



WORKING GROUP REPORT

CUSC Amendment Proposal CAP107 Redefinition of Response Energy Payment (REP) For Mandatory Frequency Response

**Prepared by the CAP107 Working Group
for submission to the Amendments Panel**

Amendment Ref	CAP107
Issue	1.0
Date of Issue	11 May 2006
Prepared by	National Grid

I DOCUMENT CONTROL

a National Grid Document Control

Version	Date	Author	Change Reference
0.1	02/05/06	CAP107 Working Group	1st Draft for CAP107 Working Group
1.0	11/05/06	CAP107 Working Group	Final Version of Working Group report for CUSC Panel

b Distribution

Name	Organisation
The Gas and Electricity Markets Authority	Ofgem
CUSC Parties	Various
Panel Members	Various
National Grid Industry Information Website	

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1.0 SUMMARY AND RECOMMENDATIONS

Executive Summary

- 1.1 CAP107 - Redefinition of Response Energy Payment (REP) for Mandatory Frequency Response proposes a change to the calculation of the Response Energy Payment (under section 4.1.3.9A of the CUSC). Under the current arrangements a generator who provides frequency response is paid a Holding Payment for the ability to provide the service and is paid, or pays a Response Energy Payment for changes in output resulting from the response to a change in frequency. The Response Energy is priced at a reference price, which is the time weighted, average of System Sell Price and time weighted average System Sell Price for the preceding calendar month.
- 1.2 The proposed change to the calculation provides for the generator to pay or be paid its first Bid Price for changes in energy output which occur as a result of delivering frequency response for each Settlement Period in which it is required to provide Frequency Response Energy.
- 1.3 The basis for the calculation of the REP was subsequently re-defined by the Working Group as within its Terms of Reference from Bid Price -1 to Offer price -1. For clarity it was therefore agreed that the price to use should be the Offer Price-1 (i.e. the first unwinding offer price associated with the first bid). The Working Group, including the Proposer considered that this clarification was consistent with the terms of reference and as a result did not constitute an alternative to the original proposal.

WGAA A Re-definition of REP Use of Imbalance Prices (SBP for Primary and Secondary Response and SSP for High Frequency Response) per Settlement Period

- 1.4 The Working Group developed an alternative proposal where the basis for the REP would be the actual prevailing SBP or SSP for the half hour settlement period in which the response was called for net of the volume response energy delivered over the half hour. Therefore a generator would be paid SBP for low frequency (Primary and Secondary) response and would pay SSP for providing High Frequency response.

WGAA B Re-definition of REP Use of Market Index Price per Settlement Period

- 1.5 A second Working Group alternative proposal was developed which used the Market Index Price parameter as the basis for REP. The REP would be based on Market Index Price with different multipliers; 0.75 for High Frequency and 1.25 for low frequency, net of the volume of response energy delivered over the half hour in each Settlement Period.

Working Group Recommendation

- 1.6 The Working Group believes that it has met its Terms of Reference, that CAP107 has been fully considered and recommends to the CUSC Panel WGAA B Market Index Price Option and that a Consultation report should proceed to wider Industry Consultation as soon as possible.

2.0 PURPOSE AND INTRODUCTION

- 2.1 This Report summarises the deliberations of the Working Group and describes the Original CAP107 Amendment Proposal as well as the Working Group Alternatives.
- 2.2 CAP107 was proposed by E.ON UK and submitted to the Amendments Panel for their consideration on 16 December 2005. The Amendments Panel determined that the proposal should be considered by the Balancing Services Standing Group (BSSG) acting as a Working Group and that the Group should report back to the Panel meeting within 3 months. This timescale was subsequently extended by two months with the approval of the CUSC Panel and the Authority, to report back to the May 2006 CUSC Panel.
- 2.3 The Working Group held its first meeting on 13 January 2006 and the members accepted the Terms of Reference for CAP107. A copy of the Terms of Reference is provided in Annex 2. The Working Group considered the issues raised by the Amendment Proposal and considered whether the Proposal and the Working Group Alternatives better facilitated the Applicable CUSC Objectives.

Summary of Working Group Meetings held

- 2.4 At the first meeting members agreed to the terms of reference with the inclusion of an additional element to give consideration to the impacts on market participants. Discussions were progressed on the outline elements of the proposal and the related Amendments that had been previously been proposed to the CUSC. Members discussed a number of options as the basis for setting response and holding payments which formed the basis of alternative proposals.
- 2.5 At the second meeting further clarification was provided on the original proposal. An alternative was developed on a payment formula based on SSP/SBP. Initial consideration was given to an alternative proposal applying a common reference price with an indexed fuel differential. To facilitate the consideration of these alternative options a one month extension was granted to the timetable.
- 2.6 At the third meeting it was agreed that the fuel based differential would not be progressed further due to complexity of the solution and the likelihood of it providing the correct answer when compared to the original proposal or the other alternative options that were being considered. The SSP/SBP alternative was discussed and it was agreed that further analysis should be progressed on the Market Index Price option.
- 2.7 At the fourth meeting the group reviewed the analysis in support of the SBP/SSP alternative. Further analysis was requested to consider different multipliers for the Market Index Price option. In order to enable the completion of further analysis a second extension was granted to the timetable.
- 2.8 At the fifth meeting the group agreed the Original and Working Group alternatives to be taken forward and the relevant parameters. The draft legal text was agreed and assessment of all the proposals was made against the CUSC Applicable Objectives.

Current Process for Frequency Response Dispatch

- 2.9 National Grid has a statutory obligation to maintain system frequency within 1% of 50Hz, save in abnormal or exceptional circumstances. Therefore National Grid seeks to normally operate the system frequency in the range 49.8 to 50.2Hz to avoid the risk that, following the largest generation loss, the system frequency would fall to 48.8Hz (at which point the first 5% of customer demand would be tripped).
- 2.10 Under the current arrangements National Grid manages system frequency by two means. Firstly, it accepts Bids or Offers in the Balancing Mechanism to meet predicted demand. However, actual demand will be different from predicted demand and it may change rapidly or generation units may breakdown etc. To contain the change in system frequency as result of these uncertainties, National Grid instructs BMUs and other providers to provide the automatic service of frequency response.
- 2.11 Under the current arrangements the provision of mandatory frequency response is defined as follows:
- Primary Response: delivery of energy between 0 – 10 seconds – requires an increase in output to increase frequency.
 - Secondary Response: delivery of energy between 10 seconds and 30 minutes - requires an increase in output to increase frequency
 - High Frequency Response: reduction of delivery from 10 seconds until instructed otherwise – requires decrease in output to reduce frequency
- 2.12 In managing frequency response dispatch, National Grid has an online information system that optimizes the decision as to which plant to re-load and/or instruct response to control the frequency. The dispatch facility provides advice to the control room on the selection of Frequency Response services to help manage frequency in the most economic and efficient manner possible. An algorithm re-runs approximately every five minutes in support of this process. The facility takes in to account; the holding prices (Primary, Secondary, High), the associated cost of Bids/Offer to move plant and the contracted volume for each genset by deload point. The REP price is not presently optimized because it is a common value applicable to all providers of mandatory frequency response and as such has no bearing on the merit order derived by the facility.
- 2.13 Once the frequency dispatch algorithm has provided an answer, the control room will issue open ended frequency response instructions and, if necessary, the appropriate Bid/Offer Acceptances to move the relevant plant Balancing Mechanism Units' output.

Current Payment Arrangements for Mandatory Frequency Response

- 2.14 Presently, a generator who provides frequency response under Section 4 of the CUSC is paid a Holding Payment for providing the capability and is paid, or pays, a Response Energy Payment (REP) for changes in output which result when the generator actively responds to a change in frequency. Note that the REP volume cannot be metered (because Generator metering is only half-hourly), and so an artificial volume is calculated from the minute-by-minute frequency trace, on the assumption that each responsive generator delivers energy exactly in accordance with the Power Delivery Data Table for that Unit. The REP is priced at a reference price which is the average of the

time weighted average System Buy Price and time weighted average System Sell Price for the preceding calendar month. Conceptually the REP has been designed to reflect the cost of providing the energy.

- 2.15 The two payments for the provision of frequency response are summarised as follows:

Holding Payment – is the payment per minute for providing the service (dependant on combination of response being provided). This is calculated on the basis of the payment rates submitted by providers.

Response Energy Payment - Payment per MWh for deviation in output as a result of providing response. The payment is based on a Reference Price average of SBP and SSP for the previous calendar month.

- 2.16 This Working Group Report has been prepared in accordance with the Terms of the CUSC. An electronic copy can be found on the National Grid Website, www.nationalgrid.com/uk/Electricity/Codes/, along with the Amendment Proposal Form.

3.0 PROPOSED AMENDMENT

- 3.1 CAP 107 proposes a change to the calculation of the Response Energy Payment (REP) under section 4.1.3A of the CUSC. It proposes that this calculation is revised so that a generator pays, or is paid, its first Bid Price -1 for changes in energy output which occur as a result of delivering frequency response.
- 3.2 The basis for the calculation of the REP was subsequently clarified by the proposer and agreed by the Working Group as within its Terms of Reference from Bid Price -1 to Offer price -1. For clarity it was therefore agreed that the price to use should be the Offer Price-1 ie. the first unwinding offer price associated with the first bid. The Working Group considered that this alteration was consistent with the terms of reference and as a result did not constitute an alternative to the original proposal.
- 3.3 The proposer believes that there are defects associated with the present definition of REP. In particular the proposer argues that because of the average and retrospective nature of the present calculation the REP is not reflective of the costs incurred by different individual generation plant with different fuel costs at the time they are required to provide frequency response energy.
- 3.4 This places an incentive on generators in the view of the Proposer to cover their potential exposure by increasing their Holding Payment rates. The Holding Payment rates can only be changed once a month by generators for use in the successive calendar month. Therefore, the level of risk premium has to reflect the uncertainty of the level of usage of the service and the degree of uncertainty as to how an individual BMU's costs, with different types of fuel, will differ from the Reference Price.
- 3.5 The proposal suggests that the solution to the identified defect could be provided by a payment mechanism where parties pay, or are paid, the relevant BMU a price equivalent to its first Bid Price (subsequently clarified as Offer Price -1). By doing so the generator concerned is able to more accurately recover its actual costs. The proposer suggests that the precise solution would be that the generator is paid its Offer Price when the delivery of response results in additional output from the BMU during the relevant period and require it to pay its Bid Price when the response results in reduced output from the BMU. However, the proposer suggested a single price is used in order to simplify the solution. An additional benefit that has been suggested with the single price solution is that it is self regulating against market opportunity, as for example a generator called for High Frequency would pay out against that price.
- 3.6 Through the course of the Working Group discussions, the proposer clarified a number of issues associated with the original proposal. It was confirmed that the use of the First Undo Offer as the basis for the REP would be the least disruptive approach to participants Bid /Offer pricing strategies.
- 3.7 Discussions were progressed in the Working Group on whether this clarification was within the scope of the original proposal or whether it constituted an alternative amendment in its own right. It was concluded by the Working Group that this clarification was consistent with its terms of reference and as a result did not constitute an alternative to the original proposal. This because the Working Group were required to assess whether the use of Bid Price -1 was the most appropriate price to use.

4.0 SUMMARY OF WORKING GROUP DISCUSSIONS

Overview of the Proposal / Issues for Consideration

4.1 In assessing the Amendment Proposal the Working Group had a wide ranged debate on the subject of the Response Energy Payment price. In particular the discussion focussed on the following areas:

- i) Previous related Amendment Proposals
- ii) Timing for the submission of prices / Use of the Balancing Mechanism
- iii) Optimisation of Frequency Response energy
- iv) Options for the Response Energy Payment Price
- v) Analysis of the original proposal

Each of these aspects is considered in turn below.

