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Gas Security of Supply Significant Code Review - Draft Impact Assessment

Consultation

Reference:	146/11
Publication date:	08 November 2011
Response deadline:	31 January 2012

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Overview:

The aim of the Gas Security of Supply Significant Code Review (Gas SCR) is to establish whether changes to the current gas market arrangements are required to enhance security of supply and, if so, what these reforms should be.

This draft impact assessment is a supplement to the draft policy decision and sets out our analysis of the potential impact of our reform options.

We are currently minded to strengthen the incentives on market participants to deliver adequate gas supplies through cash-out reform. We also recommend investigation of the need for, impacts and effects of, various further interventions to enhance gas security of supply.

Responses to the draft policy decision and the draft impact assessment will inform our final decision on the cash-out reform options, which is planned for late spring 2012. Investigation of further interventions will be progressed through a separate process.

Context

Over the two decades since privatisation and liberalisation, the gas and electricity markets in Great Britain have delivered secure supplies and substantial investment. However, for a number of years Ofgem has expressed concerns with the ability of the current market arrangements to deliver secure gas supplies over the longer term.

We launched the Gas Security of Supply Significant Code Review (Gas SCR) on 11 January 2011. At the same time we published an initial consultation document which outlined our initial proposals to enhance gas security of supply. Following this, we held several stakeholder events and meetings to elicit feedback on our proposals. Taking this feedback into consideration, we have developed and revised our reform options. A draft policy document is published alongside this draft impact assessment. It outlines the revised options and the Gas and Electricity Markets Authority's draft policy decision.

This document sets out our analysis and consults on the impact of the reform options that we have considered; in particular a proposed reform of the cash-out arrangements and possible further interventions.

Associated documents

Draft Policy Decision - Gas Security of Supply Significant Code Review, November 2011 (Reference number 145/11):
http://www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/GasSCR/Documents1/Draft%20Policy%20Decision%20Gas%20Security%20of%20Supply%20Significant%20Code%20Review.pdf

Redpoint Energy, Gas Security of Supply Significant Code Review: Modelling Report, November 2011:
http://www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/GasSCR/Documents1/Redpoint%20Energy,Gas%20Security%20of%20Supply%20Significant%20Code%20Review%20-%20Economic%20Modelling.pdf

London Economics, Estimating the Value of Lost Load – Final Report to Ofgem, July 2011:
http://www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/GasSCR/Documents1/London%20Economics,%20Estimating%20Value%20of%20Lost%20Load%20-%20Final%20Report%20to%20Ofgem.pdf

London Economics, Estimating the Value of Lost Load – Annexes, July 2011:
http://www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/GasSCR/Documents1/Lond

on%20Economics,%20Estimating%20Value%20of%20Lost%20Load%20-%20Annexes.pdf

Ofgem Consumer First Panel Year 3. Report on Value of Lost Load (VoLL), Opinion Leader, May 2011:
http://www.ofgem.gov.uk/Sustainability/Cp/CF/Documents1/Ofgem%20Consumer%20First%20Panel%20Year%203%20-%20Report%20on%20Value%20of%20Lost%20Load.pdf

Launch Statement – Gas Security of Supply Significant Code Review, January 2011:
http://www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/GasSCR/Documents1/Launch%20Statement%20-%20Gas%20Security%20of%20Supply%20Significant%20Code%20Review.pdf

Initial Consultation - Gas Security of Supply Significant Code Review, January 2011 (Reference number 02/11):
http://www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/GasSCR/Documents1/Initial%20Consultation%20-%20Gas%20Security%20of%20Supply%20Significant%20Code%20Review.pdf

Letter to update on Gas Security of Supply Significant Code Review, July 2011:
http://www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/GasSCR/Documents1/Gas%20SCR%20June%202011%20Letter_v5.pdf

Project Discovery - Energy Market Scenarios, October 2009 (Reference number: 122/09):
http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=2&refer=markets/whlmkts/discovery

Project Discovery - Options for delivering secure and sustainable energy supplies, February 2010 (Reference number: 16/10):
http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=73&refer=markets/whlmkts/discovery

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Executive Summary

Background

For a number of years, Ofgem has expressed concerns about the ability of the current market arrangements to deliver secure gas supplies over the longer term. We are particularly concerned that the cash-out price (the price faced by those shippers that do not balance their gas supplies to and off-takes from the system) is currently frozen upon entry into a Gas Deficit Emergency (GDE). A frozen cash-out price may not provide the necessary price signals to incentivise investments in security of supply and attract imports in an emergency.

This document supports our accompanying draft policy decision on the Gas Security of Supply Significant Code Review (Gas SCR). It sets out our draft impact assessment on the reform options that we have considered. The options we have considered include exposing shippers to the costs of firm customer interruptions and/or introducing further interventions (table 1).

Table 1: Options under consideration

Options	Cash-out is frozen	Cash-out rises to full VoLL	Cash-out rises to capped VoLL	Further interventions
Current arrangements	X			
Option 1		X		
Option 2			X	
Option 3	X			X
Option 4			X	X

Our draft decision is that cash-out should be allowed to rise to an estimate of domestic customers' average daily value of lost load (domestic VoLL) for all days of firm load shedding (where individual large consumers are required to reduce their gas demand) and the first day of any network isolation (where parts of the network stop receiving gas). Initial work has yielded an estimate of £20 per therm for domestic VoLL. Firm customers (customers with a non-interruptible gas supply contract) that have been interrupted would receive a payment for the involuntary demand side response service they have provided. We have also investigated a range of potential interventions which could be implemented to improve gas security of supply. These include improvements to transparency through to more interventionist measures such as the introduction of a storage obligation. Our draft decision also includes a recommendation that more work be done to consider further interventions.

Impact of reform options

The key results of our assessment are summarised in table 2. Our analysis suggests that allowing the cash-out price to be more dynamic in an emergency will enhance security of supply. We expect a more dynamic cash-out price to provide incentives to invest, and to attract imports in an emergency. However, we find that exposing shippers to the full cost of firm interruptions could have significant consequences for competition as it is likely to affect credit requirements, create barriers to entry and increase the risk of financial distress during an emergency. We are also concerned that the possibility of such a high cash-out price may not be seen as credible.

Table 2 Assessment of reform options

Key criteria	Current arrange-ment (frozen cash-out)	Option 1 Cash-out rises to full VoLL	Option 2 Cash-out rises to capped VoLL	Option 3 Further interventions with frozen cash-out		Option 4 Further interventions with cash-out rising to capped VoLL	
				Best	Worst	Best	Worst
Likelihood of firm outages							
Duration and severity of outages							
Payment for involuntary DSR services							
Consumer prices							
Competition and Market Efficiency							

Positive impact Moderate impact Negative impact

Capping the cash-out price can address these concerns. Our modelling suggests that option 2 can be effective in enhancing gas security of supply, albeit not as effective as option 1. While capping cash-out will reduce shipper exposure and the consequent impacts on competition, our modelling shows that capping this exposure reduces incentives for companies to invest and therefore leaves risks with consumers.

Further interventions could be implemented alongside a capped cash-out price to help bridge the gap in incentives and to account for the social costs of a GDE. For the purpose of this draft impact assessment, we have modelled a storage obligation as a proxy for further interventions. Our modelling shows that such an option leads to the most significant improvements in security of supply, albeit at a higher cost. Our quantitative cost-benefit analysis suggests that all options can bring about net benefits compared to the current arrangements. However, the net benefits for options 3 and 4 are dependent on the choice and design of any further intervention.

1. Background and Objectives

Chapter Summary

This chapter outlines the rationale for the Gas Significant Code Review (SCR) and our approach to assessing the impacts of the reform options.

Question box

Question 1: Do you agree with our modelling approach and the assumptions we have made?
Question 2: Are there any other limitations to our modelling approach that have not been accounted for?
Question 3: Are there additional sensitivities that we should consider for our final Impact Assessment?

Reason for the Gas SCR

1.1 As outlined in the draft policy decision, we have expressed concerns for a number of years that the incentives on gas shippers are not sufficient to ensure secure gas supply to Great Britain (GB) over the longer term. As GB becomes more dependent on gas imports, these concerns become even greater. The introduction of the new SCR process allows us to take a leading role on this issue and to take a holistic approach to reviewing the arrangements that are desired to improve gas security of supply.

1.2 Our objectives for this SCR are to:
- minimise the likelihood of an emergency occurring
- minimise the severity and duration of a gas emergency, if one ever occurred
- appropriately 'compensate' firm consumers if they are ever interrupted.

1.3 The last of these objectives is not to provide 'compensation' as such, but to ensure that any involuntary demand side response services that are provided in an emergency by firm customers are paid for by shippers that were short of gas (short shippers).

Our approach to this draft impact assessment

1.4 This draft impact assessment is a supplement to the draft policy decision.[1] It aims to identify the likely impacts, costs and benefits of the various reform options

[1] See *Draft Policy Decision - Gas Security of Supply Significant Code Review*: http://www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/GasSCR/Documents1/Draft%20Policy%20Decision%20Gas%20Security%20of%20Supply%20Significant%20Code%20Review.pdf

we are considering and compares these with the current arrangements. We consider the quantitative results of our modelling, together with a qualitative assessment of the impacts.

1.5 We commissioned Redpoint Energy to assist with the modelling component of this draft impact assessment. Redpoint has produced a report[2] which explains the modelling approach, underlying assumptions and key findings. The report is published alongside this document. A summary of the modelling approach and some of the key assumptions are outlined in Appendix 3.

1.6 The draft policy decision outlines that firm load shedding would occur in stage 2 of an emergency and physical network isolations in stage 3 (post exit reform emergency stages). We expect that firm daily metered (DM) customers would be the main group affected by a stage 2 emergency as these customers are better able to change their gas usage at short notice. However, some larger non-daily metered (NDM) customers might also be asked to reduce their gas use during stage 2 of an emergency. During stage 3, networks would be physically isolated which would affect many smaller NDM customers and potentially some DM customers also. In advance of an emergency it is difficult to know at what point load shedding would be insufficient and network isolations would become necessary. For the purpose of the modelling, we have assumed that only firm DM customers would be interrupted at stage 2 of an emergency. If all DM customers have been interrupted and an imbalance remains, we have assumed (for the purposes of modelling) that firm NDM customers will be interrupted through the physical isolation of parts of the network (representing stage 3 of an emergency). To reflect these assumptions in our reporting of the modelling results, we refer to firm DM and firm NDM customer interruptions rather than customers affected in stages 2 and 3 of an emergency.

Limitations of quantitative results

1.7 In presenting the quantitative costs and benefits estimated from the modelling, it is important to emphasise the role of this analysis in informing our minded to decision on the preferred reform option. In particular, we consider that proposed reform of the emergency gas arrangements represents an area which has considerable uncertainties associated with quantifying both the costs and benefits associated with the various reform options. For example, the modelling of low probability, high impact events in the context of the global gas market is very complex.

1.8 The results of this model, as with all models, are to a large extent determined by the underlying assumptions. Changing, for example, demand forecasts or the way frozen cash-out prices are calculated has a significant impact on the outcomes of the

[2] See Redpoint Energy, *Gas Security of Supply Significant Code Review: Modelling Report*, November 2011:
http://www.ofgem.gov.uk/Markets/WhlMkts/CompandEff/GasSCR/Documents1/Redpoint%20Energy,Gas%20Security%20of%20Supply%20Significant%20Code%20Review%20-%20Economic%20Modelling.pdf

model. We have attempted to address these challenges by introducing sensitivity analyses around such parameters. This can help to understand the relative impacts of varying specific assumptions on the modelling results.

1.9 When assigning probabilities, the modelling has been informed by historic information, where this is available. However, low-probability events that can affect gas supplies tend to be highly uncertain and difficult to predict (eg geopolitical events such as unrest in gas supplying nations). Given the limited availability of data for low-probability events and the uncertainties arising from it, we have undertaken a sensitivity analysis using different probabilities of outages.

1.10 Furthermore, the model only considers the direct costs to consumers as a result of a gas deficit emergency (GDE). These costs are based on the value of lost load estimates of the types of firm customers that are interrupted under the various scenarios. However, as we explain below, interrupting gas consuming businesses or households will have knock-on effects for the wider economy/society. Any additional social costs caused by a GDE are difficult to quantify and are not captured by the model or in the cost-benefit analysis. Hence, our cost-benefit analysis may understate the costs of a GDE.

1.11 The model assumes risk neutrality. In our modelling, we did not give greater weighting to the costs of large gas supply interruptions compared to small and permanent costs, such as consumer price increases. Therefore, our analysis could understate the benefits that society places on avoiding a GDE.

1.12 Finally, the model cannot predict the impact of the proposed reform options on competition and potential market distortions. For example, the proposed reform options might affect market efficiency and credit requirements and could therefore distort the gas market. Further, the reforms could potentially increase the risk of financial distress to suppliers and shippers and might increase barriers to entry and hence reduce competition. Through these channels, the reforms could ultimately affect consumer prices, above and beyond the direct cost effects of the reforms. These effects cannot be modelled quantitatively. We have assessed these impacts qualitatively.

