

# Gas Significant Code Review Impact Assessment for Final Policy Decision

## Impact assessment

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### Overview:

The aim of the Gas Security of Supply Significant Code Review (Gas SCR) is to reduce the likelihood, severity and duration of a gas supply emergency. We want to ensure that in an emergency the market rules provide appropriate incentives on gas shippers to balance supply and demand. We also propose a mechanism for paying large consumers if they are able to reduce their demand before an emergency. This is intended to avoid or minimise an emergency and protect consumers that incur high costs when interrupted.

This document should be read alongside our policy decision document, which explains our proposals in detail. This impact assessment evaluates how our proposals will affect consumers, competition and sustainable development. It looks at the costs and benefits of our proposals and builds on previous impact assessments we have published as part of the Gas SCR.

## Context

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We began our Significant Code Review (SCR) into gas security of supply in January 2011, in response to concerns with the gas emergency arrangements. In July 2012 we published our proposed final decision to reform the commercial arrangements that would apply in an emergency. At the same time we provided Government with our Gas Security of Supply report assessing the risks and resilience of the gas market and considering some further measures that could enhance security of supply.

In response, Government considered whether further measures to support gas storage were necessary. The study found that it would not be cost effective to subsidise investment in new storage. We and Government both agree that efficient price signals are necessary to enhance security of supply.

Since the publication of our proposed final decision, we have received a lot of feedback from gas shippers, consumer and transporters – via consultation responses and meetings. In response, we engaged extensively with stakeholders to understand their concerns. They suggested a demand-side response (DSR) mechanism, and we have examined how this could be incorporated into our proposals.

In July 2013, we published a letter updating our proposed final decision for cash-out reform. This also set out our commitment to exploring a DSR mechanism.

## Associated documents

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Final Policy Decision – Gas Security of Supply Significant Code Review, February 2014:

<https://www.ofgem.gov.uk/publications-and-updates/gas-security-supply-significant-code-review-final-policy-decision>

Pöyry – Gas SCR – Cost-Benefit Analysis for a Demand-Side Response Mechanism, February 2014:

<https://www.ofgem.gov.uk/ofgem-publications/85990/poyrygasscrsrcbafinalreportv20.pdf>

Updated Proposed Final Decision – Gas Security of Supply Significant Code Review, July 2013 (ref 128/13):

[http://www.ofgem.gov.uk/Markets/WhIMkts/CompandEff/GasSCR/Documents1/130723\\_GasSCR\\_upfd.pdf](http://www.ofgem.gov.uk/Markets/WhIMkts/CompandEff/GasSCR/Documents1/130723_GasSCR_upfd.pdf)

Demand-Side Response Tender Consultation – Gas SCR, July 2013 (ref 130/13):

[http://www.ofgem.gov.uk/Markets/WhIMkts/CompandEff/GasSCR/Documents1/130723\\_GasSCR\\_DSRtender.pdf](http://www.ofgem.gov.uk/Markets/WhIMkts/CompandEff/GasSCR/Documents1/130723_GasSCR_DSRtender.pdf)

Updated Proposed Final Decision – Responses Document – Gas SCR, July 2013 (ref 128/13):  
[http://www.ofgem.gov.uk/Markets/WhIMkts/CompandEff/GasSCR/Documents1/130723\\_GasSCR\\_responses.pdf](http://www.ofgem.gov.uk/Markets/WhIMkts/CompandEff/GasSCR/Documents1/130723_GasSCR_responses.pdf)

Gas Security of Supply Report, November 2012:  
<http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=3&refer=Markets/WhIMkts/monitoring-energy-security/gas-security-of-supply-report>

Proposed Final Decision – Gas SCR, July 2012 (ref 111/12):  
<http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=85&refer=Markets/WhIMkts/CompandEff/GasSCR>

Impact Assessment for the Proposed Final Decision – Gas SCR, July 2012 (ref 112/12):  
<http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=91&refer=Markets/WhIMkts/CompandEff/GasSCR>

Draft Policy Decision - Gas SCR, November 2011 (ref 145/11):  
<http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=46&refer=Markets/WhIMkts/CompandEff/GasSCR>

Initial Consultation - Gas SCR, January 2011 (ref 02/11):  
<http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=1&refer=Markets/WhIMkts/CompandEff/GasSCR>

Launch Statement – Gas SCR, January 2011:  
<http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=2&refer=Markets/WhIMkts/CompandEff/GasSCR>

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## Executive summary

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### Background

If the supply of gas in Great Britain (GB) is insufficient to meet demand a gas deficit emergency (GDE) will occur. The aim of the Gas Security of Supply Significant Code Review (Gas SCR) is to reduce the likelihood, severity and duration of an emergency.

The Gas SCR aims to ensure the market rules through cash-out appropriately incentivise gas shippers to balance supply and demand in an emergency. A more dynamic cash-out price will provide strong incentives to attract imports in an emergency and strengthen shippers' incentives to enhance security of supply. We also propose to establish a centralised demand-side response (DSR) mechanism to help large consumers reduce their demand before an emergency in a more efficient and coordinated manner.