Previous Related Amendment Proposals

4.2 By way of background information, the Working Group considered decisions reached on related amendments CAP010 and CAP047. The Working Group reflected on the Authority's decision for CAP010; it was noted that CAP010 was based on a two-price mechanism whereas the current proposal was focussed on a single price option to provide cost reflectivity. It was felt that the environment had changed with the implementation of CAP047. Members indicated that there had been a change noted in the holding price with prices in hi/low frequency response. Members noted that other issues such as increases gas prices could also have had an impact.

4.3 Members raised concerns that following CAP047 parties were excluding themselves from provision by submitting high prices making it uneconomic for them to be used. Also where high negative prices are submitted and they are utilised the party would pay. Members also identified issues such as the matching arrangements for Standing Reserve contracts.

Timing for the Submission of Prices / Use of the Balancing Mechanism

4.4 Discussions were progressed on the timing for submission of prices and the impact of changes to prices up to Gate Closure compared against prices frozen ahead of time. The proposer explained that the option of price change up to Gate Closure made Participants more able to manage/reduce risk as the prices would be calculated much closer to real time and actual service provision. The proposer explained that this element was currently built into the holding price to manage the exposure between the timing of the calculation of the current REP and the variation in fuel costs closer to real time. It was also felt that the process was more auditable and transparent.

4.5 The National Grid representative advised that if prices were submitted on an individual basis much closer to real time it would be more complex to manage and the individual nature of the prices, and the lack of known costs, would by their very nature give rise to sub-optimal frequency response dispatch.

4.6 One member suggested the possibility of a further mechanism with submission of a daily price element either set by reference to a prevailing Balancing Mechanism price at a set time or separately via fax or email and indicated that this could feature as a possible alternative option. The National Grid representative explained that whilst prices established with greater lead times was beneficial to the control room processes it did not remove the risk

of sub optimal dispatch of frequency response introduced by individually set prices.

- 4.7 The Working Group debated the use of the Balancing Mechanism (BM) for establishing prices for Response Energy Payments. In particular the group debated the effect of the potential pollution of the BM for non energy balancing purposes. Some members of the Working Group suggested that the use of a BM based price could impact on some plant as it may be called on to provide frequency response by virtue of having submitted a price that is attractive to National Grid, considering the self regulating aspect of a single price, when it had submitted a price to avoid being called on at a particular time of day, to avoid the requirement to two-shift for example.
- 4.8 The Working Group also considered the use of a BM based price in principle. Concerns were expressed by some members of the Working Group that this could pollute the pure energy balancing function of the prices and the mechanism. By contrast some members of the group argued that the provision of mandatory frequency response was very closely linked to the balancing function because plant is required to be moved, potentially, by activation of Bids and Offers to provide response in certain conditions.

Optimization of Frequency Response Energy

- 4.9 A significant element of the debate within the Working Group centred around where the risk lies for providing and managing frequency response. The Working Group considered the fact that presently the risk sits with generators via submission of the Holding Prices and the limitations of the present Reference Price for Response Energy Payments. It was considered whether National Grid as System Operator with its central role was better placed to manage this risk. Coupled with this the Working Group considered the overall impact to industry participants, what the costs were to the industry and the nature of frequency response dispatch.
- 4.10 National Grid set out its concerns with prices submitted on an individual basis and in particular its view that this would introduce sub-optimality in to the process of frequency response dispatch, giving rise to greater costs to the industry as it would not be possible to make economic and efficient dispatch decisions due to the sub-optimality.
- 4.11 National Grid provided further detailed explanation to the Working Group as to the issues arising from sub-optimal frequency response dispatch. These are set out in further detail in paragraph's 4.11 – 4.19. The main reason for this is that due to demand and generation uncertainties, National Grid cannot predict in advance what the system frequency will be and it follows that it cannot predict whether a particular BMU will deliver positive, negative or zero response energy during a particular half-hour. It is therefore impossible to know which response energy price was the best to opt for, as the optimal decision depends on the delivered energy, unknown until after the event.

Sub-optimality

- 4.12 The likely response energy is impossible to estimate, and likewise the cost that should be assigned to it. The response energy required depends on the number and severity of frequency incidents. The control room dispatch facility cannot predict the actual response energy cost because delivery volumes are a function of real-time events that cannot be anticipated. The best that can be done is to estimate a likely volume and cost. There are

however significant issues in doing this, in terms of calculating the amount of energy required and subsequently delivered and in turn applying a cost to the energy. The statistical nature of the problem makes averaged values inaccurate and potentially misleading.

- 4.13 National Grid does know that the system frequency averages 50Hz over longer periods of time because the difference between electric time and real time is monitored and controlled. Therefore National Grid's only option would be to take defensive measures to exclude particular BMUs with REPs above a certain threshold from consideration for holding frequency response. However, if the excluded BMU has a low response holding payment and the system frequency is such that no response energy payments actually flow to the BMU, then the effect of these defensive measures will have been to increase the cost of holding frequency response.
- 4.14 There is therefore a real risk of incurring actual costs on an ongoing basis while trying to avoid theoretical costs that could in reality be of low risk. It is impossible that existing systems could be tuned to avoid all adverse effects and therein incur sub-optimal costs. It is questionable as to whether this would be consistent with National Grid's obligation to operate the transmission system in an economic, co-ordinated and efficient manner.
- 4.15 Generators will be able to change their response energy prices every half hour and in timescales (one hour gate) that are shorter than the typical duration of the open-ended frequency response instructions. Also the short submission timescales will mean that, for example, BMUs that have provided a Physical Notification at full load with uneconomic bid prices and which have been instructed to carry (effectively) high frequency response only, will be able to change their response energy prices, to cause significant cash flow to them with no risk that they would have to pay out a similar amount of money if the frequency was low.
- 4.16 Whilst the principles of cost reflectivity should continue for the provision of energy delivered to the system during mandatory frequency response, it is hard to see how the potential for adverse pricing of such energy can be avoided once Response instructions have been issued. Depending on how participants' pricing strategies change, and in turn National Grid's own dispatch behaviour, there is potential for some generators to benefit to a greater extent than others, only more so and to a greater cost overall than under the present arrangements.

Operational Consequences

- 4.17 As National Grid seeks to avoid high response energy prices it could result in a significant churn of response holding from one half-hour to the next. National Grid would have to have processes in place (or potentially automatic systems given the BSIS, staff resource and system security implications) to ensure frequency response instructions were cancelled before the start of any half-hours when the response energy price exceeded a threshold. The systems' changes would have to apply to both the main and the contingency systems (note that at present the contingency system contains no frequency response contract information or advice whatsoever).
- 4.18 To compensate for the generation being instructed off response at the end of a half-hour, other generation will have to be instructed to hold response. Generators are currently paid for Response after two minutes from time of instruction. This was based on the assumption that to commence response

holding approximates to one minute to accept the instruction and one minute to implement it. This commercial assumption does not generally reflect the plants true capability and characteristics. Two minutes is almost certainly too short a time for them to commence providing response – for example a coal-fired power station instructed to primary, secondary and high is likely to have to start up an additional mill and increase boiler pressure before they can commence provision of response. It may take up to twenty minutes (or more) for a genset to settle in a state that delivers the units contracted volume (as recorded in the optimisation facility). Given the time needed to gain confidence that plant has reached a satisfactory holding position then this will incur additional, sub optimal costs

- 4.19 There will be a particular issue of having insufficient actual frequency response around the half-hour transition as some units will have been instructed off response and others have yet to commence provision. In many respects, half-hour transitions are when frequency response provision is most needed as demand often changes significantly due to price changes or the ending of television programmes. To mitigate against this threat to system security, National Grid will no doubt have to hold more frequency response than currently and this will be at prices above the current Holding marginal price, another factor that would be likely to increase costs if the Amendment Proposal in its original form was implemented. E.g. the frequency response requirement may be 10 units, but during the transition from one generator to another we would hold and pay for 10 units from the generator 'coming off' and 10 units from the generator 'coming on'. In addition and as a consequence it would result in flexing generators loading position to achieve the required response.
- 4.20 The proposer argued that this level of complexity can be addressed by the system operator. One group member considered each of the elements of the decision process for instructing frequency response. Under the present arrangements, National Grid has to consider:
1. The Holding Prices.
 2. The bids or offers which have to be accepted for any plant, which have to be instructed to an output level from which they can provide response.
 3. The total amount of plant required to provide response in the relevant period.
- 4.21 The proposer explained that National Grid does not have to presently consider the likelihood of frequency response being used or its possible extent, as the Reference Price is the same for all plant. If the original modification were to be approved then this would become important as, for instance, National Grid may have to make a decision between instructing a plant with a high holding price and low energy price, or one with a low holding price and high energy price. He believed however that it was possible for National Grid to optimise the selection of plant against the likely usage scenarios. Clearly there was some uncertainty associated with actual outturn usage. However, this at present was being borne by the generation section. He considered that National Grid was in a better position to manage this uncertainty centrally.

Options for the Response Energy Payment Price

- 4.22 In seeking to address the potential cost faced by individual generation plant and to overcome the issues of sub-optimality from individually submitted

prices, the Working Group discussed a number of options for setting response energy payments prices. This included a number of options as follows:

- Day ahead BMU Price with an 11:00am cut off point and fax submission of prices
- 1/2hrly submissions BM -1
- Market Based Average SSP/SBP 1/2 hourly submissions
- Market based +fuel differential 1/2 hourly submissions
- Energy Price/Holding (single price)
- CAP010 basis Offer Price for low frequency and Bid price for High Frequency
- Imbalance Prices; SBP for low frequency and SSP for High Frequency

The Working Group rated these various options on a range of criteria including how closely the option would allow participants to reflect their actual costs, and the timing for submission of prices. The group also focused on the decision making process for the System Operator and the potential risk of pollution of the energy element of the BM through the inclusion Frequency Response utilisation. Ease and cost of the implementation of each of the options for National Grid and participants was discussed. Transparency of SO actions to market participants was also covered. These options formed the basis of a number of the decisions approach on the development of the final alternative proposals taken forward.

- 4.23 Members discussed the development of a possible alternative proposal using a Market Based Average principle supported by an indexed fuel differential in further detail over and above the other options considered, save those that expressly became Working Group Alternative Amendments. An Initial assessment of potential indices that could be used and availability of information was considered by the Working Group to explore the option further.
- 4.24 After further discussions members concluded that the option based on a range of indices would lead to greatly increased complexity and would add additional burdens to the optimisation/decision making process. As a result it was concluded that this option would not address the identified defect and would provide no real improvement on the current arrangements. Therefore the Working Group agreed that it was not appropriate to develop this further as a Working Group Alternative.
- 4.25 The Working Group considered there to be further merit in exploring the options that used Imbalance Prices and the Market Index Price. These are considered further below, both as part of the analysis of the original proposal and as separate Working Group alternatives explained further below, under 'Analysis of the Original Proposal' and Section 5.0 Working Group Alternative Amendments.

Analysis of the Original Proposal

- 4.26 In the context of the sub-optimal response dispatch, the Working Group sought to establish what costs were being incurred by the industry as a consequence of the identified defects of the present Reference Price. The Working Group recognised that this was dependent on individual generation plant and their own costs, depending on fuel type and the difference within a type of contract that fuel is sourced against. It was recognised that this cost

was difficult to estimate as a whole based on the range of difference between plant. No industry participant costs were provided to the Working Group and therefore none were considered.

