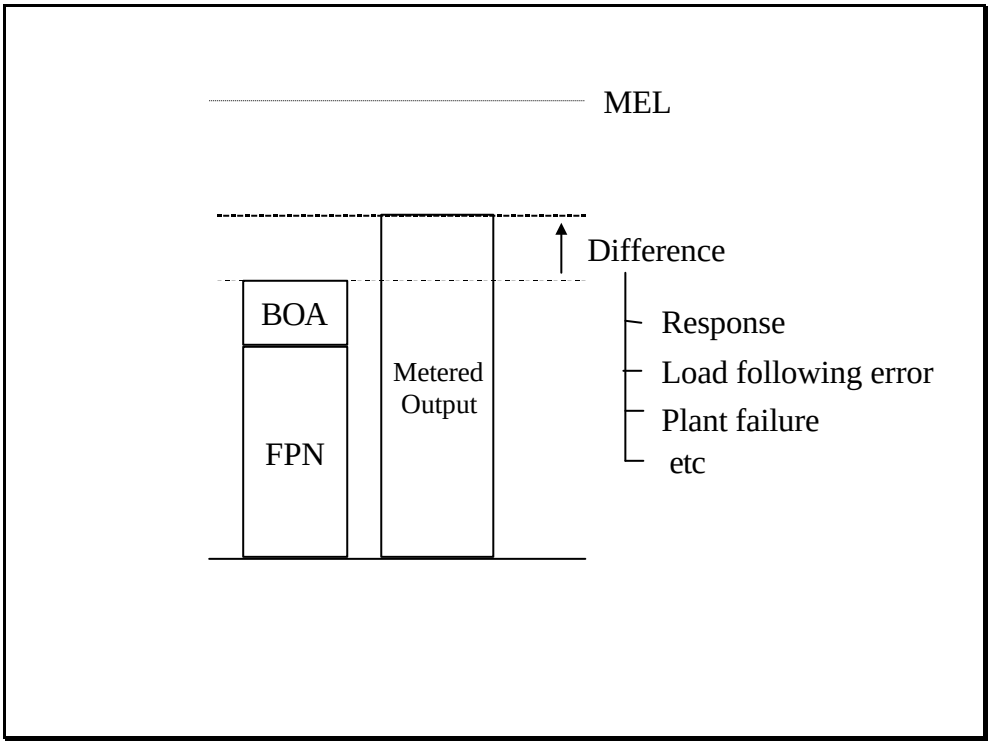
This paper presents an alternative method to determine BMU response energy volume that builds on the work already undertaken with CAP001 and CAP009. The proposed method compares the BMU's actual imbalance (metered – expected) and compares this to the calculated response energy volume (subject to a range).

This paper:

i. Describes the method in more detail;
ii. Shows some examples of how energy would be allocated to response;
iii. Considers potential methods for determining limits to the volume of energy allocated to response; and
iv. Identifies a way forward.

Description of Method

The following diagram indicates the difference between expected and actual output on a BM Unit.



Where "Difference" is Metered Output less FPN and Bid Offer Acceptances capped by MEL.

For a BM Unit, the difference term can be a result of the following elements:

i. Response;
ii. Load Following Error;
iii. Metering Error;
iv. Genset Failure; and
v. Other Reasons.

In order for us to use the difference term as the basis for the volume of response energy delivery, we need to split the difference term into two elements – that due to response delivery, and that due all other reasons.