### Our approach

This impact assessment considers the effect of the Gas SCR quantitatively and qualitatively, building on previous analysis. Given the limitations of modelling low probability, high impact events, we think the qualitative analysis and rationale for our reforms are equally important.

We have assessed cash-out reform and various designs of a DSR mechanism plus cash-out against current arrangements. The designs assessed were based on the Straw Man 2 and Straw Man 3 options in our July 2013 consultation. We also examined the proposal National Grid Gas (NGG) submitted in response to our consultation and discussed it with stakeholders. Using the Future Energy Scenarios developed by National Grid, we modelled these designs in two scenarios: 'Gone Green' and 'High Demand'.

### Benefits to consumers

Our reforms seek to improve the price signals that would prevail in an emergency. Unfreezing cash-out prices will mean they can rise and fall in line with the severity of an emergency. The reforms would also factor the cost of consumer interruptions into cash-out prices. For small consumers this is achieved by introducing a domestic value of lost load (VoLL). Larger consumers can reveal VoLL by signing commercial interruption contracts or participating in the proposed DSR mechanism. These changes should ensure there are efficient price signals in place for shippers. This should let them see the value that consumers place on their gas supplies. They can then factor this into their efforts to avoid imbalance and meet GB demand.

Our reforms also transfer risks from consumers to shippers. The reforms introduce payments to consumers for involuntary DSR and remove situations where shippers would benefit from involuntary consumer interruptions. The DSR mechanism should also let more consumers be paid for voluntarily curtailing demand before an emergency. This way shippers will bear a fair proportion of the risks of an emergency. Where shippers respond to the new risks being placed on them by making their supplies more secure, the likelihood of an emergency will fall.

Finally, our proposed reforms facilitate the efficient provision of DSR. Increasing the incentives on shippers to contract for commercial DSR via cash-out reform helps to achieve this. It's also supported by a DSR mechanism that means consumers would be disconnected according to their VoLL, those with a lower VoLL disconnected first. More voluntary DSR available pre emergency increases certainty and reduces the likelihood of an emergency.

## **Cost to consumers**

The key costs of the changes to cash-out are mainly due to any new payments to consumers in the event of an emergency and any costs shippers incur in response to the new risks placed on them. Where the reforms result in a sharpening of incentives on shippers this will also expose them to more risk when trading at high prices (eg, credit requirements). It is estimated that our reforms to cash-out will add just 1p/year to consumer bills.

The key costs of our preferred DSR mechanism are for start-up and running costs, as well as any costs consumers incur when participating. It is estimated this will add a further 6p per year to consumer bills. If option fees are included, as in Strawman 3, the costs are higher (29p/year) and our analysis suggests these are not cost effective.

## **Quantitative assessment of impacts**

It is difficult to model high impact, low probability events. The limitations include that modelling could quantify only one aspect of the benefits of a DSR mechanism – a more efficient disconnection order. It has highlighted the resilience of the GB gas market to supply losses. This is in line with previous assessments that have shown that we enjoy high levels of gas supply security. This is provided by a diverse range of supply sources, including our own production, pipeline imports from Norway and the EU, imports from global markets via LNG and storage. This resulted no energy in unserved in the modelling of the Gone Green scenario.

For cash-out, the modelling estimates that if there is no gas supply emergency the net benefit of the proposal would be zero. Compared to current arrangements under the High Demand scenario there would be a small net benefit of £2.7million. For cash-out and the DSR mechanism, the higher the perceived security of supply risks the greater the benefits. Under the Gone Green scenario the modelling estimates that the preferred design would result in a net cost of £34million. This is because the start-up costs and annual running costs are incurred but the mechanism is never used as there is no gas emergency. On the other hand in the event of an emergency the economic cost to consumers would be very high, over £50billion in some of the scenarios modelled. Therefore there would be significant benefits to a DSR mechanism if an emergency occurred. Under the High Demand scenario a DSR mechanism would result in a net benefit of £35million.

## **Risks, uncertainties and interactions**

A DSR mechanism could be inefficient. If the barriers to commercial DSR are reduced over time the DSR mechanism may crowd out a market-based solution. We are

committed to mitigating these risks wherever possible, and maintain that the DSR mechanism is designed to kickstart the market for commercial interruption.

Our analysis has also highlighted that the interactions between the gas and electricity markets remain important. Changes in the generation mix are likely to increase the interdependency of these two markets. Potential reforms to the electricity market are likely to sharpen prices in both markets. Notably, our reforms go some way to mitigating this interaction by reducing the likelihood of interruptions, particularly for gas-fired power stations. We will continue to engage with those working on reforms to the electricity market in order to ensure the interactions between the two markets are dealt with consistently.

## **Conclusion**

Our analysis shows that GB remains resilient to threats to supply. Nevertheless, the future remains uncertain and our reforms to cash-out are intended to address that. It is important that in an emergency the market rules encourage shippers to take appropriate mitigating actions. The costs and benefits of cash-out are proportional to the likelihood of an emergency.