4.27 The Working Group looked to other sources as a guide for what costs may be being incurred by the industry as a consequence of the time weighted average nature of the present Reference Price. It was suggested that a possible guide to what these costs may be to the industry overall could be the net benefit to National Grid under the present Reference Price. This was calculated at £3.3m for 2004/05¹, although these figures were calculated prior to the introduction of BETTA. In using this value as a guide, National Grid, advised that there was a degree of uncertainty against which this figure could be used to assess individual generation costs, in particular because the value will have been borne from prevailing conditions on the network, the individual position of plant at any given time and their respective financial position, recognising that not all participants were actually losing money as a result of mandatory frequency response provision.

4.28 National Grid presented analysis to the Working Group initially to quantify the affect of the original proposal as Bid Price-1 and potential alternative amendment proposals on Mandatory Frequency Response energy payments, when compared to the present payments arrangements. Four options were considered for the analysis:

- i) Current Response Energy - The present time weighted average for Response Energy Payments;
- ii) The Original Proposal - using the first bid price;
- iii) Dual Response Energy - A dual price that uses SSP for increasing output and SBP for responding to High Frequency, as a sensitivity for the possible Alternative Amendment Proposal; and
- iv) Dual Response Energy 2 - The Alternative Amendment Proposal, using SBP for increasing output and SSP for responding to High Frequency

4.29 The analysis considered two full days worth of settlement periods for 4th and 5th February 2006 as a snapshot. The two days provide a useful indication of the trend on Response Energy Payments that could be seen over longer periods. The net position for these two days for the four options is listed below:

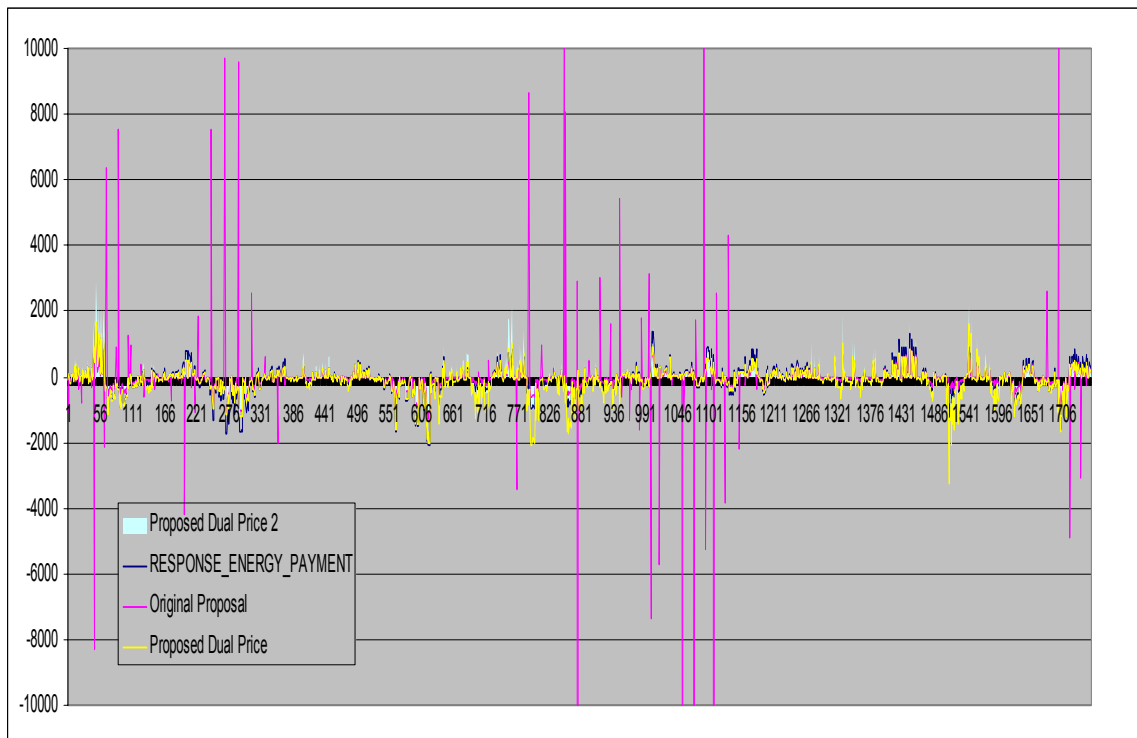
Option	Cost
Current Response Energy	-£125,254
Original Proposal	-£639,641
Dual Response Energy	-£227,050
Dual Response Energy 2	-£29,780

4.30 Although on these two days the net position is a benefit to National Grid the range between the payments under the present arrangements compared to the original proposal is quite high when compared to the Alternative Amendment Proposal (Dual Response Energy 2). National Grid believes that this indicates the potentially wide range of prices that could be experienced and total costs which could be incurred when comparing the original proposal with the present arrangements and in turn the potential alternative amendment.

¹ Report on Electricity Balancing Services Contracts, 1st April 04 – 31 March 05 (Informal Procurement Guidelines Report), Published 27th May 2005

4.31 Figure 1, below, shows the overall deviation between the prices for the four options for the response actions taken for the two days. National Grid believes that this highlights the large deviation between the original proposal and the comparative differences between the potential alternative and the present Response Energy Payment arrangements. National Grid also believes that this provides an indication of the potential risk of high prices and increasing costs that could be experienced arising from uneconomic and inefficient response despatch due to sub-optimal response despatch arising from the original proposal, the exposure is potentially far greater. Clearly this would impact on any National Grid incentive scheme and would also increase costs to the industry.

Figure 1. Difference between cash flow and number of response occurrences for the four options considered using two days data (4/5th Feb 06)



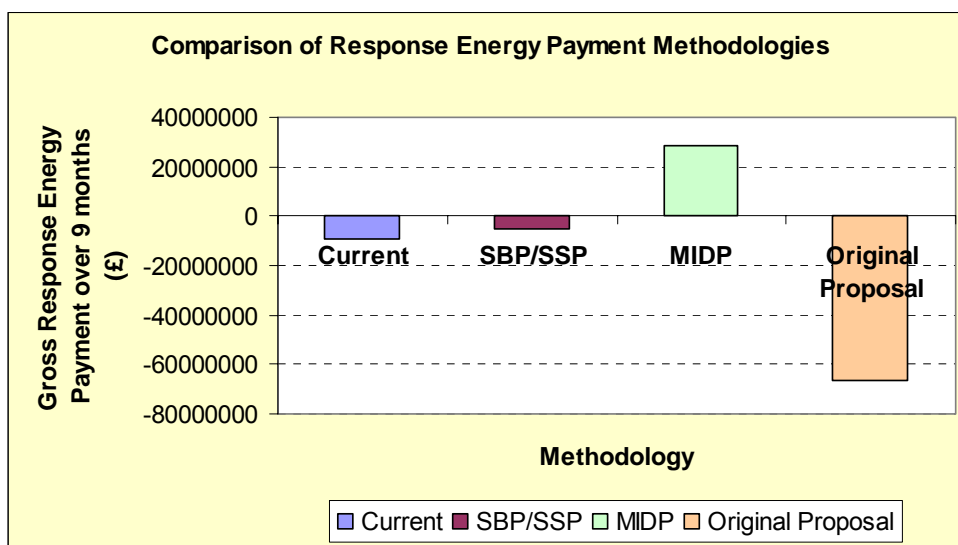
4.32 National Grid then undertook further analysis on behalf of the Working Group, following the alteration to the original proposal from Bid Price-1 to Offer Price-1. In developing alternative options the Working Group looked at existing available prices commonly used in the market to suitably reflect the cost of providing response energy at the margin. Two sets of prices were used, Imbalance Prices (SBP and SSP) and the Market Index Price. This has used historic data for frequency response despatch with the net volumes averaged over a month against which the following price options, averaged over a month, have been applied.

- i) Current Response Energy - The present time weighted average of SBP/SSP for Response Energy Payments;
- ii) The Original Proposal - using the first offer price;

- iii) SBP and SSP Methodology - The potential Alternative Amendment Proposal, using SBP for increasing output and SSP for responding to High Frequency; and
- iv) Market Index Price Methodology - The potential Alternative Amendment Proposal, using MIDP*2.5 for increasing output and MIDP*0.5 for responding to High Frequency.

4.33 Owing to the complexity of the analysis, availability of data and time, a full year's worth of data could not be analysed. Monthly averages are not ideal when the prices would be applied per settlement period. However the analysis provides a useful indication of the potential overall swings in cash flow. To provide a position representative of a full years worth of data, the nine months of January 2005 –March 2005 and September 2005 – February 2006 have been assessed. This has resulted in a net position for the four options in Figure 2 below:

Figure 2.



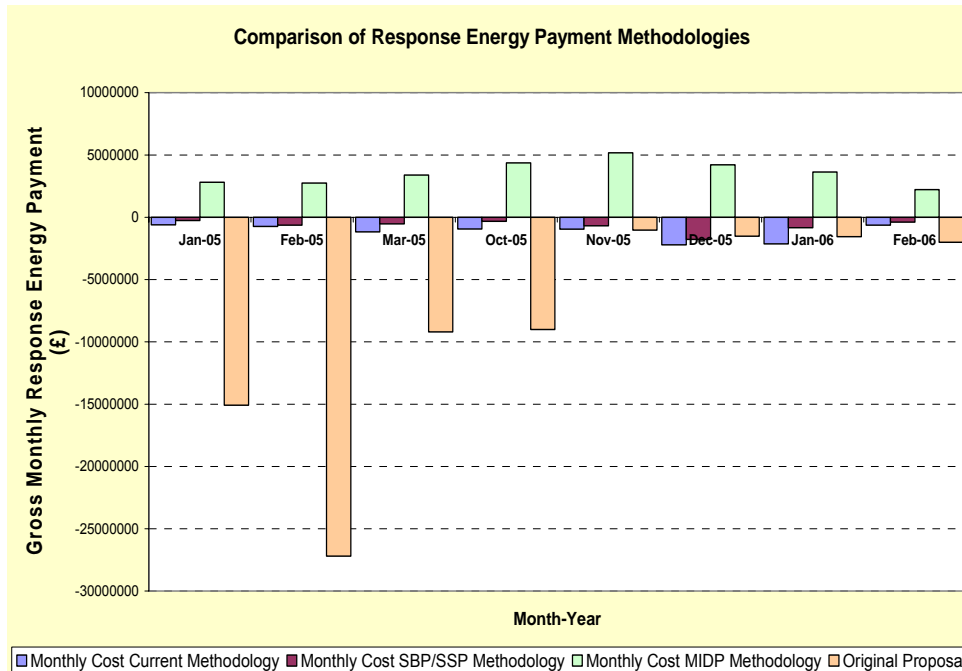
4.34 The range between the payments under the present arrangements compared to the original proposal and MIDP because of the effect of the multiplier is significantly higher when compared to the SBP/SSP Alternative Amendment Proposal. National Grid believes that this indicates the potentially wide range of prices that could be experienced and total costs which could be incurred when comparing the original proposal and MIDP Methodology with the present arrangements and in turn the SBP/SSP Methodology. Although in this instance analysis of the original proposal shows a large swing in National Grid's favour, it could be expected that this swing could be equally as great to generation plant in any given Settlement Period as behaviour changed.

4.35 Figure 3, below, shows the monthly deviation between the prices for the four options. This highlights the large range between the original proposal and the MIDP methodology and the comparative differences between the potential alternative proposal of the SBP/SSP Methodology and the present Response Energy Payment arrangements.