1.13 Given these limitations, it is important to have due regard to the less measureable impacts of the reform options which we refer to as the qualitative effects. These qualitative effects are not fundamentally different in nature or less important than the quantitative effects. We have therefore taken account of these effects alongside the quantitative analysis in reaching our draft policy decision.

2. Impact of Reform Options

Chapter Summary

This chapter outlines the potential effects of the reform options. We outline the impact of the options on consumers, competition, sustainable development and health and safety as well as potential risks and unintended consequences. We then present the cost-benefit analysis based on the modelling results.

Question box

Question 1: Have we fully captured the key impacts arising from our reform options?
Question 2: Do you agree that capping cash-out as proposed under options 2 and 4 will significantly reduce the risk of adverse consequences for competition?
Question 3: Do you believe that our modelling under or over estimates consumer price increases?
Question 4: Can you provide further evidence on the impact of our reform options on competition, in particular in relation to financial distress, credit requirements and barriers to entry?
Question 5: Can you provide information on the costs of implementing the proposed reforms, such as system changes and staff training?
Question 6: Have we effectively modelled interactions with other markets?
Question 7: Do you agree that the use of interruptible contracts will be encouraged through a reform of the cash-out arrangements?

Options

2.1 Chapter 6 of the draft policy decision outlines the reform options under consideration. Table 3 provides a summary of the four options compared to the current arrangements

Table 3: Options under consideration

Options[3]	Cash-out is frozen	Cash-out rises to full VoLL	Cash-out rises to capped VoLL	Further interventions
Current arrangements	X			
Option 1		X		
Option 2			X	
Option 3	X			X
Option 4			X	X

[3] Note that all options allow the Network Emergency Coordinator (NEC) to retain its ability to direct physical delivery of supply from GB sources of gas in an emergency.

2.2 Under options 2 and 4, cash-out would rise to domestic customers' value of lost load (VoLL), which we have assessed at £20 per therm, for all days of firm load shedding (where individual large consumers are required to reduce their gas demand) and the first day of any new network isolation (where parts of the network stop receiving gas). Firm customers that have been interrupted would receive a payment for the involuntary demand side response (DSR) service they provide to suppliers. Under option 1, the cash-out price would rise further to expose shippers to the full costs of firm interruptions.

2.3 There is a range of further interventions that could be introduced under options 3 or 4. We are minded to undertake further work to determine the need for further interventions and the appropriate further intervention if one were to be introduced. We outline a number of potential further interventions in chapter 5 and appendix 3 of the draft policy decision. For the purposes of our quantitative modelling, we have focused on a storage obligation to serve as a proxy for other further interventions.[4]

2.4 We note that a storage obligation results in a more interventionist approach when compared to the other further interventions outlined in the draft policy decision document. Appendix 2 provides an overview of the likely impacts of the other further interventions that have been considered.

Impacts on consumers

2.5 While we have never had a gas deficit emergency (GDE), if one did occur, the costs could be very substantial and the consequences significant for consumers and the wider economy in Great Britain (GB). In particular, during winter when a GDE is most likely, the consequences for vulnerable consumers could be substantial.

2.6 Two key objectives of the Gas Significant Code Review (SCR) are to minimise the likelihood as well as the duration and severity of a gas emergency occurring. Our third objective aims to 'compensate' consumers that have their gas supply interrupted as a result of a GDE.[5] Our three objectives of the Gas SCR go to the core of our statutory duty under the Gas Act 1986 to protect current and future consumers.

2.7 At a high level, our analysis regarding the impacts of our reform options on consumers suggests that cash-out reform could reduce the likelihood as well as the duration and severity of interruptions. Capping cash-out reduces shippers' incentives to invest and thus provides less protection to consumers. Overall, we believe that option 4 could be developed to provide the greatest benefit to consumers in terms of

[4] The specific characteristics of the storage obligation modelled are outlined in the Redpoint report. The obligation only allows the withdrawal of gas to prevent or reduce the severity of NDM interruptions. Once suspended, all storage is available to flow freely.

[5] The last objective is not to provide 'compensation' as such, but to ensure that any involuntary DSR services that are provided in an emergency by firm customers are paid for by shippers that were short of gas (short shippers).

reducing the likelihood and severity of an emergency. Our modelling predicts that price increases for all options will be between £0 and £6.66 for an average annual consumer bill. We note that there are other positive and negative impacts resulting from our reform options (eg impact on competition); those impacts will be outlined subsequently.

Likelihood of an emergency occurring

2.8 The best protection for consumers is to prevent an emergency from occurring. Therefore, we assessed all options in terms of their effectiveness in reducing the likelihood of firm customers being interrupted due to a GDE.

Current arrangements

2.9 In our view, the current arrangements do not provide sufficient incentives to market participants to invest in measures that will improve gas security of supply. Further, a frozen cash-out price might be too low to attract additional gas from outside GB. As GB becomes more dependent on gas imports, these concerns are exacerbated.

Table 4 Probability of outages in years under different scenarios assuming the current emergency arrangements, based on an average of the years 2012, 2016, 2020, 2030

Options	Firm DM interruptions	Firm NDM interruptions
Base case	1 in 16	1 in 122
Sensitivity 1: Frozen cash-out price partly determined by VoLL	1 in 16	1 in 188
Sensitivity 2: Increased probability and longer duration of infrastructure outages	1 in 12	1 in 83
Sensitivity 3: LNG prices driven by Japanese Crude Cocktail[6]	1 in 6	1 in 45

2.10 Table 4 shows the probability of firm customer interruptions based on the modelling.[7] We estimate that firm DM customers would be interrupted once in 16 years. Firm NDM customers would be interrupted once in 122 years. The table also shows the impact of varying some of the key modelling assumptions through sensitivity analysis. The results suggest that the likelihood of interruptions under the

[6] Japanese Crude Cocktail prices are linked to oil prices. Historically, LNG prices have been driven by oil prices but this has changed recently with the increase in shale gas production.
[7] See Appendix 3 for a description of the modelling assumptions and the sensitivities.

current arrangements could be significantly higher depending on external factors, such as future gas demand and the prices of liquefied natural gas (LNG).

Cash-out reform

2.11 A more dynamic cash-out price is expected to reduce the likelihood of firm customer disconnections for the following reasons:

- It is likely that cash-out reform would increase shippers' potential cash-out liabilities. Therefore, shippers would have stronger incentives to invest in measures to improve security of supply and to avoid being short during an emergency. This could include seeking storage provision or diversifying supplies.

- We expect that suppliers would have an increased incentive to agree interruptible contracts with DM customers. Such contracts would allow for earlier interruption of customers at a price below domestic VoLL. Customers with lower VoLLs would also have an incentive to agree such contracts at a price that is equal to or above their personal VoLL; in particular, if these include a combination of permanent option payments as well as exercise payments that are triggered by load interruptions.[8]

- More dynamic cash-out prices could attract more gas from continental Europe as well as LNG vessels; especially in emergencies that develop gradually over a number of days.

2.12 To ensure that incentives are not undermined, we propose using the cash-out payments to pay interrupted customers for any involuntary DSR services provided to the industry. Currently, any residual money due to the cash-out regime is re-distributed to the industry through neutrality. If all the additional money raised through cash-out charges were returned to the industry through neutrality, this could inhibit incentives to invest.

2.13 The modelling results as outlined in table 5 support this. The probability of firm DM and NDM customer interruptions caused by a GDE decreases significantly under option 1 and, to a lesser extent, option 2. The main driver behind the reduction in the likelihood of firm DM customer interruptions is our assumption that there will be an increased use of interruptible contracts. The reduction in the likelihood of NDM interruptions is mainly driven by additional gas imports and, in the case of option 1, by shippers investing in gas storage capacity.

2.14 We expect cash-out reform to be more effective at reducing the likelihood of emergencies than predicted by the modelling, as the model does not account for expectations of rising cash-out prices. In reality we expect that prices would rise

[8] For the purpose of our modelling, we have therefore assumed that customers with a VoLL below the average domestic VoLL hold interruptible contracts.

before any firm customers were interrupted as there would be an expectation that prices would potentially rise to VoLL. We anticipate that this would attract additional available supplies of gas into GB which could be sufficient to allow supplies to firm customers to be maintained.

Table 5 Probability of outages in years under the base case, based on an average of the years 2012, 2016, 2020, 2030

Options	Firm DM interruptions	Firm NDM interruptions
Current arrangements (frozen cash-out)	1 in 16	1 in 122
Option 1: Cash-out rises to full VoLL	1 in 67	1 in 303
Option 2: Cash-out rises to capped VoLL	1 in 63	1 in 182
Option 3: Further interventions (using storage example) with current arrangements	1 in 15	1 in 588
Option 4: Further interventions (using storage example) with cash-out rising to capped VoLL	1 in 175	1 in 2000

2.15 The model predicts that risk neutral shippers would invest in storage[9] if option 1 were implemented. This is because investing in storage would be cheaper than the expected probability of facing high cash-out prices. However, uncapped cash-out could be extremely high. This might lack credibility if there is a perception amongst shippers that some form of support would be given to help avoid financial distress of shippers or to avoid consumer price increases. This might reduce the industry's incentives to invest. Capping cash-out prices can address this concern.

2.16 No additional investment is predicted for option 2. This is because it would be cheaper for shippers to accept the potential risk of facing cash-out prices of £20/therm given the low probability of an emergency. However, the model assumes risk neutrality. In reality, many individuals and companies are risk averse (otherwise there would be no market for insurance). Therefore, we would expect a greater investment response to option 2 than predicted by the model.

2.17 We note that higher cash-out prices can only attract more gas in an emergency if gas is physically available. Table 6 illustrates the results of our sensitivity analysis with LNG prices being driven by Japanese Crude Cocktail (JCC) as an example of where it is not possible to attract sufficient gas imports. JCC is linked

[9] We note that the model assumes that any additional investment in security of supply would be in the form of investments in gas storage. We note that in reality, other options would be available to the industry to mitigate the risks of higher cash-out prices (eg diversification of imports, investments in DSR contracts).

to oil and prices are generally higher than assumed under the base case. Higher LNG prices would result in GB importing more from continental Europe compared to the base case and less through LNG. In these cases, increasing the cash-out price would have a more limited effect on attracting more imports because interconnectors are already importing at close to maximum capacity.

Table 6 Probability of outages in years assuming that LNG prices will be driven by JCC, based on the year 2020

Options	Firm DM interruptions	Firm NDM interruptions
Current arrangements (frozen cash-out)	1 in 6	1 in 45
Option 1: Cash-out rises to full VoLL	1 in 27	1 in 75
Option 2: Cash-out rises to capped VoLL	1 in 28	1 in 71
Option 3: Further interventions (using storage example)with frozen cash-out	1 in 15	Less than 1 in 1500
Option 4: Further interventions (using storage example) with cash-out rising to capped VoLL	1 in 100	Less than 1 in 1500

2.18 In summary, the results show the effectiveness of cash-out reform. Sharper emergency cash-out prices can incentivise investment, facilitate entry into interruptible contracts and attract more gas in an emergency. Although under specific circumstances, the latter effect could be limited due to a physical inability to import sufficient quantities of gas.

Further interventions could reduce the probability of outages substantially[10]

2.19 If cash-out prices are capped, the incentives to avoid firm interruptions are lower than the value customers attribute to secure gas supplies. Our modelling supports the theory that shippers are less likely to invest in measures to improve security of supply when cash-out is capped. In fact, no additional investment response was observed for option 2. Therefore, capping cash-out leaves a gap in the arrangements.

2.20 Furthermore, cash-out reform is only proposed to mirror the VoLL of gas consumers. It does not take into account any wider social costs or externalities of a GDE. We outline below that these costs could be significant. Hence, options 1 and 2 would not necessarily provide a socially optimal level of security of gas supply. Option 4 could address these concerns by introducing further interventions alongside capped cash-out reform.

[10] We have outlined the rationale for further interventions in chapter 5 of our draft policy decision.

2.21 Option 3 would introduce further interventions but would leave cash-out arrangements unchanged. As the cash-out price would still be frozen at stage 2 of an emergency, firm customer interruptions could occur even when gas is available at a lower price than customers would be willing to pay to retain their gas supply.[11]

2.22 We modelled a storage obligation as an example of further interventions to assess the effectiveness of such measures.[12] As outlined in table 5, our modelling suggests that a storage obligation combined with capped cash-out, is most effective in reducing the likelihood of interrupting firm DM and NDM customers. Option 3 is less effective. This is particularly the case for DM customers since the cash-out arrangements would remain unchanged.

2.23 In summary, we consider that cash-out reform is an effective tool to reduce the probability of firm gas interruptions. Capping cash-out however leaves a gap in the arrangements, placing a value on security of supply that is below customers' VoLL. The modelling shows that further interventions combined with capped cash-out could help fill this gap and address any social costs associated with a GDE. Such an option could therefore be an effective instrument in increasing the level of supply security.