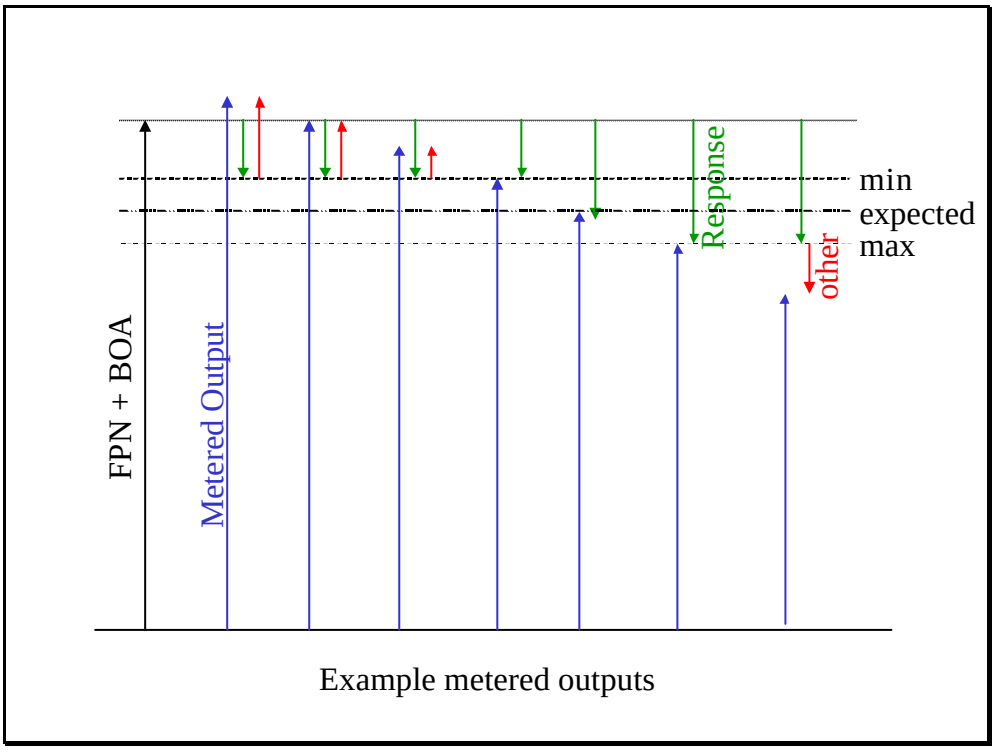
By estimating the minimum and maximum volumes of response that we would expect to be delivered, the amount of the difference term allocated to response can be limited thus:

$$RE = \max\left(\min\left(difference, R_{\max}\right), R_{\min}\right)$$

where R_{max} and R_{min} and the maximum and minimum expected volumes of response delivery respectively. The purpose of this being to ensure that all response energy is correctly identified, but as much energy as possible due to other reasons is excluded.

Examples

The following diagram indicates the volume of energy that this method would allocate to response delivery for a range of possible outputs from a BM Unit.



Example metered outputs

Hence, provided that the output from the BM Unit lies in the expected range for changes in output due to response, the entire difference is allocated to response energy. In the event that the output lies outside the expected range, a volume of energy is allocated to response, such that the response volume is in the expected range and to minimise the volume allocated to non-response.

Determination of expected response delivery range

The minimum and maximum response limits could be determined using the expected frequency response, FR(t), and applying a tolerance, T, as follows:

$$R_{\min} = \int_0^{SPD} (1-T) \times \max(FR(t),0) + (1+T) \times \min(FR(t),0) dt$$

$$R_{\max} = \int_0^{SPD} (1+T) \times \max(FR(t),0) + (1-T) \times \min(FR(t),0) dt$$

For example, if T was set to 0.1 (10%), for a high frequency event, as a minimum we would expect 90% of FR(t) to be delivered, and a maximum of 110% of FR(t) to be delivered.

FR(t) may be determined in a number of ways, for example, in line with its current definition in CUSC (*v1,1, paragraph 4.1.3.9A*), or possibly based on revised tables as proposed in CAP009.

It is noted that there is no fundamental method of determining T.