4.36 National Grid believes that this provides an indication of the potential risk of high prices and increasing costs that could be experienced arising from uneconomic and inefficient response despatch due to sub-optimal response

despatch arising from the original proposal, the exposure is potentially far greater. Particularly as Bid/Offer strategies could result in significant swings in cash flow. Both the original proposal and the MIDP Methodology would impact on any National Grid incentive scheme and would also increase costs to the industry to a significantly greater and disproportionate extent than the present arrangements or the SBP/SSP Methodology

Figure 3.



4.37 Some group members believed that the analysis could not show the likely effects of the original proposal, as it simply showed the effect in relation to the decisions that National Grid had taken under the present methodology. There were two main issues which the analysis ignored. Firstly, it was to be expected that National Grid would have chosen a different mix of plant to provide frequency response had CAP107 original been implemented. The plant selected in this analysis would have been chosen ignoring the possible effects of their bids or offers on frequency response energy payments, as it was not a consideration. It was likely that National Grid would have made different decisions if these prices were relevant. Secondly, the analysis could not consider the likely change in generator bidding behaviour as a result of the proposal being implemented, or any reduction in Holding Price rates. Whilst National Grid recognised the validity of these points the unpredictable nature of frequency means that predicting what is needed and what would be taken is impossible and that it is this point that gives rise to the concerns of sub-optimal frequency response dispatch.

4.38 Following this analysis and National Grid's concerns regarding the effects of the original proposal, the Working Group sought to develop two Working Group Alternative Amendments based on the Market Index Price with an appropriate set of multipliers and the Imbalance price option using SBP for low frequency (Primary and Secondary) response and SSP for High Frequency response. These are considered further in the next section below, 5.0 Working Group Alternative Amendments.

5.0 WORKING GROUP ALTERNATIVE AMENDMENTS

WGAA A Re-definition of REP Use of Imbalance Prices (SBP for Primary and Secondary Response and SSP for High Frequency Response per Settlement Period)

- 5.1 In consideration of the original proposal the Working Group agreed to the progression of development of an alternative proposal based on SBP to compensate for increasing changes in energy output for low frequency, Primary and Secondary Response, and SSP for reducing energy output called for High Frequency response
- 5.2 The prices used as the basis for the REP would be the actual prevailing SBP and SSP for the half hour settlement period in which the response was called for net of volume response delivered over the half hour. Therefore a generator would be paid SBP for low frequency response and would pay SSP for providing High Frequency response. It was felt that paying SBP was appropriate as it reflected the marginal cost of energy, which response provision arguably fell in to.
- 5.3 When considering the overall impact to the costs faced by the industry as a reflection of potential individual generators costs, the Working Group undertook analysis of four months was analysed; April 2005, July 2005, October 2005 and February 2006 to provide an indicative year. These prices were then applied to the overall monthly amount of response energy provided to obtain the net position. Figure 4, below, shows the actual net position for Response Energy payments for these months and in turn, Figure 5, below, shows the effect that the use of the Imbalance Prices would have:

Figure 4

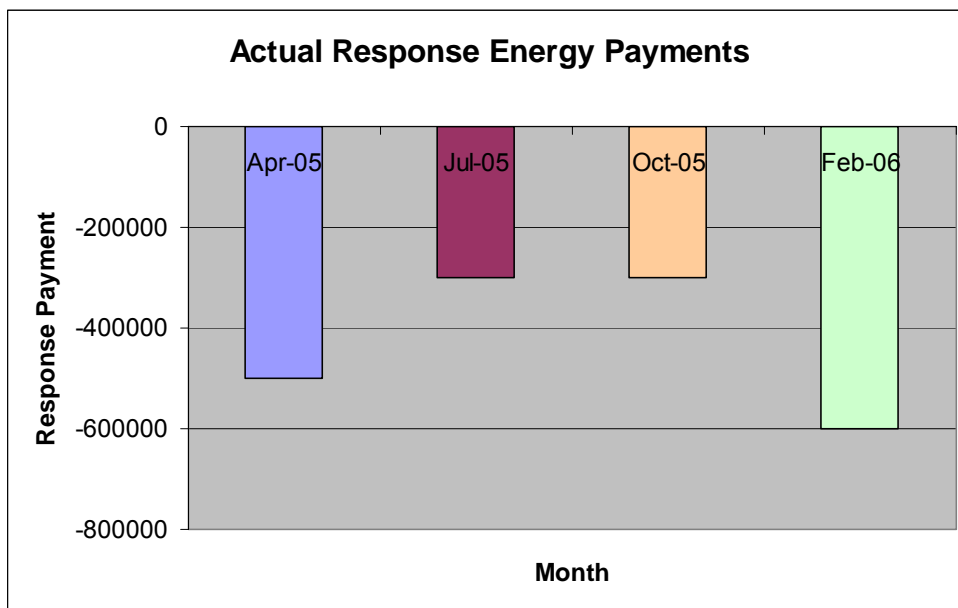
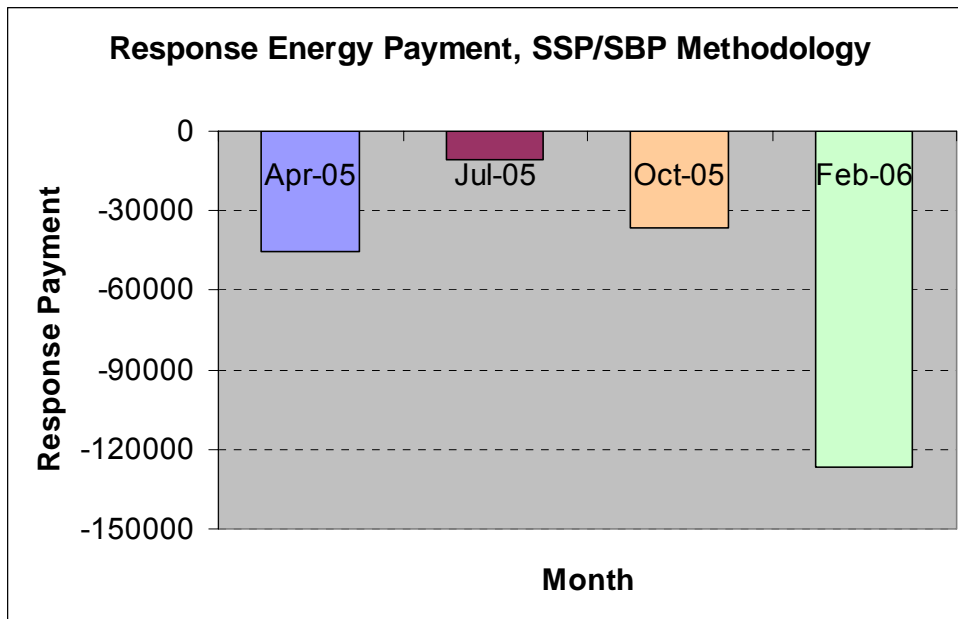


Figure 5.



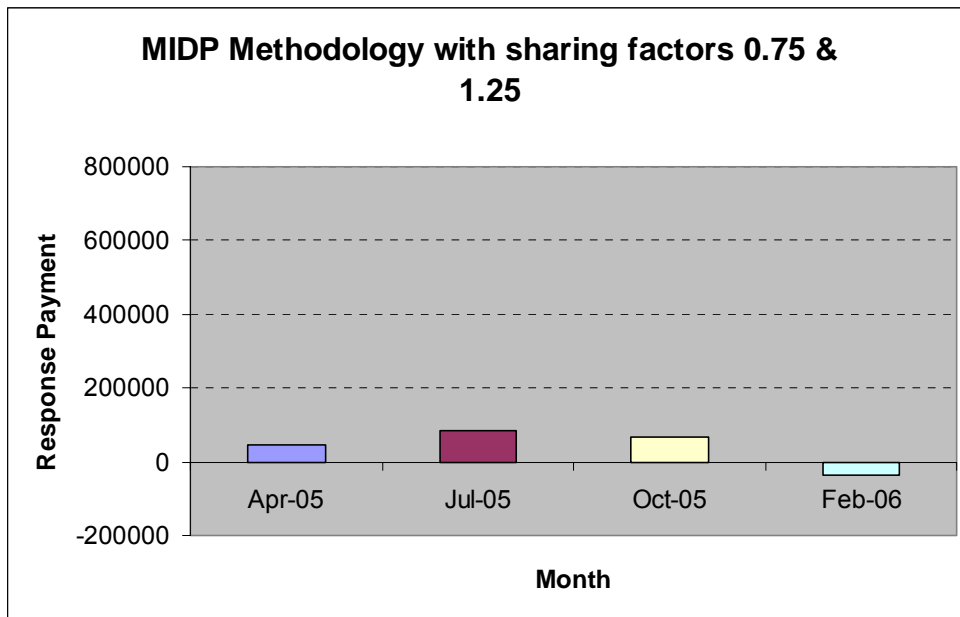
- 5.4 Concern was expressed by the Working Group as to the volatility of the Imbalance Prices and in particular the use of SSP for High Frequency response, in that similarly large payments could be made by generators for reducing output. On this basis the Working Group requested further analysis of the Market Index Price alternative as the Market Index Price was considered to be a less volatile parameter.
- 5.5 It could be argued that this provides a keener market based signal to National Grid to manage frequency on the transmission system. National Grid believes however, that any increase in costs however is likely to be more proportional to the defect that the original amendment proposal is seeking to address when compared with the sub-optimality despatch risks associated with the original proposal, although National Grid would be exposed to the spread between SBP and SSP.
- 5.6 A consequence, however, of higher energy payments could be that holding prices could become more competitive because generators may want to be available to benefit from the higher payments for low frequency response. This may have the knock-on affect of reducing total holding costs. As such, whilst total costs for Mandatory Frequency Response may remain broadly the same, the distribution of payments between holding and energy response may be more appropriate to reflect the costs of providing the response energy at the time it is called for, on the principle that the energy utilisation payment should be cost reflective. This could potentially also have system security benefits as more plant could therefore be economically available for response.
- 5.7 There are still likely to be parties that overall gain a net benefit and those parties conversely that do not, depending on how they are despatched in relation to the prevailing frequency conditions on the network. The proposed alternative does, however, have the benefit of potentially paying a more accurate price for response energy than the present arrangements as it uses prices closer to real time. Importantly it maintains a common response price

for all generators so removes the risk of sub-optimal response despatch, and the high costs risk associated with individual generator submitted high prices