Duration and severity of a gas emergency

2.24 The second objective of the Gas SCR is to minimise the severity and duration of a gas emergency if one were to ever occur. We have considered whether reforms can enhance the resilience of the GB gas market and improve its effectiveness in reducing the potential overall impact of an emergency.

2.25 Table 7 shows the average impact of an outage in therms and its pounds sterling value across the modelled years. The outage is conditional on interruptions occurring that affect non-power generating DM customers at a minimum (irrespective of whether they are firm or interruptible). We believe this is a good proxy for the ability of the different options to reduce the duration and severity of gas interruptions.

2.26 In summary, our modelling suggests that under the current arrangements, an average outage would affect 20.4 million therms of firm DM customer demand and 34.8 million therms of firm NDM customer demand. The associated cost is approximately £811 million for all firm customers combined. All options that were modelled reduce overall costs of an outage with option 4 being most effective where the further intervention used as an example is a storage obligation.

[11] To a lesser extent, this could also apply to option 2 since cash-out liability would be capped.
[12] We would expect other further interventions under option 4 to reduce the probability of outages to a greater extent than option 2. However, we expect that a storage obligation will be among the interventions that are likely to minimise the likelihood of an emergency. This is because a storage obligation can provide a higher degree of certainty that sufficient physical gas supplies are available to avoid firm NDM customer interruptions.

Table 7 Average outage size in millions of therms if interruptions occur (average over the years 2012, 2016, 2020, 2030). Number in brackets shows the value in millions of real 2011 pounds sterling based on VoLL

Options	Firm DM interruptions	Firm NDM interruptions
Current arrangements (frozen cash-out)	20.4 (114.2)	34.8 (696.8)
Option 1: Cash-out rises to full VoLL	1.2 (20.4)	12.9 (257.3)
Option 2: Cash-out rises to capped VoLL	1.5 (24.4)	27.1 (542.2)
Option 3: Further interventions (using storage example) with frozen cash-out	20.9 (115.6)	6.4 (128.7)
Option 4: Further interventions (using storage example) with cash-out rising to capped VoLL	0.8 (13.7)	5.7 (114.5)

Reduction in duration and severity of outages as a result of cash-out reform

2.27 We expect that sharpening price signals as proposed under options 1, 2 and 4 would reduce the duration and severity of an emergency. Higher cash-out prices could help to attract more gas from continental Europe and LNG cargoes allowing for faster recovery from an emergency. Table 7 reflects the impact of these incentives in our modelling. Option 1 reduces the expected outage size significantly for firm DM and NDM customers. The average expected cost is 65 per cent lower than under the current arrangements.[13]

2.28 As the cash-out price will only rise to a capped VoLL under option 2, we would expect this option to be less effective in reducing the duration and severity of a GDE. The modelling results confirm our hypothesis. Compared to the current arrangements the modelling shows a reduction in the expected costs of a GDE of 23 per cent, which indicates that option 1 is significantly more effective in this regard.

Further interventions can reduce the impact of a GDE

2.29 We consider that the effectiveness of the different further interventions on GDE duration and severity would vary significantly. For example, our current view is

[13] The interruptions of interruptible customers are not included in this calculation. However, if we included interruptible customers, the total expected cost of an outage under option 1 would be 59 per cent lower than under the current arrangements.

that an information provision may be much less effective than the storage obligation used as an example in our modelling in reducing the duration and severity of an emergency.

2.30 The results for option 3 illustrate that while a storage obligation as a standalone reform and in the way it was modelled is effective in reducing the impact of a GDE on firm NDM customers, it is less effective in protecting firm DM customers compared to the current arrangements. This is because the obligation modelled would only allow the release of gas to help prevent NDM interruptions.[14]

2.31 Option 4 can address this shortcoming by introducing cash-out reform alongside further interventions. The modelling results tend to support this conclusion in the case of our example of a storage obligation. Option 4 is the most effective in reducing the duration and severity of a GDE, both for firm DM and NDM customers. Compared to the current arrangements, the average impact for firm customers is expected to be 78 per cent lower under option 4 as modelled.

2.32 Overall, all options are expected to reduce the duration and severity of an emergency compared to the current arrangements. Of these, we believe based on our modelling and qualitative assessment that option 4 would provide the greatest protection to firm customers. This is in line with our assessment on the likelihood of interruptions.

Compensation of firm customers if their gas supplies are interrupted

Gas customers place a high value on gas supplies

2.33 The third objective of the Gas SCR is to appropriately 'compensate' firm consumers if they are ever interrupted. The objective is not to provide 'compensation' as such, but to ensure that any involuntary DSR services that are provided in an emergency by firm customers are paid for by shippers that were short of gas (short shippers).

2.34 Interruptions to gas supply will tend to have real cost impacts for firm gas customers, for example, businesses might have to close and domestic customers might need to find alternative heating and cooking sources. Under the current arrangements, these costs would be borne by consumers and potentially government.

2.35 However, we believe that in principle firm customers should be paid for the involuntary DSR services they provide if a supply shortage leads to their gas supply

[14] While interruptions of DM customers would not trigger the release of gas, DM customers could still benefit once the gas is re-injected into the market. We also note that in reality the storage obligation would potentially need to be conditional on the declaration of a particular stage of an emergency. If it were to be conditional on stage 3 of an emergency being declared, it is possible that NDM customers would be asked to stop using gas at stage 2 before gas under the obligation would be released from storage.

being interrupted. To achieve this, we propose the introduction of a payment for involuntary DSR services. This acknowledges the fact that firm customers are, in essence, providing a service to suppliers by being interrupted involuntarily in an emergency.

2.36 Analysis conducted by London Economics (LE) on behalf of Ofgem estimated the value that various types of gas users place on a secure gas supply. The analysis suggests that domestic customers are, on average, willing to accept a payment of approximately £20 per therm for each day they provide involuntary DSR services by having their supplies interrupted for one week in winter once in 20 years. This shows that gas users do attribute real value to retaining an uninterrupted, secure gas supply.

Payment for involuntary DSR services can reallocate the risks from customers to suppliers

2.37 Introducing payments for involuntary DSR services to interrupted customers, as foreseen under options 1, 2 and 4, could help mitigate the risks that consumers face. This is particularly important for vulnerable consumers who cannot easily afford to make alternative arrangements.

Table 8 Payments to firm customers for involuntary DSR services, in pounds sterling per therm

Stage of an emergency	Option 1: Payment for involuntary DSR services reflects full VoLL	Option 2 and 4: Capped payment for involuntary DSR services
Load shedding in stage 2 (per day)	£20	£20
Physical network interruptions in stage 3 (lump sum)	£280	£20

2.38 Table 8 shows payments for involuntary DSR services as proposed under the different reform options. In line with cash-out reform, option 1 provides the highest payments to firm customers since the level is set at an approximation of full domestic VoLL for interruptions occurring under stage 3 of an emergency[15] while being uncapped in stage 2 of an emergency.[16] Capping shippers' liability as foreseen

[15] For the purposes of modelling this, we assumed that the minimum period that NDM customers would be interrupted for would be 14 days.

[16] From a practical perspective, payment for involuntary DSR service in stage 2 might have to be restricted to gas users that can verify that they have either reduced or stopped their gas use. This may mean that only DM customers would be able to receive payment for involuntary DSR services in stage 2.

under options 2 and 4 will reduce this effect, meaning that consumers or potentially government would have to bear part of the costs.

Consumer bills

2.39 Enhancing security of supply is likely to come with additional costs. This section of the draft impact assessment focuses on the direct costs that can be assessed through our modelling.17 These include higher balancing costs in an emergency and investment costs for example as a response to a storage obligation.

2.40 Cash-out reform will increase the cash-out price during an emergency. Shippers and suppliers have several options to respond to these potential costs. They can ensure more secure gas supplies for example by investing in storage, diversifying imports and agreeing DSR contracts with consumers. Alternatively, suppliers and shippers might decide to accept these risks and not invest at all. Hence, reforming the cash-out arrangements will either increase suppliers' investment costs and/or expected balancing costs. These costs are captured in the quantitative modelling and are shown in table 9. It is assumed that these costs are fully passed through to consumer prices.[18]

2.41 The table shows a range for consumer price increases. This range was calculated using different assumptions for the cost of storage. The first figure represents the lower bound of costs and is based on the assumption that companies do not need to invest in additional storage because they already invest in sufficient storage for commercial reasons before winter. In this case, the actual costs for shippers would be lost arbitrage profits.[19] The second figure is based on the assumption that all investment in storage is new investment, which is likely to represent an upper bound of costs. This was calculated based on the long-run marginal cost of storage. We believe that the range represents an upper and a lower bound and we would expect the actual cost to be somewhere within that range. In reality, the cost of storage depends on each company's storage portfolio; in particular, whether a company already invests in storage capacity before winter. Companies that already invest in storage are likely to face significantly lower costs than companies that make no such provision.

[17] There are also potential indirect costs, for example, if the reform options adversely impact on competition. The subsequent sections of this impact assessment will consider these issues.
[18] We note that in reality suppliers and shippers could not simply increase prices without the risk of losing market share.
[19] The storage obligation modelled requires the industry to keep 1bcm of gas in storage in 2011, increasing to 3bcm in 2030. Such an obligation could be met using existing storage facilities. Companies already invest in higher levels of storage before each winter (around 4.5 bcm). Such companies might only need to keep gas in storage facilities for longer than they would otherwise do for commercial purposes. Consequently, the additional costs are only the opportunity costs of lost arbitrage given that companies cannot sell gas when it is expected to be most profitable.

Table 9 Increase in average annual consumer gas bills in real 2011 pounds sterling (based on average for the years 2012, 2016, 2020 and 2030)

Options	Annual consumer bill increase
Current arrangements (frozen cash-out)	0.00
Option 1: Cash-out rises to full VoLL	-0.04 to 0.64
Option 2: Cash-out rises to capped VoLL	-0.01 to 0.16
Option 3: Further interventions (using storage example) with frozen cash-out	0.04 to 6.59
Option 4: Further interventions (using storage example) with cash-out rising to capped VoLL	0.25 to 6.66

2.42 The modelling estimated that retail costs are likely to increase by up to £0.64 for an average annual domestic bill for option 1 and by up to £0.16 for option 2.[20] Introducing further interventions within options 3 and 4 can have very different effects on prices depending on the type of intervention chosen. Some further interventions such as an information provision would introduce minimal additional costs. Others would lead to additional costs that would need to be borne by suppliers and ultimately customers.

2.43 The introduction of a storage obligation under options 3 and 4 might impose considerable costs on those companies that do not already invest sufficiently in storage. The modelling estimated that average consumer bills would likely increase by between £0.04 to £6.66 per year for options 3 and 4. This illustrates that if a company already invests in sufficient levels of storage every year, then the cost impact is expected to be minimal. In this case, the main cost would be the opportunity cost of not being able to sell the gas stored in order to comply with the relevant obligation in times of high prices.

2.44 The price increases for all options are low compared to the estimated amount that customers would be willing to pay to avoid interruptions. LE observed that domestic customers are willing to pay around £33 more per year in order to avoid being without gas in winter for one week every 20 years. Their analysis indicated that small and medium enterprises are willing to pay around 6.7 per cent more for gas per year (which is on average £487) to avoid such a scenario.[21]

2.45 Overall, the trade-off between costs and the level of security of supply is evident. While a storage obligation under option 4 is estimated to be most effective

[20] Note that the lower bound value represents a price decrease. This is because the commercial value of storage would increase because stored gas can be released in an emergency when prices are likely to be higher as a consequence of cash-out reform compared to the current arrangements.
[21] This analysis did not include customers' willingness to pay to avoid interruptions with a very low probability (for example moving from 1 in 122 to a 1 in 303 year chance of NDM interruptions as calculated for option 1); therefore, comparisons for this group need to be treated with caution.

at reducing the likelihood as well as duration and severity of a GDE, it is also estimated to be the most expensive option to implement.

Impacts on competition

2.46 We have assessed the impact of the reform options we have considered on competition in the gas market. This includes an assessment of the implications for the competitiveness of businesses operating in GB. In summary, we found that uncapped cash-out could lead to higher risk of financial distress. Capping cash-out prices would lower these adverse impacts.

Credit

2.47 Access to credit and the costs of credit are important factors that influence the competitiveness of the industry. Credit implications arising from the proposed reform options are particularly important for small market players. To reflect additional risks placed on supplies and/or shippers, financial institutions could charge higher premiums for credit or require a better credit rating or more collateral. The reform options may therefore act to increase credit requirements and credit costs as they are intended to shift risks from consumers to shippers/suppliers.

2.48 A financial institutions' approach to risk is dependent on a range of factors including the shippers' and/or suppliers' position and their financial stability. The risk premium paid by shippers/suppliers can vary widely and is dependent on a range of factors, including: the risk grade of the customer; the number of facilities that the client has with the bank; the term of the bond; if the facility is cash covered; the nature of the instrument (financial/physical); and the structure of the facility.