Conclusions

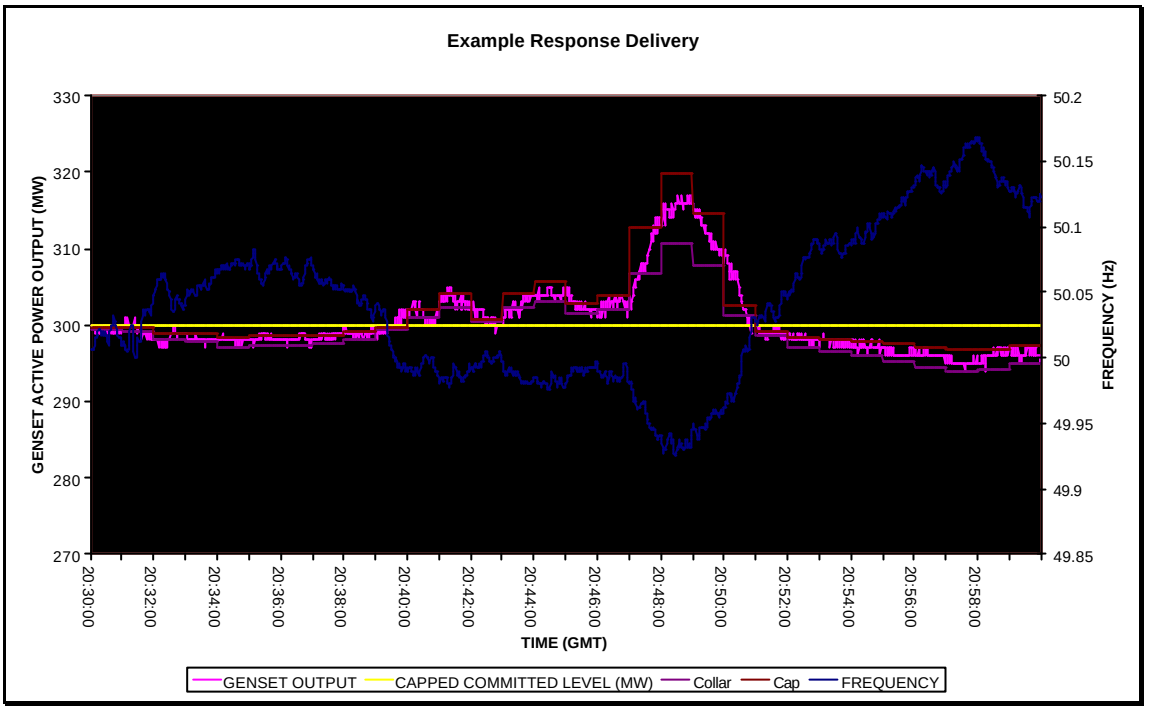
This mechanism for determining the volume of response energy delivered develops on work already undertaken in CAP001 and CAP009.

This mechanism takes into account the fact that an accurate calculation of continuously delivered response energy is all but impossible to achieve. For example, response delivery is effected by previous frequency deviations and the duration of frequency deviations which is not considered in the CAP001/CAP009 approach. In the single example considered, where a generator failed part way through a settlement period, the error introduced into the imbalance exposure was less than 0.1%.

There would be a benefit in using the output from real BM units to determine the mechanism's effectiveness at identifying response volumes.

This method is compatible with P34 and potentially removes some of the risk associated with response delivery under this mechanism.

Appendix – Example Application



The above illustration shows a generator operating in mandatory frequency responsive mode (primary, secondary and high) with an FPN of 300 MW. SEL is 280 MW and MEL is 485 MW. There were no Bid Offer Acceptances.

Cap and collar values are shown based on a 30% tolerance, and by application of CAP001 methodology.

Integrating these results over the settlement period gives the following results:

Expected Output (excluding response)	150.00 MWh
Metered Output	150.29 MWh
Difference	0.29 MWh
Expected Response (CAP001)	0.20 MWh
Collar	-0.30 MWh
Cap	0.70 MWh
Energy allocated to response	0.29 MWh
Imbalance*	0.00 MWh

* Assumes contract position is 150 MWh

If the generator had failed 10 minutes into the settlement period, the results would be modified as follows:

	MEL unchanged	MEL redeclared
Expected Output (excluding response)	150.00 MWh	50.00 MWh
Metered Output	49.79 MWh	49.79 MWh
Difference	-100.21 MWh	-0.21 MWh
Expected Response (CAP001)	0.20 MWh	-0.24 MWh
Collar	-0.30 MWh	-0.31 MWh
Cap	0.70 MWh	-0.17 MWh
Energy allocated to response	-0.30 MWh	-0.21 MWh
Imbalance*	-99.91 MWh	-100.00 MWh

* Assumes contract position is 150 MWh

Conclusion

In this example half hour, the proposed method:

i. Where the unit has delivered response whilst followed its CCL, allows the difference between the CCL and the metered output all to be allocated to response energy – this has the effect of completely removing imbalance exposure;

ii. If the set fails to follow its CCL (for example following a breakdown without redeclaring of MEL) the amount of energy allocated to response is potentially minimised to minimise exposure to imbalance. In this example, where a 30% response tolerance was applied, the error introduced to imbalance exposure was less than 0.1%.

Annex 6 – Copy of Representations Received

No representations regarding Amendment Proposal CAP009 have been received from outside the Standing Group.