WGAA B – Re-definition of REP Use of Market Index Price per Settlement Period

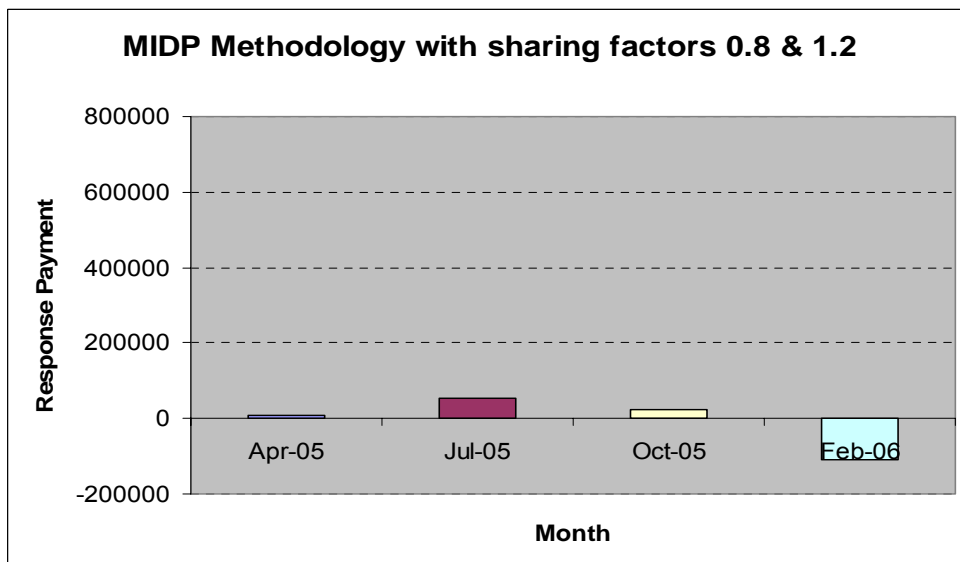
- 5.8 Following analysis of the first WGAA a further alternative was developed with a formula based on the Market Index Price plus and minus a percentage, as a proxy for SBP and SSP. Market Index Data is used in Settlement to calculate a price expressed in £/MWh in respect of each Settlement Period which reflects the price of wholesale electricity in respect of that Settlement Period in the short term market.
- 5.9 Whilst this second Working Group Alternative has many of the characteristics of the Imbalance Price alternative above, it was generally agreed by the Working Group that this option would address the degree of risk associated with the exposure of National Grid to the spread between SBP and SSP and generators' exposure to more extreme imbalance prices in any given Settlement Period.
- 5.10 Initially the Working Group assessed the Market Index Price option against multipliers of 2.5 for low frequency provision and 0.5 for high frequency, when initially assessing the original proposal and the Imbalance Price (SBP/SSP) alternative option. These multipliers were based on National Grid's Net Imbalance Adjustment value taken from the Transmission Licence.
- 5.11 Due to the results seen from the original analysis for the use of the Market Index Price multipliers of 2.5 for low frequency provision and 0.5 for High Frequency response the Working Group sought to consider other multipliers. The aims were twofold. Firstly, to achieve prices which were reflective of the average spread of SBP and SSP around the Market Index Price. Secondly, to achieve a neutral or as close to neutral effect based on the use of historic data. It was felt that this would overcome the perceived disadvantages of the Imbalance Price option. To achieve this, further analysis was undertaken that looked at different multipliers used with the Market Index Price with the aim of addressing the potential costs faced by the industry to derive a neutral position. A set of four months was chosen; April 2005, July 2005, October 2005 and February 2006 to provide an indicative year. These prices were then applied to the overall monthly amount of response energy provided to obtain the net position.
- 5.12 Annex 2 shows all the analysis undertaken of different multipliers to achieve a neutral or as close to neutral position as possible. A picture is developed that shows that as the multipliers used close the neutral position in terms of overall costs to the industry could be achieved, based on the historic data used and when compared to the current arrangements shown in Figure 4 above. By comparison analysis of the Imbalance Price option showed that the payments increased but the net overall position was lower when compared to the present arrangements.
- 5.13 The net position closest to neutral in terms of net overall payments to the industry would use multipliers of 0.75 for High Frequency provision and 1.25 for low frequency (Primary and Secondary) mandatory response provision, this is shown in Figure 6 below:

Figure 6.



5.14 The Working Group also undertook price analysis to consider the historic average percentage difference between SBP and SSP in relation to Market Index Price. This showed that over the last two years SBP and SSP have on average been 120% and 80% of Market Index Price respectively (shown in Annex 2 below). Additionally, an example looking at 29th December 2005 on a day of record prices, showed that the Market Index Price option would have been less volatile (also shown in Annex 2 below). Analysis of the Market Index Price option that uses 0.8 for High Frequency and 1.2 for low frequency response provision was assessed, in figure 7 below. On balance it was the Working Groups' view that the multipliers of 0.75 for High Frequency provision and 1.25 for Low Frequency provision were the most appropriate.

Figure 7.



- 5.15 Working Group Alternative Amendment B would therefore be based on the use of Market Index Price with different multipliers of 0.75 for High Frequency and 1.25 for low frequency (Primary and Secondary) response provision, net of the volume of response energy delivered over the half hour in each Settlement Period.

6.0 ASSESSMENT AGAINST CUSC APPLICABLE OBJECTIVES

6.1 The Working Group assessed the Amendment Proposal and the Working Group Alternative Amendment Proposals against the CUSC Applicable Objectives. CUSC Amendments are required to be assessed in terms of their ability to better facilitate achievement of the applicable CUSC Objectives. These are set out in National Grid's Transmission Licence and can be summarised as follows:

- (a) the efficient discharge by the licensee of the obligations imposed upon it under the Act and by this licence; and
- (b) facilitating effective competition in the generation and supply of electricity, and (so far as consistent therewith) facilitating competition in the sale, distribution and purchase of electricity

6.2 The Working Group were asked to assess each of the three options as to whether it 'better' facilitated the Applicable Objectives and which of those three 'best' facilitated the Applicable Objectives. The overall assessment, based on those members of the Working Group present, is summarised in the table below:

	BETTER	BEST
Original Proposal – Offer Price-1	4	2
WGAA A – Imbalance Prices	4	1
WGAA B – Market Index Price	6	3

6.3 The Working Group propose that **CAP107 WGAA B Use of Market Index Price per Settlement Period** should be approved and implemented.

Original Amendment

6.4 The Proposer and a majority of the Working Group consider that original CAP107 would better facilitate both Applicable Objectives. Several members expressed concerns over the difficulties expressed regarding the implementation costs (see Section 7.0 below) and concerns over the identified risks to the optimisation process resulting in increased costs.

6.5 National Grid believes that the Original Amendment does not better facilitate the CUSC Applicable Objectives. Whilst it agrees in principle to the defect that the Original Amendment is seeking to address, the potentially high cost risks of sub-optimal response dispatch and the potential implementation costs are disproportionate to the potential overall industry cost that the Original Amendment is seeking to re-allocate. National Grid would like to point readers to our more detailed concerns outlined in paragraphs 4.11 – 4.19.

WGAA A Re-definition of REP Use of Imbalance Prices (SBP for Primary and Secondary Response and SSP for High Frequency Response) per Settlement Period

6.6 One member of the Working Group believed that this Alternative Proposal better facilitated the CUSC Applicable Objective b) in particular. Whilst a majority considered that this alternative provided a better option than the current baseline, Working Group Alternative Amendment B and the Original Amendment received more support.

- 6.7 A number of Working Group members felt that the this Alternative did not satisfy the Applicable Objectives and felt that the concerns expressed over the impact on volatility of the Imbalance Prices and in particular SSP meant that it could not be supported by the majority of the Working Group as the best option. This proposal has the benefit the solution could be implemented in shorter timescales with minimum changes to both system operator and participant systems.
- 6.8 National Grid supported this Working Group Alternative Amendment as better facilitating the Applicable Objectives as it more proportionately addressed the defects that the Amendment Proposal was seeking to address, without the high cost risks of sub-optimal response dispatch and the associated implementation costs.

WGAA B Re-definition of REP Use of Market Index Price per Settlement Period

- 6.9 All members of the Working Group agreed that WGAA B better facilitated both of the CUSC Applicable Objectives and it received the highest level of support that this best facilitated the Applicable Objectives.
- 6.10 All members of the Working Group were in support of WGAA B as they believe it addressed the defect identified by the original Amendment Proposal, in particular the prices likely to be more stable than imbalance prices. This proposal also has the benefit the solution could be implemented in shorter timescales with minimum changes to both system operator and participant systems.
- 6.11 National Grid considered that this second Alternative Amendment Proposal best facilitated the Applicable Objectives as it more proportionately addressed the defects that the Amendment Proposal was seeking to address, without the high cost risks of sub-optimal response dispatch and the associated implementation costs.

7.0 PROPOSED IMPLEMENTATION

- 7.1 The Working Group propose that **CAP107 WGAA B Use of Market Index Price per Settlement Period** should be implemented three months following an Authority decision.

CAP107 Original Proposal

National Grid Implementation Issues

- 7.2 National Grid confirmed the estimated IS costs for this option would be in the order of £600k and that they could not be implemented until April 2008, due to IS lead times. This was based on the option of enhancing existing tools, to build in defensive measures against high prices and to develop additional offline advice tools to the control room, along with accompanying settlement system changes.
- 7.3 The costs were stressed as an initial estimate only, based on the initial feasibility and analysis work. This analysis had been based on three cases, minimum change, the compromise option and a third 'ideal' option. The third option would require significant IS development and fundamental change to control room processes and with high cost implications and be subject to even greater lead times

Market Participant Implementation Issues

- 7.4 Working Group Members agreed that the required changes could be implemented within approximately three months.

WGGA A Re-definition of REP for Mandatory Frequency Response - Use of Imbalance Prices (SBP for Primary and Secondary Response and SSP for High Frequency) per Settlement Period

National Grid Implementation Issues

- 7.5 National Grid explained that to deliver this option changes would be required to its settlement systems with implementation in three months following an Authority decision.

Market Participant Implementation Issues

- 7.6 Working Group Members agreed that the required changes could be implemented within approximately three months.

WGAA B Re-definition of REP Use of Market Index Price per Settlement Period

National Grid Implementation Issues

- 7.7 National Grid explained that to deliver this option changes would be required to its settlement systems with implementation in three months following an Authority decision.

Market Participant Implementation Issues

- 7.8 Working Group Members agreed that the required changes could be implemented within approximately three months

8.0 IMPACT ON THE CUSC

- 8.1 CAP107 original requires amendments to Section 4.1.3.9A (a) and 4.1.3.9A (d) of the CUSC.
- 8.2 CAP 107 WGAA A requires amendments to Section 4.1.3.9A (a) and 4.1.3.9A (d) of the CUSC.
- 8.3 CAP 107 WGAA B requires amendments to Section 4.1.3.9A (a) and 4.1.3.9A (d) of the CUSC.
- 8.4 The text required to give effect to the Original Proposal is contained as Part A of Annex 1 of this document.
- 8.5 The text to give effect to the WGAA A is attached as Part B of Annex 1 of this document. The text for WGAA A contains additional drafting to compensate for the Imbalance and Market Index Price default rules in the Balancing and Settlement Code. This has been added to avoid any potential for negative prices to apply.
- 8.6 The text to give effect to the WGAA B is attached as Part C of Annex 1 of this document. The text for WGAA B contains additional drafting to compensate for the Imbalance and Market Index Price default rules in the Balancing and Settlement Code. This has been added to avoid any potential for negative prices to apply. In addition the drafting is intended to cover the potential for more than one Market Index Data Provider in the calculation of the Market Index Price.

9.0 IMPACT ON INDUSTRY DOCUMENTS

Impact on Core Industry Documents

- 9.1 At this stage no impact has been identified from CAP107 on other Core Industry Documents.

Impact on other Industry Documents

- 9.2 At this stage no impact has been identified from CAP107 on other industry documents.

ANNEX 1 – PROPOSED LEGAL TEXT TO MODIFY THE CUSC

Part A - Text to give effect to the Original Proposed Amendment

Payment Formulae – Response Energy Payment

4.1.3.9A (a) The **Response Energy Payments** for **BM Unit i** in **Settlement Period j** to be made by **The Company** to a **User** referred to in Paragraph 4.1.3.8 shall be calculated in accordance with the following formulae:-

$$REP_{ij} = RE_{ij} \times \text{Reference Price}$$

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

Where:

REP_{ij} is the **Response Energy Payment** to be made to or, as the case may be, by the **User**; and

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

$$RE_{ij} = \int_0^{SPD} \left[\max(FR_{ij}(t), 0) \times (1 - SF_{LF}) + \min(FR_{ij}(t), 0) \times (1 - SF_H) \right] \times K_T \times K_{GRC} dt$$

Where:

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

SF_{LF} is equal to SF_P in the case of a **BM Unit** being instructed to deliver **Primary Response** without **Secondary Response** or the mean of SF_P and SF_S in the case of a **BM Unit** being instructed to deliver **Primary Response** and **Secondary Response**.