Impact of cash-out reform on suppliers and their financiers

2.49 Under all options, except option 3, we are proposing to introduce more dynamic cash out prices in an emergency. These additional risks could increase *c*redit requirements and premiums. This might make it more difficult for shippers to operate within the market and for new businesses to enter into the market. If shippers are not insured against such risks, then the likelihood of a shipper defaulting during a GDE increases compared to the current arrangements. Some shippers may find it difficult to cover liabilities and/or to underwrite credit requirements.

2.50 The risks and credit implications resulting from cash-out reform would be greatest under option 1. The key trade-off under this option is between efficient cost targeting via uncapped cash-out, and the relative increase in the risk of financial distress for individual shippers during an emergency. Should it be necessary to isolate parts of the network (stage 3), then the costs associated with uncapped cash-out prices could be difficult to afford for some shippers, in particular smaller ones.

This might lead to some shippers having increased risk of financial distress. From our modelling results, we estimate that the average maximum annual exposure of the shipper community to high cash-out prices is approximately £8bn under Option 1.[22] The high costs under option 1 are particularly problematic because shippers cannot influence the restoration process that follows the physical isolation of parts of the network.

2.51 The increased risk of financial distress might inhibit shippers' responses in an emergency, potentially exacerbating the situation. Shippers might not have the reserves or financial backing to actually be able to pay out on this liability if they were ever short during an emergency. These risks are likely to significantly undermine the business case for option 1. However, cash-out prices are able to already rise to very high levels under the current arrangements before they are frozen. We therefore consider it appropriate for cash-out to rise to VoLL, but we have proposed capping exposure under options 2 and 4. Capped cash-out will significantly lower risks for shippers and the financial institutions funding them compared to uncapped cash-out. Our modelling results indicate that the average maximum annual exposure of the shipping community to high cash-out prices is approximately £1.2bn for option 2. This suggests that capping cash-out can effectively reduce the risks for shippers. We believe that the remaining risks can be best managed by the industry through, for example, diversifying imports, ensuring an appropriate mix of long-term and short-term contracts, agreeing DSR contracts with consumers and investment which enhance security of supply.

Further interventions can affect credit requirements

2.52 Further interventions as proposed within options 3 and 4 can also impact on credit requirements. In particular, obligations that introduce additional risks and investment requirements, such as a storage obligation and licence conditions, are likely to increase credit requirements.

2.53 For example, a storage obligation could require shippers or suppliers to make additional investment in physical storage. Suppliers or shippers that have not already invested in storage may need additional finances to cover these costs. Hence, costs for debt servicing and interest payments may increase. This may be problematic for smaller suppliers or shippers, who may lack the financial backing, credit rating and cash flow of larger players.

2.54 Further, a licence condition that requires suppliers or shippers to use best endeavours to avoid an emergency could also have adverse credit implications. If the Authority decides that a company has breached the requirements of its licence, it can impose financial penalties and potentially revoke the licence. It is likely that a failure to comply could result in serious damage to the company's external reputation as it may be seen as having caused the emergency.

[22] The maximum is calculated over 1,500 years simulated for each of the spot years modelled and then an average is taken over the maxima calculated for the four spot years. Note that total exposure within a given year can be due to more than a single outage event.

Liquidity

Liquidity is important for competition and to keep prices low

2.55 The gas market in GB is highly liquid. It is important that reforms do not disproportionately damage liquidity to the detriment of the market. Liquidity in the wholesale gas market is important to deliver effective competition. Liquid wholesale energy markets give market participants the confidence that they can buy and sell at prices that reflect underlying demand and supply conditions. They allow firms to manage risks effectively and reduce the scope for market manipulation. Importantly, they also provide transparent prices on which firms can base their investment decisions, and potential entrants can assess opportunities to enter the market.

2.56 Without sufficient liquidity, it would be difficult for smaller, non-vertically integrated suppliers to source gas in the required quantities. Therefore, liquidity in the wholesale market has a direct impact on competition in the retail market and low liquidity can serve as a barrier to entry.

Cash-out reform could inhibit trading during an emergency

2.57 Cash-out reform as proposed by options 1, 2 and 4 could have liquidity implications. Trading companies tend to have trading limits in place to limit the exposure of shippers to any market movements and unauthorised trading. If cash-out rises to VoLL during an emergency, this could result in shippers and traders having to delay trades in order to obtain approval from senior management. This might even cause traders and shippers to withdraw from the market. Trading limits on the On the Day Commodity Market might have to increase, which could affect the ability to facilitate trades. This could be particularly important for smaller players who might not be able to underwrite the necessary credit requirements. This in turn might reduce market liquidity and limit shippers' ability to balance.

2.58 However, traders as well as shippers and suppliers could put the necessary arrangements in place, such as revisiting approval processes to allow for a case when cash-out rises to VoLL. Cash-out reform is aimed at incentivising suppliers and shippers to invest in measures that will improve gas security of supply. These measures will help shippers and suppliers to avoid being short in an emergency thus avoiding paying high cash-out prices.

2.59 It has been suggested that introducing VoLL into the cash-out price when interruptions occur might reduce liquidity prior to that point. It was argued that VoLL could act as a target price in an emergency, with producers and importers potentially holding back gas, knowing that they will receive a guaranteed higher price once interruptions occur, thus increasing the likelihood of firm outages.

2.60 We believe this is unlikely. The price available for additional gas would probably be among the highest prices ever seen in GB and there would be no guarantee of achieving a higher price. There is also a question as to whether any supplier of gas holds enough market power to force firm interruptions. There could

be competition among imports given that prices prior to an emergency are likely to be high. Moreover, any supplier that did withhold gas in such a circumstance could see their reputation damaged if their behaviour was made public. Shippers could also be in breach of their licence obligations if they pursue a course of conduct which would prejudice the safe and efficient operation and balancing of the system.

A Storage obligation may not allow the release of gas in the early stages of an emergency

2.61 Further interventions could also affect liquidity. For example, a storage obligation – depending on its actual design – would likely require suppliers/shippers to keep gas storage at a certain level throughout winter. Selling stored gas supplies into the market below that threshold would only be allowed during certain circumstances. Suppliers would no longer be free to withdraw gas from storage during peak times. This could reduce liquidity in times of high demand, leading to higher wholesale prices in tight market conditions. However, suppliers/shippers would still be able to place additional gas into store, above the levels required by the storage obligation. Any additional gas stored could be released at any time for commercial reasons.

Market distortions

2.62 New regulations and market interventions may risk distorting markets. For example, interventions might favour incumbent suppliers/shippers over new entrants by raising barriers to entry. On the other hand, interventions can enhance market efficiency by allocating risks and responsibilities to those market players that are best able to manage those risks.

Barriers to entry

2.63 The credit and liquidity implications outlined above may affect smaller suppliers/ shippers and new market entrants disproportionately. In particular, increased cost of credit is likely to impact on companies' available cash flow. This is particularly important for small players whose cash flow is often key to growing their business. More dynamic cash-out charges in an emergency as proposed under option 1 are more likely to cause financial distress for smaller market players. Capping cash-out can help to address these concerns (which as noted above may already exist given that cash-out prices are able to rise to very high levels under the current arrangements).

2.64 Complying with any obligations imposed by potential further interventions could be more difficult for small suppliers/ shippers and new market entrants, depending on the type of a possible further intervention and its design. For example, in the case of a storage obligation, small suppliers/ shippers and new entrants may not have access to storage under the same terms as larger players or in sufficiently small volumes. Some of these concerns could be reduced with careful design of further interventions.

Market efficiency

2.65 The reform options under consideration might also impact on the efficiency of the gas market. In general, we believe that cash-out reform enhances the efficiency of the market because it shifts the risks associated with a GDE to those who are best able to manage those risks (ie suppliers and shippers). Under the current arrangements, risks are largely with customers and government. Interruptions can occur even though customers may be willing to pay more to retain a secure gas supply. Cash-out reform attempts to redress the balance of risk by making short shippers liable for at least some of the costs associated with firm customer interruptions.

2.66 Where possible, allowing the market to determine the allocation of resources tends to provide more efficient outcomes. Some possible further interventions that prescribe specific instruments, such as a storage obligation, can be viewed as being inefficient and "picking winners". By prescribing the use of one type of flexibility, a storage obligation could lead to a crowding out of other forms of flexibility. Further, it is important that the market has confidence that gas stored for this purpose could not be released for other reasons (such as high prices) as this could otherwise undermine and distort the market for commercial storage. For these reasons, the specific design of any further intervention which favours a certain form of flexibility would be important.

Impact on international competitiveness

2.67 Security of gas supply is crucial for the competitiveness of businesses in GB. A GDE is most likely to impact on industrial and commercial customers (ie DM customers). For safety reasons, larger customers would tend to have their demand curtailed first. The analysis conducted by LE on behalf of Ofgem shows the high value that businesses place on secure gas supplies. Small and medium sized enterprises are willing to pay 6.7 per cent more for gas per year to avoid a one week interruptions in winter that occurs every 20 years. LE's calculation for industrial and commercial customers is based on a value at risk analysis. It shows for example that the VoLL for the vehicle industry is in the range of £17.08 to £22.77 per therm. For the chemical industry, VoLL is in the range of £2.72 to £3.62 per therm. These examples illustrate the significant risks businesses can face when having their gas interrupted.

2.68 We note that gas interruptions can have wider economic knock on effects. Such costs result, for example, from indirectly affected businesses, lost tax revenue, possible civil unrest and dampened investor perception of the GB energy market. In particular, a gas disruption is likely to affect suppliers (upstream) and consumers (downstream) of interrupted businesses. These indirect effects along the value chain can be significant (see box 1). One example illustrating these widespread, economy-wide effects is the recent oil spill in the Gulf of Mexico which had significant knock-on effects for the entire local economy (and consequently tax revenue).

Box 1: Study on economic costs of firm load interruptions

A study conducted by ILEX Energy in 2006 estimated the costs of gas disruptions to the United Kingdom (UK) economy.[23] Besides estimating the direct effects of gas disruptions to interrupted businesses, the study further estimated the costs to directly affected upstream and downstream businesses. ILEX estimated that a six week complete and nationwide gas interruption would have cost the UK economy up to 0.81 per cent of GDP (ca. £7.9 bn) in 2006. This is made up of 0.18 percentage points of direct costs to interrupted businesses and 0.02 percentage points to upstream businesses as well as 0.61 percentage points to downstream companies.[24] The calculation is based on lost production and does not take into account longer-term effects, such as damages to equipment, effects further up and down the value chain, loss of market share of affected companies as well as adverse impacts on the perceived investment climate. The results indicate that the entire economic costs of a GDE could be a multiple of the direct costs of those consumers that have had their gas supplies interrupted.

Secure gas supplies reduce risks for businesses in GB

2.69 Given the high value at risk, the impact of gas supply interruptions over the course of several weeks and months could be very significant. As shown above, we estimate that all options under consideration would increase gas security of supply, albeit to a varying extent. Of particular importance here is the likelihood and expected costs of interruptions for firm DM customers (which was modelled as a proxy for stage 2 of an emergency). Options 1 and 2 would reduce the likelihood and costs, mainly by providing incentives to agree interruptible contracts. However, in both cases cash-out prices would not attempt to mirror any social costs of a GDE but only the VoLL of directly affected users.

2.70 Further interventions can have differing effects depending on the type of intervention and the design of the relevant intervention. Our modelling shows for example that out of the options we modelled a storage obligation combined with cash-out reform has the most positive effect for firm DM customers. Such an option could potentially lead to a more optimal level of supply security by better reflecting any social costs and externalities associated with a GDE. However, we note that these options are also likely to increase the gas bills of businesses most significantly.

[23] ILEX Energy Consulting, 2006: *Economic implications of a gas supply interruption to UK industry*. Updated (but less detailed) information on the economic impact of a gas supply interruption can be found in Pöyry 2010: *GB Gas security of supply and options for improvement - A report to Department of Energy and Climate Change.*

[24] The calculation assumes that upstream and downstream businesses cannot easily find alternative suppliers and customers and therefore have to cease production. If one assumes that downstream businesses can easily find alternative suppliers then the costs would be somewhere in the range of 0 per cent to 0.61 per cent of GDP. If one assumes that upstream companies can easily find alternative customers then the costs would be somewhere between 0 per cent and 0.02 per cent of GDP.

Payments for involuntary DSR services can pay for the costs to businesses in GB caused by outages

2.71 Introducing payments for involuntary DSR services under options 1, 2 and 4 would mitigate the impact on businesses should an emergency occur. However, as outlined above, such payments would not cover any indirect costs to GB businesses and the economy as a whole. If a licence condition that requires suppliers or shippers to use best endeavours to avoid an emergency under options 3 and 4 were to be implemented, the Authority could potentially impose significant financial penalties of up to 10 per cent of turnover, if a shipper/supplier is found in breach of the obligations in its licence. Government could potentially use this to cover part or all of any social costs caused by a GDE.