SF_P , SF_S , SF_H , K_T and K_{GRC} have the meanings ascribed to them in Paragraph 4.1.3.9.

$FR_{ij}(t)$ 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 **Frequency Response Power Delivery Data** table 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 table entitled "**High Frequency Response Power Delivery – Mode A**" 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 table entitled "Primary Response Power Delivery – Mode A" in the case of a **BM Unit** being instructed to deliver **Primary Response** without **Secondary Response**; or
 - B) the table entitled "Primary and Secondary Response Power Delivery – Mode A" in the case of a **BM Unit** being instructed to deliver **Primary Response** and **Secondary Response**,

in each case set out in the **Mandatory Services Agreement** and shall be signed positive.

Reference Price = PO_{ij}^{-1}

Where:

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

PO_{ij}^{-1}
"SPD"

Deleted: reference price =

Deleted: \overline{SBP}_{month} and \overline{SSP}_{month} are the calculated time weighted average of SBP_j and SSP_j respectively for the preceding calendar month in which the service is provided.

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Deleted: <#>(not used)

Deleted: "SSP_j"

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Part B - Text to give effect to the Working Group Alternative Amendment A

Payment Formulae – Response Energy Payment

4.1.3.9A (a) The **Response Energy Payments** for **BM Unit i** in **Settlement Period j** to be made by **The Company** to a **User** referred to in Paragraph 4.1.3.8 shall be calculated in accordance with the following formulae:-

$$REP_{ij} = RE_{ij} \times \text{Reference Price}$$

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

Where:

REP_{ij} is the **Response Energy Payment** to be made to or, as the case may be, by the **User**; and

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

$$RE_{ij} = \int_0^{SPD} \left[\begin{array}{l} \max(FR_{ij}(t), 0) \times (1 - SF_{LF}) \\ + \min(FR_{ij}(t), 0) \times (1 - SF_H) \end{array} \right] \times K_T \times K_{GRC} dt$$

Where:

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

SF_{LF} is equal to SF_P in the case of a **BM Unit** being instructed to deliver **Primary Response** without **Secondary Response** or the mean of SF_P and SF_S in the case of a **BM Unit** being instructed to deliver **Primary Response** and **Secondary Response**.

SF_P , SF_S , SF_H , K_T and K_{GRC} have the meanings ascribed to them in Paragraph 4.1.3.9.

$FR_{ij}(t)$ 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 **Frequency Response Power Delivery Data** table 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:-

(iii) for a positive **Frequency Deviation** the expected change in **Active Power** output of **BM Unit i** shall be derived from the table entitled "**High Frequency Response Power Delivery – Mode A**" set out in the **Mandatory Services Agreement** and shall be signed negative; and

(iv) for a negative **Frequency Deviation**, the expected change in **Active Power** output of **BM Unit i** shall be derived from:

C) the table entitled "Primary Response Power Delivery – Mode A" in the case of a **BM Unit** being instructed to deliver **Primary Response** without **Secondary Response**; or

D) the table entitled "Primary and Secondary Response Power Delivery – Mode A" in the case of a **BM Unit** being instructed to deliver **Primary Response** and **Secondary Response**,

in each case set out in the **Mandatory Services Agreement** and shall be signed positive.

Reference Price =

Deleted: reference price =

Where:

RE_{ij} is positive then shall equal SBP_i

RE_{ij} is negative then shall equal SSP_i

Where SBP_i or SSP_i is signed negative and continues to be signed negative after the Determination of Energy Imbalance Prices in accordance with Section T paragraph 4.4 of the Balancing and Settlement Code (as amended) then it shall be zero.

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

"SSP_j"
"SBP_j"
"SPD"

Deleted: SBP_{month} and SSP_{month} are the calculated time weighted average of SBP_j and SSP_j respectively for the preceding calendar month in which the service is provided.

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Part C - Text to give effect to the Working Group Alternative Amendment B

Payment Formulae – Response Energy Payment

4.1.3.9A (a) The **Response Energy Payments** for **BM Unit i** in **Settlement Period j** to be made by **The Company** to a **User** referred to in Paragraph 4.1.3.8 shall be calculated in accordance with the following formulae:-

$$REP_{ij} = RE_{ij} \times \text{Reference Price}$$

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

Where:

REP_{ij} is the **Response Energy Payment** to be made to or, as the case may be, by the **User**; and

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

$$RE_{ij} = \int_0^{SPD} \left[\max(FR_{ij}(t), 0) \times (1 - SF_{LF}) + \min(FR_{ij}(t), 0) \times (1 - SF_H) \right] \times K_T \times K_{GRC} dt$$

Where:

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

SF_{LF} is equal to SF_P in the case of a **BM Unit** being instructed to deliver **Primary Response** without **Secondary Response** or the mean of SF_P and SF_S in the case of a **BM Unit** being instructed to deliver **Primary Response** and **Secondary Response**.

SF_P , SF_S , SF_H , K_T and K_{GRC} have the meanings ascribed to them in Paragraph 4.1.3.9.

$FR_{ij}(t)$ 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 **Frequency Response Power Delivery Data** table 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:-

(v) for a positive **Frequency Deviation** the expected change in **Active Power** output of **BM Unit** i shall be derived from the table entitled "**High Frequency Response Power Delivery – Mode A**" set out in the **Mandatory Services Agreement** and shall be signed negative; and

(vi) for a negative **Frequency Deviation**, the expected change in **Active Power** output of **BM Unit** i shall be derived from:

E) the table entitled "Primary Response Power Delivery – Mode A" in the case of a **BM Unit** being instructed to deliver **Primary Response** without **Secondary Response**; or

F) the table entitled "Primary and Secondary Response Power Delivery – Mode A" in the case of a **BM Unit** being instructed to deliver **Primary Response** and **Secondary Response**,

in each case set out in the **Mandatory Services Agreement** and shall be signed positive.

Where RE_{ij} is positive then:

$$\text{Reference Price shall equal} = \max \left(\frac{\sum_s \{PXP_{sj} \times QXP_{sj}\}}{\sum_s \{QXP_{sj}\}} PXP_{sj} \times 1.25, 0 \right)$$

where \sum_s represents the sum over all **Market Index Data Providers**.

Where RE_{ij} is negative then:

$$\text{Reference Price} = \max \left(\frac{\sum_s \{PXP_{sj} \times QXP_{sj}\}}{\sum_s \{QXP_{sj}\}} \text{ then shall equal } PXP_{sj} \times 0.75, 0 \right)$$

where \sum_s represents the sum over all **Market Index Data Providers**.

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

" PXP_{sj} "

" QXP_{sj} "

"**SPD**"

"**Market Index Data Provider**"

Deleted: reference price =

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Deleted: SBP_{month} and

SSP_{month} are the calculated time weighted average of SBP_j and SSP_j respectively for the preceding calendar month in which the service is provided.¶