2.72 The analysis conducted by LE on behalf of Ofgem shows the wide array of values at risk across industry sectors. VoLL varies significantly between and within customer segments. The incentive created by introducing one administrative level of VoLL to the cash-out arrangements and the variation in personal VoLLs of each consumer should provide opportunities for suppliers and consumers to strike mutually beneficial interruptible contracts. The LE analysis shows that there are industry sectors with VoLLs far below £20 per therm. Hence, those businesses should be willing to be interrupted earlier and receive a DSR payment that is between their VoLL and the administrative VoLL; in particular, if that is paid as a combination of lower gas prices in all periods and exercise payments if they are interrupted. Overall, such contracts would help to avoid getting into an emergency.

2.73 Standard contracts as proposed in the draft policy decision as one potential further intervention option within options 3 and 4 could facilitate the process of agreeing interruptible contracts. Both parties could agree on a reduction of gas prices. Companies could use the money saved to invest in back-up fuel, for example. An exercise price could then be paid in addition should interruptions occur. Standard interruptible contracts could be particularly advantageous for businesses with low VoLLs.

Impacts on sustainable development

Ensuring a secure and reliable gas and electricity supply and managing the transition to a low carbon economy

2.74 There are important interactions between the electricity and gas markets that need to be considered here. Gas-fired generation forms a significant proportion of the GB electricity generation mix (around 40 per cent), and is a valuable source of flexible capacity. Gas-fired generation may become more important for electricity security of supply in the future with an increasing penetration of intermittent renewable energy (such as wind power). Recognising this, a key proposal arising from the Government's Electricity Market Reform consultation is the introduction of an electricity capacity mechanism.

2.75 In Project Discovery, we noted our concern that in the imbalance arrangements for both gas and electricity, customers could have their load curtailed

before cash-out prices have reached the VoLL of those consumers. It may be necessary to introduce measures to reflect VoLL in electricity cash-out arrangements to ensure efficient allocation of gas between sectors.

2.76 In an emergency ensuring secure gas supplies to firm NDM customers may be prioritised over electricity supplies for safety reasons. We would expect much of the reduction in demand from gas-powered electricity generators to be in response to price spikes. To this end, DM customers (including gas-fired generators) could effectively provide a 'buffer' against firm NDM customer outages.

2.77 Reform options that reduce the likelihood of load shedding will in turn reduce the need to interrupt gas-fired generators. We therefore expect such options to have positive knock-on effects on electricity security of supply. Table 10 shows that all reform options that are being considered enhance security of electricity supply, with option 4 being the most effective.

Table 10: Probability of power interruptions to electricity customers in years, based on an average of the years 2012, 2016, 2020, 2030

Options	Firm I&C electricity	Domestic electricity
Current arrangements (frozen cash-out)	1 in 54	1 in 154
Option 1: Cash-out rises to full VoLL	1 in 105	1 in 263
Option 2: Cash-out rises to capped VoLL	1 in 88	1 in 303
Option 3: Further interventions (using storage example) with current arrangements	1 in 76	1 in 208
Option 4: Further interventions (using storage example) with cash-out rising to capped VoLL	1 in 263	1 in 1250

2.78 In the detailed design phase of the Gas SCR, we will need to carefully consider the implications of our proposals on the security of electricity supplies. We anticipate further discussions with National Grid Gas (NGG) and National Grid Electricity Transmission (as system operator for the gas and electricity systems) and other key stakeholders on these important interactions. While the electricity emergency arrangements remain out-of-scope for this review, we will need to be mindful of any potential unintended consequences of our proposals.

Eradicating fuel poverty and protecting vulnerable consumers

2.79 We held discussions with our Consumer First Panel to elicit panellists' views on the importance of gas security of supply for domestic customers.[25] Panellists noted that price implications are a crucial consideration since higher consumer prices can increase the number of people in fuel poverty. We note that increased security of supply comes at a cost. Our modelling suggests that average annual consumer price increases will be no more than £6.66 as a consequence of the reforms we considered.

2.80 One of the main concerns panellists noted was the impact of unplanned interruptions on potentially vulnerable customers; in particular the elderly, those with disabilities, and those living alone. Panellists voiced concerns about the ability of a vulnerable consumer to arrange alternative means to keep themselves fed, warm and clean. Overall, panellists commonly felt that these individuals would need to be prioritised in terms of support.

2.81 It is not within the scope of this review to address emergency support services for vulnerable customers in the case of a GDE. However, we believe that vulnerable customers will benefit from the reform options outlined in this document as they reduce the likelihood as well as impact of firm interruptions.

2.82 Options 1, 2 and 4 will introduce payments for involuntary DSR services that can help vulnerable consumers to cope with the consequences of gas interruptions. However, such payments are likely to be paid some time after the outage has occurred (eg as a rebate on the next gas bill). This might impact on the ability of vulnerable consumers to make alternative arrangements in the short term to mitigate the impact of an outage. Hence, there may remain a role for government if we ever get into an emergency which requires supplies to domestic customers to be interrupted.

Impacts on health and safety

2.83 As outlined in chapter 4 of the DPD, our proposed approach to cash-out under all proposed options would allow NGG to retain (via the powers of the Network Emergency Coordinator (NEC)) ability to direct physical delivery of supply from GB sources of gas in a GDE. For this reason we would expect the impact of the proposals on the NGG and NEC safety cases to be limited. This is because the safety case focuses on the physical activities of NGG. The changes proposed for the cash-out arrangements relate more to the commercial arrangements for providing incentives to reduce the likelihood and duration/severity of an emergency. As such, it is

[25] See chapter 6 of the Draft Policy Decision for more information on the Consumer First Panel. The panel report is available here: http://www.ofgem.gov.uk/Sustainability/Cp/CF/Documents1/Ofgem%20Consumer%20First%20Panel%20Year%203%20-%20Report%20on%20Value%20of%20Lost%20Load.pdf

currently believed that the proposed reforms would not require a change to the NEC's safety case beyond those already required as part of Exit Reform.

2.84 We have outlined above that uncapped cash-out prices could increase the risk of financial distress for shippers in the event of an emergency and that this could reduce their ability to cooperate with NGG's instructions in an emergency. We believe that by capping cash-out these risks can be reduced.[26] Other measures to mitigate these risks (for example increased payment timescales) would need to be considered. The Health and Safety Executive (HSE) supports Ofgem's approach and is broadly satisfied that it will have no adverse effect on the health and safety standards associated with preventing or managing an emergency.

2.85 The impact of potential further interventions depends on the type and design of intervention. We will continue to liaise with NGG, the NEC and the HSE on this issue.

Risks and unintended consequences

Cash-out reform

2.86 Introducing cash-out reform may result in higher costs for short shippers in the case of an emergency occurring which could lead to higher risks of financial distress for short shippers. Furthermore, the potential for financial difficulties in an emergency may distract shippers from taking market actions that would help to minimise the duration and severity of a GDE. We believe this is a significant risk under option 1 but is materially reduced by capping cash-out as proposed under options 2 and 4. The industry should mitigate these risks by investing in security of supply measures to ensure that shippers can meet contracted demand.

Further interventions

2.87 Designing possible further interventions is complex. There is a risk that a flawed design might lead to unintended consequences; in particular, market inefficiencies. For example, a poorly designed storage obligation might incentivise the construction of storage facilities that are not appropriate for emergencies (for example due to a low deliverability rate). Further, any required storage level would need to be determined carefully so that costs of improving security of supply do not outweigh the benefits to consumers. In particular, the ongoing costs of holding gas in storage could greatly outweigh the benefits if too much gas is put aside for this purpose.

2.88 As discussed in appendix 3 of the draft policy decision, a licence condition setting out a new obligation for suppliers or shippers is another example of a possible further intervention. Such a condition could introduce an obligation requiring

[26] Potentially introducing increased payment timescales could further reduce such risks.

shippers to use their "best endeavours" to avoid being short in an emergency. As such a licence condition would be assessed ex post; this could create uncertainty for market participants. If there is a legal challenge to the Authority's decision there could be a lengthy legal dispute. Therefore, any work stream on further interventions would need to investigate potential risks and unintended consequences of such interventions.

European Interaction

Trade within Europe

2.89 Many European countries have regulations in place that provide stronger incentives to ensure security of gas supplies such as public service obligations (PSOs). PSOs can have adverse effects on European market liquidity since gas may not flow freely within Europe in specific circumstances. This is important as higher prices in GB can only attract more gas from Europe if gas can flow freely and is not, for example, held as strategic storage. Hence, a sharper price will be of limited effect in an emergency if no physical gas can be imported due to PSOs or other measures applied in other countries.

2.90 If similar PSOs, such as storage obligations, were introduced in GB, this could further inhibit trade within the EU during tight market conditions. More stringent security arrangements in GB could trigger a trend to increasingly tougher and more "nationalistic" security of supply arrangements in other European countries. This would need to be taken into consideration when choosing and designing further interventions.

Gas Quality

2.91 As explained in appendix 2 of the draft policy decision, gas quality specifications are different in continental Europe and GB. Stakeholders have previously suggested that there is a risk that shippers might not be able to import gas of the required quality during an emergency.

2.92 As described above, cash-out reform may incentivise industry to invest in measures that will improve gas security of supply. We expect that one of the ways in which this could be achieved would be to invest in gas processing facilities to allow for the imports of different quality gases.

Compliance and monitoring costs of the proposed arrangements for stakeholders

2.93 Some of the proposed reforms will require monitoring to ensure compliance. Further, suppliers and shippers as well as other market participants might have to bear additional costs to comply with the obligations introduced as part of the reforms.

2.94 We do not expect the new proposed cash-out arrangements to require significant resources to monitor compliance. The implementation may however require

one-off investments from NGG and the industry to ensure that the appropriate structures, including IT systems, are in place and staff are trained. This might result in additional costs for the industry.

2.95 Further interventions would likely create additional compliance and monitoring costs for the industry and Ofgem depending on the specific design. For example, an information obligation could require suppliers to provide data which could require Ofgem and potentially NGG to aggregate and analyse the data received. Further, Ofgem might have to conduct random spot checks to ensure the reliability of the data provided. In general, staff training and human resources might be required for the industry to comply with such interventions.

Post-implementation review

2.96 As part of our proactive surveillance of the gas market, we would continue to monitor the impact of the reform proposal if this were to be introduced. With regard to possible further interventions, we intend to outline an appropriate post implementation review as part of our new work stream and consultation process.

Cost-Benefit Analysis

2.97 The Cost-Benefit Analysis (CBA) was conducted by Redpoint and is based on the modelling results that we have outlined above.[27] The limitations of the CBA analysis as well as the results are outlined below.

Key limitations of CBA

2.98 The quantitative analysis has several limitations. In particular, the CBA does not include any economic knock-on effects, externalities and social costs caused by a GDE. The analysis focuses on the direct costs that gas consumers have to bear should a GDE occur. As discussed above, the analysis does not take into account any externalities and social costs; therefore, the CBA may underestimate the total costs to the economy/society resulting from a GDE.

2.99 The CBA is based on the direct consumer price increases arising from investment and balancing costs. Indirect costs, such as impact on competition (through credit requirements, liquidity, barriers to entry and financial distress) are not considered in the CBA. Should a reform option adversely affect competition, then it could be assumed that further price increases would be possible.

[27] The CBA assumes a perfectly competitive supply market that passes on all the costs to consumers. Further, it is assumed that the real rate of return required on gas storage is 12 per cent and the total capital expenditure cost of new storage capacity is £800m/bcm.

2.100 The CBA assumes risk neutrality and therefore weights all losses and gains equally. At an individual level and at a societal level, there is a measurable preference to avoid the largest risks, particularly where those risks might have a profound and lasting effect and potentially threaten the viability of an individual, enterprise or society. This risk aversion is the basis for insurance, whereby individuals voluntarily pay insurance premiums to avoid particular adverse impacts, even though, in aggregate, the probability weighted value of the insured event is usually significantly less than the premiums paid. If we were to build risk aversion into our assessment, it would imply that we should give greater weighting to large adverse events (such as a prolonged and widespread loss of gas supply to domestic consumers) and less weighting to small and predictable costs, such as the carrying cost of maintaining strategic storage. As a result, when weighted for risk aversion, the benefits could be significantly larger than our analysis implies.

CBA results

2.101 Table 11 shows the results of the CBA analysis. Similar to what we have shown for consumer price increases, the table shows a range for retail costs, net consumer welfare, retail revenue and cost of storage. The first value is based on a calculation of storage costs as being defined as the long-run marginal costs of storage. The second value is based on storage costs being defined as the opportunity costs of lost arbitrage profits, assuming that companies already hold sufficient levels of storage capacity.

2.102 Our analysis suggests that consumer welfare can differ significantly across the four options. Table 11 shows that consumer price increases are likely to be more significant for options 3 and 4 (using a storage obligation as an example) compared to options 1 and 2. Under options 1, 2 and 4, consumers benefit from receiving payments for the involuntary DSR services they provide to suppliers. Under all reform options, consumers benefit from a decline in load reductions compared to the current arrangements.