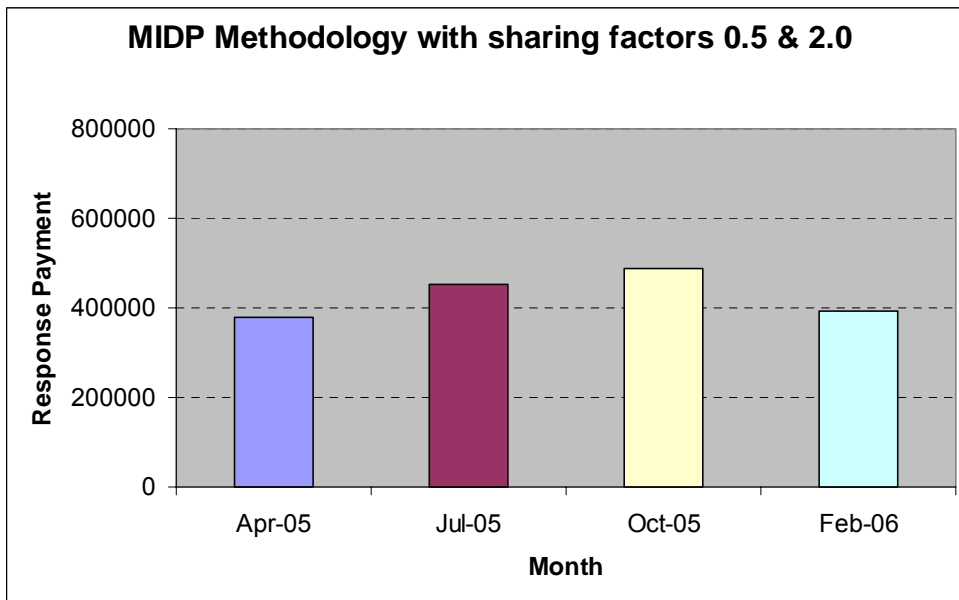
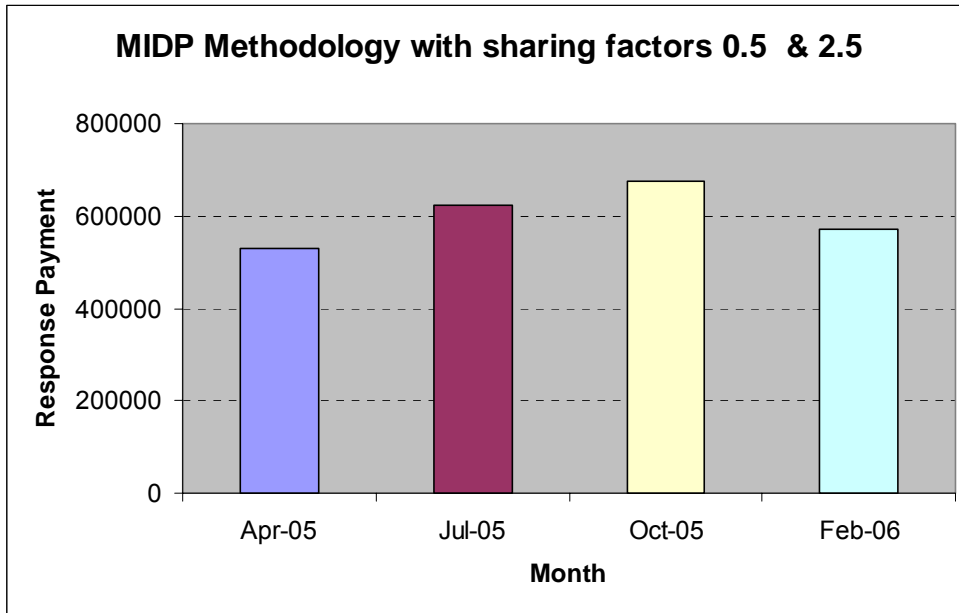
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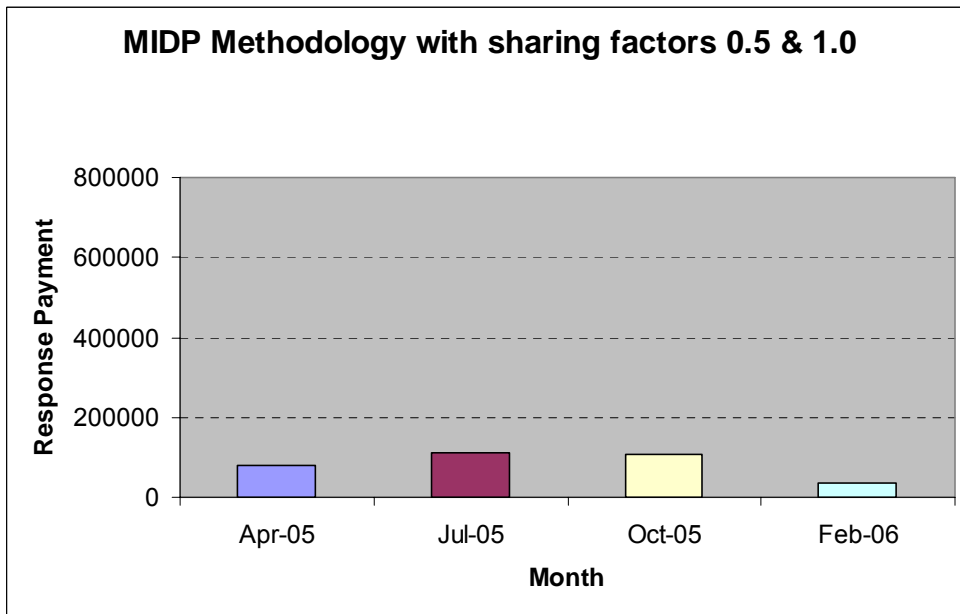
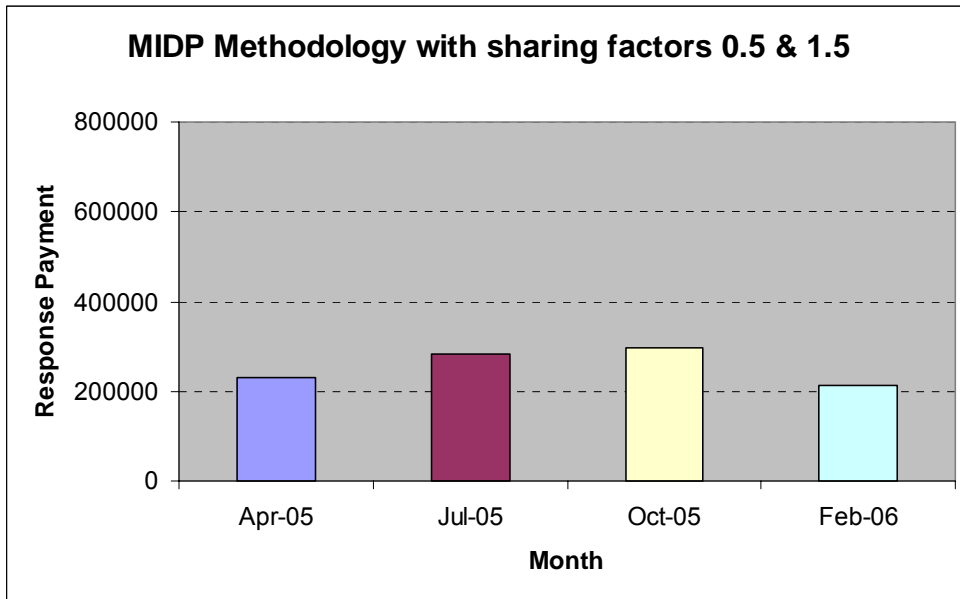
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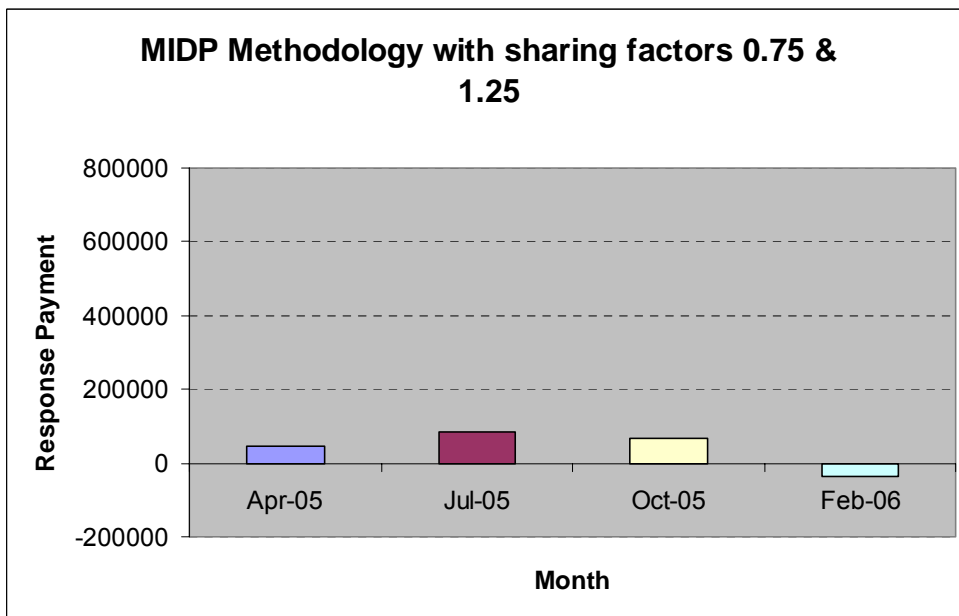
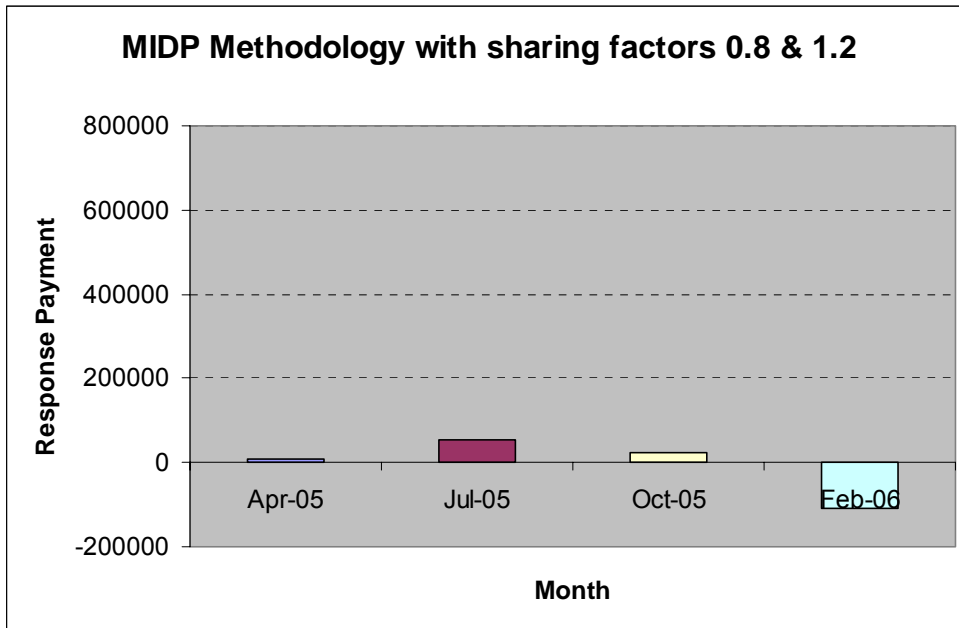
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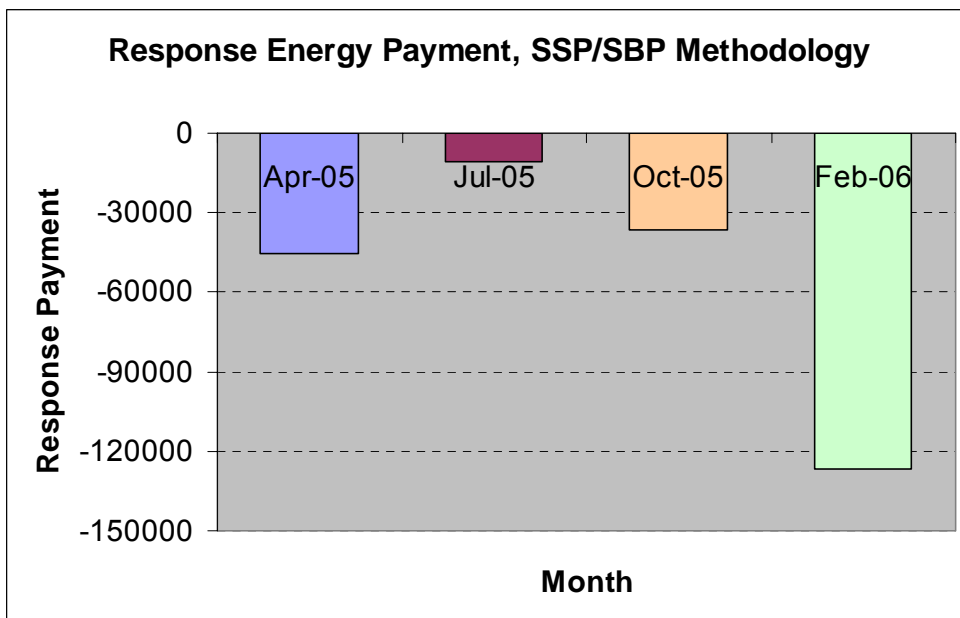
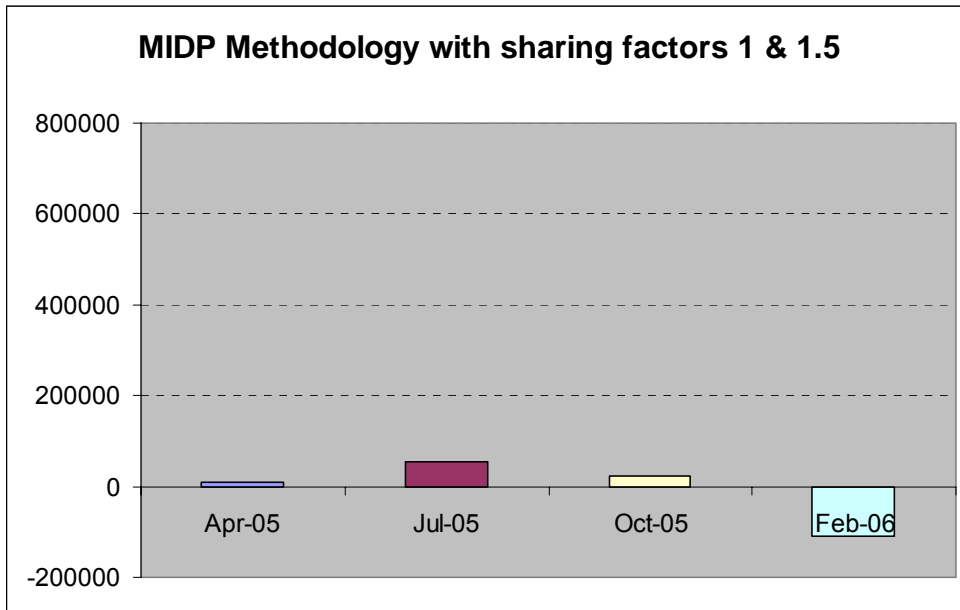
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" SBP_j "¶