2.103 With regard to supplier welfare, the retail revenue and cash-out liability are equivalent to retail costs and DSR payments on the consumer side. The table illustrates that most of the retail price increases estimated under options 3 and 4 are a result of rising storage costs.[28] Since the model assumes a perfectly competitive market with all costs and benefits being passed through to consumers, the net supplier welfare is zero. This means that the overall net benefit is equal to net consumer welfare.

[28] The upper end of the range for storage cost in options 1 and 2 indicates positive storage costs. This means that suppliers benefit commercially from holding storage more strongly than under the current arrangements. This is because under the assumption of "lost arbitrage opportunity profits", the storage necessary for the obligation is taken from the available capacity for commercial storage, making the remaining storage capacity more valuable. This should in turn incentivise investment in commercial storage.

Table 11 Cost-Benefit Analysis of the different reform options in £ million relative to current arrangements

	Cost Item	Option 1: Cash-out rises to full VoLL	Option 2: Cash-out rises to capped VoLL	Option 3: Further interventions (using storage example)	Option 4: Further interventions (using storage example) with cash-out rising to capped VoLL
Consumer Welfare	Retail Costs	-348 to -7	-89 to -12	-3,146 to -255	-3,178 to 190
	Payment for involuntary DSR service	256	89	0	32
	Load reduction to firm gas customers	348	159	438	530
	Load reduction to firm electricity customers	12	11	6	23
	Load reduction to interruptible customers	1	1	-5	-2
	Net consumer welfare (ie net benefit)	**269 to 610**	**170 to 248**	**-2,706 to 185**	**-2,596 to 393**
Supplier Welfare	Retail revenue	348 to 7	89 to 12	3,146 to 255	3,178 to 190
	Cash-out liability	-256	-89	0	-32
	Cost of storage	-92 to 250	0 to 78	-3,146 to -255	-3,146 to -157
	Net supplier welfare	0	0	0	0

2.104 Overall, the CBA shows that options 1 and 2 have a positive net benefit, mainly due to payments for involuntary DSR services and a reduction in gas interruptions compared to the current arrangement. The table also illustrates that the net benefit for the storage obligation as modelled under options 3 and 4 can be positive or negative depending on whether the obligation can be met through existing capacity.[29]

2.105 As noted above, the CBA does not take into account economic effects which we have assessed qualitatively, such as the risk of financial distress for shippers in the case of uncapped cash-out. Furthermore, the CBA does not capture alternative further interventions, other than storage. Hence, while providing important insights into the effectiveness of the different reform options, the CBA is not a complete assessment of the impact of the reforms under consideration. The next section summarises the key quantitative and qualitative analysis which has been used to inform our draft policy decision.

[29] As pointed out above, the storage obligation was modelled as a proxy for further interventions.

3 Conclusion

Chapter Summary

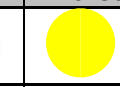
This chapter summarises our views on the quantitative and qualitative costs and benefits and overall impacts arising from the implementation of the proposed reform options.

Question box

Question 1: Do you agree that option 4 is the best option?
Question 2: Do you think that table 12 provides an appropriate assessment of the reform options?

3.1 We have analysed the key impacts of the proposed reform options on consumers, competition, sustainable development, health and safety as well as the potential risks and unintended consequences. Table 12 shows the impact of the options on some key criteria.

Table 12 Assessment of reform options

Key criteria	Current arrange-ment (frozen cash-out)	Option 1 Cash-out rises to full VoLL	Option 2 Cash-out rises to capped VoLL	Option 3 Further interventions with frozen cash-out		Option 4 Further interventions with cash-out rising to capped VoLL	
				Best	Worst	Best	Worst
Likelihood of firm outages							
Duration and severity of outages							
Payment for involuntary DSR services							
Consumer prices							
Competition and Market Efficiency							

 Positive impact Moderate impact  Negative impact

3.2 We believe that the current emergency arrangements whereby cash-out prices are frozen and imbalances are managed by instructing domestic supplies to flow are becoming increasingly less effective due to depleting domestic gas reserves. Our modelling suggests that these arrangements are not fit for purpose, in particular in an adverse external environment, for example during periods of high liquefied natural gas prices. Furthermore, no involuntary demand side response (DSR) payment is made to firm consumers should they be interrupted. Therefore, the risks are largely with customers.

3.3 Our analysis suggests that cash-out reform is an effective instrument to reduce the likelihood as well as duration and severity of interruptions. It also provides payments for the provision of involuntary DSR services to customers that are disconnected. It improves market efficiency by reallocating risks from consumers to those that are better able to manage those risks, ie the industry. However, we believe that there may be an impact on competition, in particular in terms of a higher risk of financial distress.

3.4 Capping cash-out as proposed under option 2 can address some of the concerns around competition. However, such an approach reduces the effectiveness of the price signals provided through cash-out reform and leaves a gap in the arrangements. Hence, consumers and potentially government still face substantial risks.

3.5 Further interventions as an alternative to cash-out reform do not provide the required price signals to attract gas to GB in an emergency. Moreover, such standalone interventions do not provide payments for involuntary DSR services and leave significant risks with customers. Therefore, we believe that cash-out reform should be an essential element to any reform under the Gas SCR.

3.6 Combining capped cash-out reform and further interventions can address the concerns we have identified for options 2 and 3. Essentially, further interventions can help bridge the gap that is created by capping cash-out while reducing the potential for the adverse impacts on competition resulting from an uncapped level of cash-out. As shown by our modelled example of a storage obligation combined with the introduction of capped cash-out arrangements, such a reform option can provide an enhanced level of gas security of supply and ensure that interrupted customers are to some extent paid for the involuntary DSR services they provide in an emergency. However, the actual impact will depend on the intervention chosen and its specific design.

3.7 We consider that the cash-out reform element of option 4 brings about the most significant benefits for consumers. In relation to further interventions, we have only modelled the effects of one form of intervention — that is, a storage obligation. In developing any further interventions to meet the objectives of this Gas SCR we recommend further investigation of the need for, impacts and effects of the various interventions that have been discussed in chapter 5 and appendix 3 of the draft policy decision before deciding the extent to which further interventions are necessary and the nature of such further interventions.

Appendices

Index

Appendix 1 - Consultation Response and Questions

1.1 Ofgem would like to hear the views of interested parties in relation to any of the issues set out in this document.

1.2 We would especially welcome responses to the specific questions which we have set out at the beginning of each chapter heading and which are replicated below.

1.3 Responses should be received by 31 January 2011 and should be sent to: gb.markets@ofgem.gov.uk

1.4 Unless marked confidential, all responses will be published by placing them in Ofgem's library and on its website www.ofgem.gov.uk. Respondents may request that their response is kept confidential. Ofgem shall respect this request, subject to any obligations to disclose information, for example, under the Freedom of Information Act 2000 or the Environmental Information Regulations 2004.

1.5 Respondents who wish to have their responses remain confidential should clearly mark the document/s to that effect and include the reasons for confidentiality. It would be helpful if responses could be submitted both electronically and in writing. Respondents are asked to put any confidential material in the appendices to their responses.

1.6 Having considered the responses to this consultation, Ofgem intends to publish a final decision in spring 2012. We will also be looking to run a number of stakeholder workshops and seminars during and after the consultation process. Although these are intended to inform our thinking on the Gas SCR process these workshops should not be seen as a substitute for providing a full written response. Any questions on this document should, in the first instance, be directed to:

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Steffen Felix (Economist)
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Tel: 020 7901 7000
E-mail: gb.markets@ofgem.gov.uk

CHAPTER: 1. Background and Objectives

Question 1: Do you agree with our modelling approach and the assumptions we have made?
Question 2: Are there any other limitations to our modelling approach that have not been accounted for?
Question 3: Are there additional sensitivities that we should consider for our final Impact Assessment?

CHAPTER: 2. Impact of Reform Options

Question 1: Have we fully captured the key impacts arising from our reform options?
Question 2: Do you agree that capping cash-out as proposed under options 2 and 4 will significantly reduce the risk of adverse consequences for competition?
Question 3: Do you believe that our modelling under or over estimates consumer price increases?
Question 4: Can you provide further evidence on the impact of our reform options on competition, in particular in relation to financial distress, credit requirements and barriers to entry?
Question 5: Can you provide information on the costs of implementing the proposed reforms, such as system changes and staff training?
Question 6: Have we effectively modelled interactions with other markets?
Question 7: Do you agree that the use of interruptible contracts will be encouraged through a reform of the cash-out arrangements?

CHAPTER: 3. Conclusion

Question 1: Do you agree that option 4 is the best option?
Question 2: Do you think that table 12 provides an appropriate assessment of the reform options?

Appendix 2 – Preliminary Assessment Tables for Further Interventions

2.1 The following tables provide an overview of the potential impacts of further interventions (see appendix 3 of the draft policy decision for an explanation of the interventions). Under option 3, further interventions would be introduced as standalone reforms. Option 4 combines option 2 (capped cash-out) and option 3 (further interventions). The impact of capped cash-out is described in the following for reference but will not be described for each further intervention.

Cash-out reform

2.2 For option 1, cash-out is set at daily VoLL for each day of firm DM customer interruptions and at 14 days daily VoLL for firm NDM customer interruptions. Under option 2 cash-out is set at daily VoLL for each day of DM interruptions and for the first day of firm NDM interruptions.

Table 13 Assessment table for cash-out reform

Criteria	Current arrangement (frozen cash-out)	Option 1 Cash-out rises to full VoLL	Option 2 Cash-out rises to capped VoLL
Likelihood of firm outages			
Duration and Severity of GDE			
Payment for involuntary DSR services			
Consumer prices			
Competition and Market Efficiency			

General remarks

- The modelling shows that cash-out reform is effective in attracting gas under tight market conditions, thus reducing the likelihood as well as duration and severity of firm interruptions. It also incentivises shippers to agree interruptible contracts to avoid paying domestic VoLL for emergency interruptible services.

- Option 1 is more effective than option 2 in attracting gas once firm NDM customers are interrupted. It also incentivises more investment in security of

supply measures to avoid an emergency. However, there is a higher risk of financial distress and impact on competition under option 1 than option 2.

- Cash-out reform improves market efficiency by shifting risks from consumers to suppliers. It also allows suppliers to invest in the most cost-effective flexibility measures. However, companies might fail to invest and might prefer to take risks.

- The effects of option 2 also apply to option 4 in respect of the cash-out element.

Information provision obligation

2.3 An information provision would oblige suppliers and/or shippers to provide relevant information on their demand and supply portfolio to Ofgem and/or the system operator. This could further develop the currently voluntary winter information requests by making these mandatory and improving the information requirements. We plan to refine the information request either on a voluntary or formal basis.

Table 14 Assessment table for an information provision

Criteria	Option 3 Information provision	Option 4 Information provision combined with capped cash-out
Likelihood of firm outages		
Duration and Severity of GDE		
Payment for involuntary DSR services		
Consumer prices		
Competition and Market Efficiency		

General remarks

- This obligation could give the system operator more information to assess and anticipate system tightness. This could also potentially help to interrupt customers in a more economically efficient way; thus, reducing the severity of an outage. However, we do not expect the overall effect to be significant when compared with a storage obligation for example.

- Apart from placing an additional but manageable administrative burden on suppliers and/or shippers, we do not expect this obligation to have further impacts on consumer prices, market efficiency or competition.

Licence condition

2.4 An ex-ante licence condition could require suppliers and/or shippers to provide proof that they have arrangements in place to have sufficient gas to meet their customers' gas demands under severe conditions (eg 1 in 20 peak day). Failure to prove this would constitute a licence breach which could result in a fine. Alternatively, an ex-post licence condition could require suppliers and/or shippers to use best endeavours to ensure they meet their customers' gas demands under all but exceptional circumstances.

Table 15 Assessment table for a licence condition

Criteria	Option 3 Licence condition	Option 4 Licence condition combined with capped cash-out
Likelihood of firm outages		
Duration and Severity of GDE		
Payment for involuntary DSR services		
Consumer prices		
Competition and Market Efficiency		

General remarks

- A licence condition of this type is likely to increase security of supply by providing a stronger imperative to purchase sufficient gas through the prospect of a licence breach for non-compliance. However, it does not ensure that enough physical gas is available. In addition, the obligation is more geared towards preventing an emergency and might do little to reduce the duration and severity should one occur.

- Such an obligation in a licence condition would allow suppliers and shippers flexibility as to the kind of security of supply measures they chose to use which should be more efficient than choosing only one mechanism such as a storage obligation, for example.

- An obligation of this type might affect competition by increasing credit requirements. This is because a licence breach can be a significant risk given the substantial penalties that could potentially be imposed on companies (ie up to 10% of the licensee's turnover). These penalty payments could potentially be used to pay for any social costs of an emergency.

Reliability option

2.5 A reliability option could require suppliers to buy options for the delivery of gas for a given strike price. Shippers and potentially other companies would bid to sell such options through an auction. These companies would receive a constant revenue stream from suppliers but would pay the difference between the market and the strike price should the supplier exercise its right to receive gas under the option.