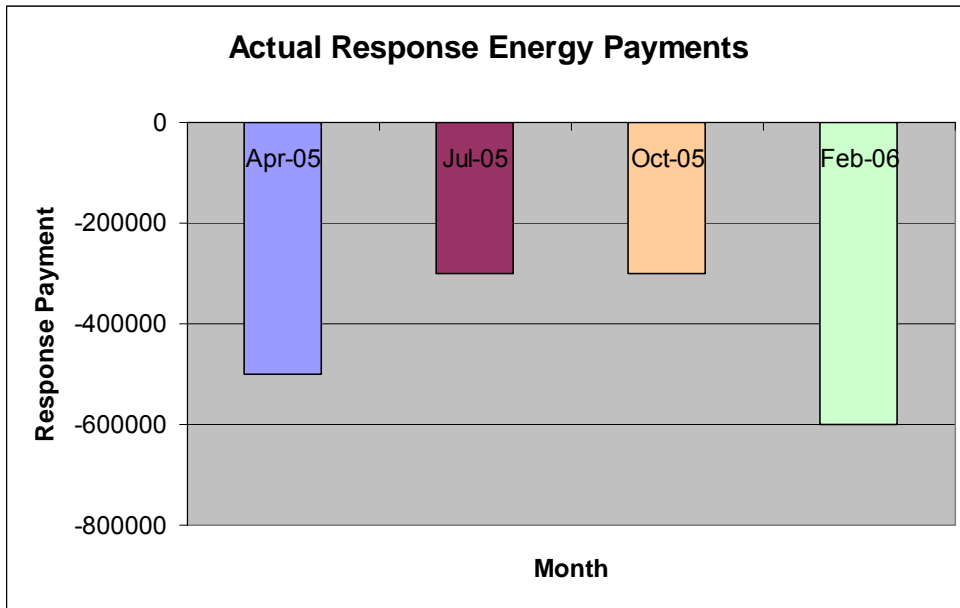
ANNEX 2 – ANALYSIS OF WORKING GROUP ALTERNATIVE AMENDMENTS



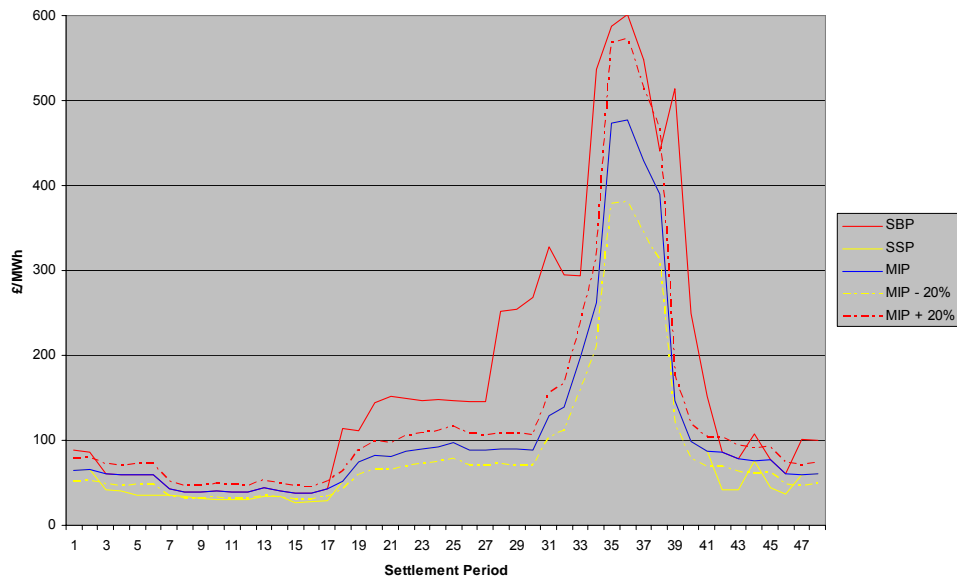








Prices 29 December 2005



Average of all values

£/MWh	SSP	MIP	SBP
2004	16.82	21.38	24.94
2005	29.80	36.43	42.97
2003/04	15.55	18.96	23.27
2004/05	18.77	23.72	27.87

	SSP	SBP
2004	78.7%	116.7%
2005	81.8%	118.0%
2003/04	82.0%	122.7%
2004/05	79.1%	117.5%

Average of values where MIP > 0

£/MWh	SSP	MIP	SBP
2004	16.83	21.47	24.98
2005	29.80	36.52	43.01
2003/04	15.59	19.24	23.42
2004/05	18.78	23.82	27.92

	SSP	SBP
2004	78.4%	116.4%
2005	81.6%	117.8%
2003/04	81.0%	121.8%
2004/05	78.8%	117.2%

Average over two years

	£/MWh	SSP	MIP	SBP
Calendar	Jan 2004 to Dec 2005	23.30	28.89	33.94
	Apr 2003 to Mar 2005	17.16	21.34	25.57

	SSP	SBP
Jan 2004 to Dec 2005	80.7%	117.5%
Apr 2003 to Mar 2005	80.4%	119.8%

	Max	SSP	MIP	SBP
Calendar	Jan 2004 to Dec 2005	476.91	476.91	601.62
	Apr 2003 to Mar 2005	283.79	289.02	433.45

Max with percentage mark up/down

	SSP	SBP
Jan 2004 to Dec 2005	384.64	560.30
Apr 2003 to Mar 2005	232.35	346.27

	Min	SSP	MIP	SBP
Calendar	Jan 2004 to Dec 2005	-5870.84	0.00	8.73
	Apr 2003 to Mar 2005	-5870.84	0.00	2.04

Min with percentage mark up/down

	SSP	SBP
Jan 2004 to Dec 2005	0.00	0.00
Apr 2003 to Mar 2005	0.00	0.00

ANNEX 3 - TERMS OF REFERENCE FOR CAP107 WORKING GROUP

RESPONSIBILITIES

1. The Working Group is responsible for assisting the CUSC Amendments Panel in the evaluation of CUSC Amendment Proposal CAP107 - Redefinition of Response Energy Payment for Mandatory Response. CAP107 was presented by E.ON UK plc to the Amendments Panel meeting on 16 December 2005. The Balancing Services Standing Group (BSSG) has been actioned by the Panel to act as the Working Group for the assessment of CAP107.
2. The proposal must be evaluated to consider whether it better facilitates achievement of the applicable CUSC objectives. These can be summarised as follows:
 - (a) the efficient discharge by the Licensee 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.

SCOPE OF WORK

3. The Working Group must consider the issues raised by the Amendment Proposal and consider if the proposal identified better facilitates achievement of the Applicable CUSC Objectives.
4. The Working Group will undertake the appropriate analysis to consider the following areas:
 - Use of the Bid price for Frequency Response provision
 - The impact of an energy based price on ancillary service markets
 - Complexity of optimisation and pricing decision
 - Impact on costs and incentive schemes
 - Implementation issues - system changes
 - Impact on Market Participants
5. The Working Group is responsible for the formulation and evaluation of any Working Group Alternative Amendments (WGAAAs) arising from Group discussions which would, as compared with the Amendment Proposal, better facilitate achieving the applicable CUSC objectives in relation to the issue or defect identified.
6. The Working Group should become conversant with the definition of Working Group Alternative Amendments which appears in Section 11 (Interpretation and Definitions) of the CUSC. The definition entitles the Group and/or an individual Member of the Working Group to put forward a Working Group Alternative Amendment if the Member genuinely believes the Alternative would better facilitate the achievement of the Applicable CUSC Objectives. The extent of the support for the Amendment Proposal or any Working Group Alternative Amendment arising from the Working Group's discussions should be clearly described in the final Working Group Report to the CUSC Amendments Panel.

7. The Working Group is to submit their final report to the CUSC Panel Secretary on 23 March 2006 for circulation to Panel Members. The conclusions will be presented to the CUSC Panel meeting on 31 March 2006.

MEMBERSHIP

8. Industry Participants who are not currently represented on the BSSG are free to nominate themselves for the purpose of assessing CAP107. The membership can be amended from time to time by the CUSC Amendments Panel.

9. **Members**

Ben Graff (Chair)
Clare Talbot (Technical Secretary)
Guy Phillips (National Grid)
Paul Jones (E.On) - Proposer
Claire Maxim (E.On)
John Morris (British Energy)
Rachel Lockley (British Energy)
Mark Manley (Centrica)
Rupert Judson (EdF Energy)
Simon Lord (First Hydro)
Raoul Thulin (RWE)
Paul Hinksman (RWE)
Garth Graham (Scottish and Southern)

RELATIONSHIP WITH AMENDMENTS PANEL

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

MEETINGS

12. The Working Group shall, unless determined otherwise by the Amendments Panel, develop and adopt its own internal working procedures and provide a copy to the Panel Secretary for each of its Amendment Proposals.

REPORTING

13. The Working Group Chairman shall prepare a final report to the 31 March 2006 Amendments Panel responding to the matter set out in the Terms of Reference.
14. A draft Working Group Report must be circulated to Working Group members with not less than five business days given for comments.
15. Any unresolved comments within the Working Group must be reflected in the final Working Group Report.

16. The Chairman (or another member nominated by him) will present the Working Group report to the Amendments Panel as required.

ANNEX 4 – AMENDMENT PROPOSAL FORM

CUSC Amendment Proposal Form	CAP: 107
Title of Amendment Proposal:	
Redefinition of Response Energy Payment (REP) for Mandatory Frequency Response	
Description of the Proposed Amendment <i>(mandatory by proposer):</i>	
A change to the calculation of Response Energy Payment under section 4.1.3.9A of the CUSC so that a generator pays, or is paid, its first Bid Price (PB _{ij} ¹ under the BSC) for changes in energy output which occur as a result of delivering frequency response.	
Description of Issue or Defect that Proposed Amendment seeks to Address <i>(mandatory by proposer):</i>	
<p>Presently, a generator who provides frequency response under Section 4 of the CUSC is paid a Holding Payment for the ability to provide the service and is paid, or pays, a Response Energy Payment for changes in output which result when the generator actively responds to a change in frequency. The Response Energy is priced at a reference price which is the average of the time weighted average System Buy Price and time weighted average System Sell Price for the preceding calendar month.</p> <p>Given the average and retrospective nature of its calculation and the significantly differing costs of different types of generating unit, this price is unlikely to reflect the true costs that individual generators face. Therefore, there is an incentive for generators to cover the associated risk by increasing the Holding Payment rates. These can only be changed once a month by generators for use in the successive calendar month. Therefore, the level of risk premium has to reflect the uncertainty of the level of usage of the service and the degree of uncertainty as to how an individual BMU's costs will differ from the Reference Price.</p> <p>By paying, or charging, the relevant BMU a price equivalent to its first Bid Price, the generator concerned is able to more closely reflect its actual costs. Clearly, the precise solution would be to pay the generator its Offer Price when the delivery of response results in additional output from the BMU during the relevant period and require it to pay its Bid Price when the response results in reduced output from the BMU. However, we propose that the first Bid Price is used in order to simplify the solution.</p>	
Impact on the CUSC <i>(this should be given where possible):</i>	
We anticipate that this will require a change to Section 4 of the CUSC.	
Impact on Core Industry Documentation <i>(this should be given where possible):</i>	
None anticipated.	
Impact on Computer Systems and Processes used by CUSC Parties <i>(this should be given where possible):</i>	
Not known.	

Details of any Related Modifications to Other Industry Codes (where known):

None known.

Justification for Proposed Amendment with Reference to Applicable CUSC Objectives**

(mandatory by proposer):

(a) the efficient discharge by the licensee of the obligations imposed upon it under the Act and by this licence.

National Grid is obliged by its licence to control frequency within the limits specified in the Electricity Supply Regulations. The amendment will allow this obligation to be met more efficiently as Holding Payment rates will not need to be inflated to reflect the risk associated with the present Reference Price.

Details of Proposer: Organisation's Name:	Paul Jones E.ON UK plc
Capacity in which the Amendment is being proposed: (i.e. CUSC Party, BSC Party or "energywatch")	CUSC Party
Details of Proposer's Representative: Name: Organisation: Telephone Number: Email Address:	Paul Jones E.ON UK plc 024 7642 4829 paul.jones@eon-uk.com
Details of Representative's Alternate: Name: Organisation: Telephone Number: Email Address:	Claire Maxim E.ON UK plc 024 7642 5378 claire.maxim@eon-uk.com
Attachments: No	