Table 16 Assessment table for a reliability option

Criteria	Option 3 Reliability option condition	Option 4 Reliability option combined with capped cash-out
Likelihood of firm outages		
Duration and Severity of GDE		
Payment for involuntary DSR services		
Consumer prices		
Competition and Market Efficiency		

General remarks

- A reliability option incentivises investments in security of supply, such as storage, interconnector capacity and LNG terminals. The right to exercise the option could potentially be conditional upon a GDE or Gas Balancing Alert being declared. Consequently, we would expect that in an emergency, additional gas can be pumped into the market to reduce the duration and severity of an outage.

- If the obligation is purely financial, option sellers (eg shippers) might not respond to the incentives if it seems more profitable for them to keep the option payment and take the risk of having to pay a penalty in an emergency.

- The cost impact is likely to be lower than under a storage obligation given the flexibility of reliability options. Further, this could act to reduce credit costs for shippers that offer reliability options since they receive a constant revenue stream for investments in security of supply.

Standard contracts

2.6 Standard contracts could be introduced to facilitate the agreement of interruptible contracts between suppliers and customers. This need not restrict the use of customised contracts for interruptibility. Potentially, suppliers could be obliged to agree a certain number of interruptible contracts to provide additional certainty regarding the volume of interruptibility.

Table 17 Assessment table for standard contracts

Criteria	Option 3 Standard contracts	Option 4 Standard contracts combined with capped cash-out
Likelihood of firm outages		
Duration and Severity of GDE		
Payment for involuntary DSR services		
Consumer prices		
Competition and Market Efficiency		

General remarks

- Such an intervention should increase the use of interruptible contracts. However, if the agreement of interruptible contracts is purely voluntary, there would be little incentive for suppliers to do so under option 3 since the cost of being short in an emergency is limited.

- Under option 4 there is an incentive to agree such contracts voluntarily to avoid high cash-out charges. This should decrease the likelihood of firm interruptions.

- Suppliers can decide whether or not to interrupt in an emergency prior to NGG directing curtailment. This will depend on their demand and supply circumstances. Hence, it may not be as effective as a DSR auction where a central authority can order interruptions in avoiding firm outages.

Demand side response auction

2.7 A DSR auction would allow DM customers that meet certain security requirements to bid for interruptible contracts before winter. The design assessed here would restrict the DSR payments of firm DM customers under option 4 to those that cannot participate in the auction. Successful bidders would receive an exercise price only should they be interrupted.

Table 18 Assessment table for DSR auctions

Criteria	Option 3 DSR auction	Option 4 DSR auction combined with capped cash-out
Likelihood of firm outages		
Duration and Severity of GDE		
Payment for involuntary DSR services		
Consumer prices		
Competition and Market Efficiency		

General remarks

- All DM customers have a strong incentive to participate in the auction as they would receive an exercise price should they be interrupted. Hence, it is very likely that the volume of interruptible contracts increases, which will reduce the likelihood of firm interruptions.

- A DSR auction would facilitate the interruption of DM customers in the most economically optimal order, thus reducing the severity of an emergency and increasing market efficiency.

- DM customers with high VoLLs would be least likely to be successful in an auction and would therefore not receive a payment for their involuntary DSR services. This creates an inefficient outcome since it would be those customers that are most severely affected by gas interruptions (compared to other DM customers).

- In general, the design of an auction is challenging and there is a risk of unintended consequences.

Storage intervention

2.8 A storage intervention could oblige suppliers and/or shippers to invest in storage and ensure a certain volume of gas is stored by them throughout winter. Alternatively, the system operator or Government could invest in strategic storage or build new storage facilities for companies to use. Table 20 assumes a storage obligation on shippers as modelled quantitatively for this IA.

Table 19 Assessment table for a storage obligation

Criteria	Option 3 Storage obligation	Option 4 Storage obligation combined with capped cash-out
Likelihood of firm outages		
Duration and Severity of GDE		
Payment for involuntary DSR services		
Consumer prices		
Competition and Market Efficiency		

General remarks

- The storage obligation modelled provided a high level of security which greatly protects firm NDM customers. However, the obligation as a standalone reform (option 3) increased the likelihood of DM interruptions as it effectively withholds gas in the early stages of an emergency. A different design could provide more protection for DM customers. Overall, the modelling estimated option 4 to be the most effective reform option with regard to enhancing security of supply.

- A storage obligation can potentially crowd out other forms of flexibility, such as interruptible contracts. Further, there could be an expectation that gas would be re-injected into the market at times of high prices. This could potentially undermine and distort the market for commercial storage.

- A storage obligation could also form a barrier to entry and deter competition. In particular, small suppliers/shippers and new entrants may find it more difficult to raise the necessary investments.

Appendix 3 – Modelling Approach

Background

3.1 In the following section, we describe the basic modelling approach used to assess the impacts of the various reform options.

3.2 The quantitative impacts of the reform options have been modelled using a stochastic model of the GB gas market. The model contains a full representation of the gas supply infrastructure and demand segments, together with a representation of the GB electricity sector. The model constructs an annual supply profile for a given demand curve at monthly granularity. It generates day-by-day simulations incorporating stochastic variations in gas demand, gas supply availability, and infrastructure outages.

3.3 The model runs numerous simulations based on these variables using a within day optimisation routine that tries to meet total demand at least cost using available supplies. In any given day, the level of each exogenous variable is determined stochastically based on the distribution assumptions for that variable. There is no foresight of this stochastic variation in the model. This generates some scenarios in which the combination of variables results in a gas deficit emergency (GDE) and curtailment of firm load. The model then generates outputs for the scenarios in which a GDE has occurred. This allows us to look at the cause of the GDE and to model how the effects of the GDE change with the various reform options compared with the current arrangements.

Key assumptions

3.4 We acknowledge that, as with any modelling, the outcomes of the analysis are heavily reliant on the underlying assumptions that Ofgem and Redpoint agreed on. Redpoint has published the modelling assumptions in their report and we welcome feedback on these assumptions. Where possible the modelling has used National Grid (NG) historic data to calibrate stochastic functions. Additional assumptions were made to estimate the probability and extent of infrequent events, including for example:

- Tightness of the global Liquefied Natural Gas (LNG) market: The model randomly used either Henry Hub pricing (ie the price prevalent in the United States), tighter Japanese Crude Cocktail (JCC) pricing and combinations of the two. In the former case, this means that GB would be acting as a 'Western Hub' for European Union (EU) LNG imports while in the latter case GB would be more reliant on imports through interconnectors.

- Speed of LNG response: It was assumed that unscheduled cargoes take a minimum of seven days to reach GB in response to price signals.

- Probability, scale and duration of supply shocks: It was assumed that on average there is a 30 per cent chance of some form of outage on Interconnector UK (IUK), BBL[30], gas storage and LNG imports in a given year, with the probability of outages occurring in winter being double the probability of outages occurring in the summer. For United Kingdom Continental Shelf (UKCS) and Norwegian Continental Shelf (NCS) supplies the probability of sudden outages was assumed to be 10 per cent in any given year as these were modelled on top of variable supply that was calibrated to 10 years of historical output data.

- Interconnector flows: It was assumed that, for higher gas price levels, a larger price differential between GB and continental gas prices would be required to attract gas into GB across the IUK than to draw gas out of GB. This captures the effect of measures such as Public Service Obligations (PSOs) in Europe and long-term contracts.

- Amount of gas storage capacity: This was based on Ofgem's latest assessments on current projects. The Rough storage facility is classified as long-range storage (LRS) while all others are classified as short-range storage (SRS)[31]

- Volumes and prices of demand side response/the Value of Lost Load (VoLL): For electricity users and gas powered electricity generators, we used the same assumptions as in Project Discovery. For other gas users, London Economics was engaged to estimate VoLL for domestic, small and medium enterprises (SMEs) and industrial and commercial (I&C) customers. To set cash-out in the event of firm customer interruptions, we chose to use the VoLL for domestic consumers for a one week outage occurring in winter with a frequency of once in twenty years (approximately £20/therm). London Economics also estimated VoLL for various gas intensive industries. These estimates were used to determine a number of tranches of VoLL in the model. Further, it was assumed that two of the three tranches of daily metered (DM)[32] customers (which each have VoLLs lower than £20/therm) would hold interruptible contracts under all options that propose cash-out reform (that is, options 1, 2 and 4).

- GB gas generation and demand: The underlying generation mix is based on Project Discovery's Green Transition scenario. Demand forecasts are based on National Grid's updated Gone Green. Under this scenario, National Grid forecasts declining gas demand over time. Seasonal demand variation was based on trends from the last ten years of actual gas demand published by NG.

- Frozen cash-out: We cannot know exactly when National Grid Gas (NGG) would announce a stage 2 emergency and the cash-out price. Further, our

[30] Balgzand (the Netherlands) – Bacton (UK) Gas interconnector.
[31] For the purpose of this report, we will not distinguish between medium-range storage (MRS) and SRS.
[32] This is a gas customer with a meter which allows their consumption to be measured on a daily basis.

modelling only reflects a daily level of granularity which does not account for price changes during a gas day. Hence, assumptions need to be made about the level cash-out would be frozen at in an emergency. To model the current arrangements (and option 3) we assumed that cash-out would be frozen at the previous day's closing price on a day in which an imbalance causes firm customers to be interrupted. If an emergency is announced on this day, this price is likely to represent a lower threshold for frozen cash-out as the price could have risen on the day of the emergency and post emergency claims[33] could mean that the effective price is higher. However, if an emergency were actually declared before firm customers are interrupted, our frozen cash-out assumption could overestimate frozen cash-out.

Sensitivity analysis

3.5 The modelling is to a large extent dependent on our assumptions. We have undertaken sensitivity analysis to help identify the impact of a number of key assumptions. These have tested the sensitivity of the results to assumptions on for example:

- Increased frozen cash-out prices: A sensitivity analysis has been conducted with the frozen cash-out price being calculated based on 80 per cent of the previous day's price and 20 per cent of the price that would be achieved on the day under option 2.

- Increased likelihood of infrastructure outages: Under this sensitivity, we assume that supply shocks are twice as likely and would last twice as long as assumed under the base case (detailed above). The scale of the shocks was not altered.

- Increased LNG prices: The price of LNG is a key determinant of how dependant GB is on supplies from the continent. We expect that high LNG prices would result in GB importing more from continental Europe and less through LNG and vice versa. This was tested by assuming that LNG prices are only linked to higher, predicted JCC prices instead of a random choice between Henry Hub and JCC.

- Reduced demand side response: As explained above, we assumed a certain number of customers became interruptible under the options that propose cash-out reform (options 1, 2 and 4). Under this sensitivity we assume there are no interruptible customers under these options.

3.6 Modelling under the base case assumptions was run for all options over four years: 2012, 2016, 2020 and 2030. The reported figures show the average impact

[33] Under the post emergency claims arrangements suppliers get compensated if they deliver gas to the system in excess of their offtakes and if the cost of supplying this gas exceeds the price they would be paid through cash-out.

over these four years. The sensitivities were run for all four years for the current emergency arrangements. For other options, the sensitivities were only run for 2020 unless otherwise stated.

Appendix 4 - Glossary

A

Agency for Cooperation of National Energy Regulators (ACER)

The Agency for Cooperation of National Energy Regulators is a body of European Union designed to help co-ordinate and support the actions of national energy regulators. Its over-arching objective is to help achieve a single energy market in Europe.

Authority (The)

The Authority is the Gas and Electricity Markets Authority (GEMA). GEMA is the governing body of Ofgem and consists of non-executive and executive members and a non-executive chair.

C

Cash-out

National Grid Gas is responsible for taking out balancing actions on behalf of the market. The prices paid for these balancing actions are then passed onto long and short shippers. That is, long shippers are paid at one rate for their positive imbalance and short shippers have to pay at a different rate for their negative imbalance. These charges are known as cash-out prices.

Cash-out (dynamic)

Dynamic cash-out means that the level of the cash-out continues to change in response to circumstances upon declaration of a stage 2 emergency. This approach was proposed in the initial consultation.

Cash-out (frozen)

Under current gas emergency arrangements the cash-out price is frozen when stage 2 of an emergency is declared. That is, the cash-out price remains at the level it was at this time for the duration of the emergency.

Curtailment Order

The order in which load will be curtailed at stage 3 and above of an emergency.

D

Daily-metered customer (DM) customer

This is a gas customer with a meter which allows their consumption to be measured on a daily basis.

Demand Side Response (DSR)

A Demand Side Response is a short-term change in the use of, in this case, gas by consumers following a change in the balance between supply and demand.

Distribution Network Operator

Distribution Network Operators are companies licensed by Ofgem to distribute gas or electricity in Great Britain.

E

Emergency curtailment arrangements

The emergency curtailment arrangements provide for compensation to be provided to shippers in the event that transporters instruct, under the direction of the NEC, the curtailment of gas off-takes at any relevant supply point. Shippers are still required to pay cash-out on their imbalances but curtailed quantities are subject to a trade between the shipper and the residual balancer at the Emergency Curtailment Trade Price. As such, shippers will not be 'cashed out' on these curtailed quantities.

Emergency curtailment trade price

The price at which a shipper's emergency curtailment quantity is compensated. This is determined as the 30 day average System Average Price prevailing at the commencement of a Gas Deficit Emergency.

Emergency specification gas

For gas to be allowed to enter the GB network it must meet certain specifications with respect to, for example, its calorific content. In the event of an emergency these specifications may be relaxed to allow for gas that would not normally meet the tighter specifications to enter the system. This is known as emergency specification gas.

Ex Ante / Ex Post

These are Latin terms meaning "before the event" and "after the fact" respectively.

Exit Reform

The Reform of the NTS Exit Capacity arrangements also known as Exit Reform began in 2005 following the Authority's decision to approve National Grid Gas's sale of four of its distribution network businesses. The process concluded in January 2009 with the implementation of UNC195AV known as the Introduction of Enduring NTS Exit Capacity Arrangements.

The reform was necessary to ensure NGG received efficient investment signals in respect of NTS users' capacity needs under the new arrangements. This reforms process has also resulted in changes being made to the stages of a national gas deficit emergency.

F

Firm customer

A customer with a non-interruptible gas supply contract. These customers cannot be requested to reduce their demand or have their demand curtailed except for following the announcement of stage 3 or greater of an emergency.

Firm load shedding

Upon declaration of stage 3 of an emergency, the NEC may instruct transporters of gas to request that consumers stop using gas. This is known as firm load shedding.

Force Majeure

Force Majeure (FM) is a way in which parties to a contract can agree on specific circumstances when a failure to perform an obligation will be excused (ie when the breaching party will not face liability for its breach).

Clause 3 of Section 3 of the UNC General Terms defines Force Majeure as: "Any event or circumstance, or any combination of events and/or circumstances the occurrence of which is beyond the reasonable control of, and could not have been avoided by steps which might reasonably be expected to have been taken by, a Party (the Affected Party) and which causes or results in the failure of the Affected Party to perform or its delay in performing any of its obligations owed to any other Party or Parties under the code."

G

The Gas Act (1986)

The Gas Act is a piece of primary legislation that prohibits persons from engaging in specified activities unless authorised to do so by a licence granted by the Authority. The Gas Act also sets out the powers of the Authority in carrying out its functions under Part I of the Gas Act.

Gas Balancing Alert (GBA)

A Gas Balancing Alert is used by NGG where the amount of demand on the system reaches a certain trigger level relative to the supply available. It provides a signal to the market to increase gas flows to the system in order to reduce the risk of entering into a gas supply emergency.

Gas Deficit Emergency (GDE)

A Gas Deficit Emergency is a type of Gas Supply Emergency arising as a result of insufficient deliveries of gas being available to meet required demand on the gas system or as a result of a potential or actual breach of a safety monitor.

The Gas Safety (Management) Regulations 1996 (GS(M)R)

The GS(M)R set out the requirement for a Network Emergency Coordinator (NEC) for any network which includes more than one gas transporter. They also require each gas transporter, as well as the NEC, to prepare a safety case which must be approved by the HSE.

Gas Supply Emergency

A Gas Supply Emergency is defined in the UNC as the occurrence of an event or series of events that results in, or gives rise to a significant risk of, a loss of pressure in the gas system which may lead to a supply emergency.

H

Health and Safety Executive (HSE)

The Health and Safety Executive (HSE) is the national independent watchdog for work-related health, safety and illness. The safety case produced by the Network Emergency Coordinator must be submitted to the HSE for their approval.

I

Interconnector

The gas pipelines and associated terminals which connect the European and UK gas transmission networks.

Interruptible contract

An interruptible contract may be signed by gas consumers where the relevant transporter and/or supplier has the ability to ask a consumer to reduce its off-takes (generally daily metered customers). These contracts allow the transporter and/or supplier to disconnect the consumer (in or out of an emergency) in order to manage demand on the system. Consumers may sign these contracts in return for reduced rates on their gas supply.

L

Licensee (Gas)

The Gas Act requires parties involved in the gas industry to be licensed by the Authority. As license holders, these parties are required to comply with a number of licence conditions. In addition, licensees are required to adhere to the legal and contractual framework that is set out in the Uniform Network Code (UNC).

Licence condition

All parties licensed by the Authority to partake in gas industry activities are required to meet certain licence conditions. The licence conditions for the gas industry are categorised into transporter, shipper, supplier and interconnector licence conditions. The licence conditions are separated into standard licence conditions which apply to all licensees of one type (eg transporters) and special licence conditions which apply only to a specific party (eg NGG).

Line-pack

Gas line-pack is the quantity of gas that is available in the network itself held in the pipes that are used to transport the gas. As there is some flexibility in the pressures that are allowed in the gas system line-pack may be used by NGG to manage load to a certain degree.

Liquefied Natural Gas (LNG)

Liquefied Natural Gas or LNG is natural gas (predominantly methane, CH4) that has been converted temporarily to liquid form for ease of storage or transport.

Liquidity

Liquidity is a measure of the potential for new entrants to join a market. A low liquidity means that it is difficult for new entrants to enter into and grow in a market.

Local Distribution Zone (LDZ)

Local Distribution Zones (LDZs) are low pressure pipeline systems which deliver gas to final users and Independent Gas Transporters. There are twelve LDZs which take gas from the high pressure transmission system for onward distribution at lower pressures.

M

Market Balancing Action (MBA)

An action taken by NGG to balance the system in which it enters into a transaction with a party so that that party will agree to make an acquiring or disposing trade nomination. The cash-out prices set the price at which these trades will be made.

Modification (Code)

The Uniform Network Code is the framework which sets out the gas transportation arrangements for those parties licensed under the Gas Act 1986. This code has

developed through modifications raised by signatories to the UNC. It is still possible for modifications to be made through this industry led process. However, the introduction of the Significant Code Review process now allows for Ofgem to lead on the development of modifications before directing them to be raised.

Moral hazard

An economics term used to describe the tendency of parties to take greater risks in relation to an event occurring when they have insurance against the occurrence of this event.

N

National Grid Gas (NGG)

National Grid Gas (NGG) is the Gas Transportation licence holder for the North West, West Midlands, East England and London Gas Distribution Networks. NGG also hold the Gas Transportation licence for the gas National Transmission System (NTS). Prior to 10 October 2005, NGG was known as Transco.

National Transmission System

This is National Grid Gas's high pressure gas transmission system. It consists of more than 6,400 km of pipe carrying gas at pressures of up to 85 bar (85 times normal atmospheric pressure).

Network Emergency Coordinator (NEC)

The Network Emergency Coordinator is responsible under safety legislation for the coordination of a gas supply emergency.

Non-daily metered gas customer (NDM)

This is a gas customer who does not have a meter which is read on a daily basis.

Neutrality

This refers to the system of Balancing Neutrality Charges which are used under the Uniform Network Code (UNC) to ensure that National Grid neither benefits nor loses financially from the balancing actions it is required to undertake. The charges reflect the difference between all amounts received and paid by National Grid for gas used to balance the system and are spread across all signatories of the UNC on the basis of their usage of the transportation system.

O

On-the-day Commodity Market (OCM)

This is the market on which trading takes place to allow NGG to balance the system. Shippers may also trade with each other on the OCM.

P

Post Emergency Claim (PEC)

The post emergency claims arrangements are used to compensate parties for flowing additional gas onto the system in an emergency, if opportunity costs for shippers to do so exceed the cash-out price they received for going long.

Project Discovery

Project Discovery is Ofgem's 2010 investigation into whether or not future security of supply could be delivered by the existing market arrangements over the coming decade. A copy of the report and associated documents can be accessed on our website.

Public Appeal

An appeal made by NGG to consumers in the event of a Gas Supply Emergency to reduce gas use.

Public Service Obligations

An obligation on suppliers to meet the needs of certain categories of customers. The details of the obligation placed on each supplier will differ.

R

Royal Assent

Royal Assent is the Monarch's agreement to make a Bill into an Act. A Bill must have Royal Assent before it can become an Act of Parliament (law).

S

Safety case

The Gas Safety (Management) Regulations 1996 set out the requirement for each transporter of gas to publish a safety case which must be approved by the HSE. These safety cases must demonstrate the method by which the holder will ensure the safe operation of its network. In the case of the NEC, the safety case includes details of the procedures that the NEC has established to monitor the situation throughout a supply emergency and for co-ordinating actions across affected parts of the gas network.

Safety Monitor

The Safety and Firm Gas Monitor Methodology (Safety Monitor) provides a requirement for sufficient gas to be held in storage to meet a number of criteria. This requirement remains valid in the event of a GDE.

Significant Code Review

A new modifications process introduced through the Code Governance Review. This process allows Ofgem to develop modifications proposals before directing them to be raised.

Shippers

Gas shippers buy gas from producers and sell the gas onto suppliers, and are defined as any body which introduces, conveys and takes out gas from the gas pipeline.

Smeared/shared cost

This is a cost that is spread across all relevant parties. For example, the costs to National Grid of a certain activity may be spread across all shippers involved in the GB gas market.

Stage 2 Emergency

Upon entrance into a Gas Supply Emergency, a number of stages may be declared. Under the current arrangements the cash-out price is frozen upon declaration of stage 2 of an emergency.

System Average Price

This is the average of the prices paid by National Grid in taking market balancing actions for all balancing transactions.

System Marginal Buy Price

The System Marginal Buy Price is the greater of the system average price plus the default system marginal price, and; the price of the highest balancing action offer price in relation to a Market Balancing Action taken by National Grid Gas for that day.

System Marginal Sell Price

The System Marginal Sell Price is the lesser of the system average price minus the default system marginal price, and the price of the lowest balancing action offer price in relation to a Market Balancing Action taken by National Grid Gas for that day.

System Operator

The entity responsible for operating the GB transmission system and for entering into contracts with those who want to connect to and/or use the transmission system. National grid is the GB system operator.

T

Therm

A unit of heating value equivalent to 100,000 British thermal units (Btu) (0.1 MMBtu).

The Third Package

The Third Package is a key step in implementation of the internal EU energy market. It recognises the need for better co-ordination between European network operators and continuing co-ordination between regulators at that level.

When discussing the 'Third Package' in this document we are referring to Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and to Regulation (EC) No 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators.

Transporter (Gas)

The holder of a Gas Transporter's licence in accordance with the provisions of the Gas Act 1986.

U

Uniform Network Code (UNC)

The UNC defines the rights and responsibilities for all users of gas transportation systems in GB. The UNC is, in effect, a contract between the gas transporter and the users of its pipeline system.

Uniform Network Code (UNC) – Section Q

Section Q of the UNC is the main framework which sets out the arrangements that will be in place in the event of declaration of a gas emergency.

V

Value at Risk

This was a methodology used by London Economics to calculate the Value of Lost Load for Industrial and Commercial consumers (with the exception of generators). It estimates the value of risks (eg loss profits) of gas consuming businesses if they had their gas supplies interrupted.

Value of Lost Load (VoLL)

This is the theoretical price at which a consumer would rather have their gas supply disconnected than continue to pay for a firm supply.

List of Acronyms

ACER	Agency for Cooperation of National Energy Regulators
ASSAP	Average Summer System Average Price
CM	Choice Modelling
BCM	Billion Cubic Meters
CV	Contingent Valuation
DECC	Department of Energy and Climate Change
DM	Daily Metered (gas customer)
DN	Distribution Networks
DSR	Demand Side Response
ECQ	Emergency Curtailment Quantity
EMR	Electricity Market Review
GBA	Gas Balancing Alert
GDE	Gas Deficit Emergency
GS(M)R	Gas Safety (Management) Regulations 1996
HSE	Health and Safety Executive
I&C	Industrial and Commercial
LDZ	Local Distribution Zone
LNG	Liquefied Natural Gas
MBA	Market Balancing Action
NDM	Non-Daily Metered (gas customer)
NEC	Network Emergency Coordinator
NGG	National Grid Gas
NGSE	Network Gas Supply Emergency
NTS	National Transmission System
OCM	On-the-day Commodity Market
OTC	Over The Counter
PEC	Post Emergency Claims
PSOs	Public Service Obligations
SAP	System Average Price
SCR	Significant Code Review
SO	System Operator
SWCQ	Storage Withdrawal Curtailment Quantity Arrangements
UKCS	UK Continental Shelf
UNC	Uniform Network Code
VoLL	Value of Lost Load

Appendix 5 - Feedback Questionnaire

5.1 Ofgem considers that consultation is at the heart of good policy development. We are keen to consider any comments or complaints about the manner in which this consultation has been conducted. In any case we would be keen to get your answers to the following questions:

1. Do you have any comments about the overall process, which was adopted for this consultation?
2. Do you have any comments about the overall tone and content of the report?
3. Was the report easy to read and understand, could it have been better written?
4. To what extent did the report's conclusions provide a balanced view?
5. To what extent did the report make reasoned recommendations for improvement?
6. Please add any further comments?

Please send your comments to:

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