In a gas deficit emergency the costs to consumers would be extremely high and there would be very significant benefits from a more coordinated and efficient disconnection order. Therefore, given the uncertainties and potentially very high costs we think it is prudent to implement cash-out reform and a DSR mechanism. We believe the impacts described here support our proposed reforms.

# 1. Introduction

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## Chapter Summary

This chapter provides some background on the Gas Significant Code Review (Gas SCR) and sets out our approach to this impact assessment.

## Rationale for Gas SCR

- 1.1. If the supply of gas in GB is insufficient to meet demand, a Gas Deficit Emergency (GDE) will be declared and consumers may be interrupted.
- 1.2. Gas shippers who do not balance their supply and demand are subject to cash-out charges. Under current arrangements, cash-out prices are frozen in a GDE. The emergency would be managed by instructing domestic gas supplies to maximise flows and, where necessary, interrupting consumers.
- 1.3. Furthermore, under current arrangements the cost of interrupting firm consumers is not factored into the cash-out price that would be paid by shippers who are out of balance. This means the risks of an emergency currently sit with consumers who are poorly placed to manage those risks. Shippers do not account for the full value that consumers place on maintaining their gas supplies.
- 1.4. We are aiming to resolve these issues by ensuring the market rules appropriately incentivise gas shippers to balance supply and demand. We are also proposing to establish a centralised demand-side response (DSR) mechanism to help large consumers reduce their demand before an emergency and reveal their cost of interruption.

## Reform options

- 1.5. Our final proposals document outlines proposals for cash-out reform that have been discussed extensively with stakeholders. This impact assessment considers the impact of our reforms quantitatively and qualitatively building on previous analysis. We have assessed cash-out reform against current arrangements.
- 1.6. In July 2013 we consulted on whether or not to include a DSR mechanism as part of the Gas SCR reforms and sought feedback on various DSR designs. We considered 3 potential DSR designs. This impact assessment quantifies the costs and benefits of a DSR mechanism and cash-out under various designs.



## Document structure

- 1.7. The document is structured as follows:
- Chapter 2 summarises our modelling approach.
  - Chapter 3 assesses the impacts on consumers.
  - Chapter 4 then looks at the impacts on competition.
  - Chapter 5 addresses the merits of different DSR mechanism designs.
  - Chapter 6 discusses possible risks and unintended consequences, as well as any other impacts.
  - Chapter 7 then summarises with an overall cost-benefit analysis.
- 1.8. So as to avoid unnecessary duplication this impact assessment (IA) seeks to build on previous IAs that have looked at the impacts of cash-out reform. It also builds on the Responses Document we published in July 2013 which sought to address various issues raised by stakeholders with respect to our previous IA. Where our proposals differ from those assessed in previous IAs this document will set out our view of the relative impact of those changes.
- 1.9. This IA has been written using Ofgem’s updated impact assessment guidance.<sup>1</sup> In general the key topics raised in the guidance that this IA addresses are: security of supply, resilience to external shocks, gas and electricity interactions, the risks of extreme prices and volatility, and impacts on consumer bills, notably for vulnerable consumers.
- 1.10. We do not consider that the Gas SCR reforms have a material impact on the other key topics raised in the guidance. For instance our proposed reforms are unlikely to have a discernible impact on long-term environmental goals and the transition to a low carbon economy. As such these topics are not addressed in this IA.

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<sup>1</sup> <https://www.ofgem.gov.uk/publications-and-updates/impact-assessment-guidance>

## 2. Modelling Review

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### Chapter Summary

This chapter outlines the modelling approach taken by Pöyry for this impact assessment, as well as highlighting previous modelling undertaken by Redpoint.

- 2.1. For this impact assessment we commissioned Pöyry to conduct quantitative modelling. Firstly, we would note that modelling high impact low probability events is inherently difficult and any modelling approach has limitations. In particular, the modelling focused on the benefits and costs of utilising DSR more efficiently. It was unable to assess the dynamic effects of price signals. As such the quantitative modelling results in this IA should be considered alongside the range of qualitative arguments we also discuss. More detail on Pöyry's modelling approach and their findings can be found in their full report.
- 2.2. The quantitative impacts of the reforms have been modelled using a deterministic model of the GB gas market. Pöyry's model contains a full representation of GB gas supply and demand. In order to get an accurate view of demand the GB electricity market was also modelled as a significant proportion of GB gas demand comes from gas-fired power stations. This also allowed for a detailed investigation of gas and electricity market interactions.
- 2.3. In order to assess the risks to GB security of supply the model was run using a series of pre-defined infrastructure outages. This approach meant greater emphasis was placed on providing tangible examples of gas supply emergencies. The intention was to better understand how our proposed reforms would alter the management of an emergency should one occur. A limitation of this approach is that it does not generate estimates of the likelihood of consumers being interrupted. For this we have relied on qualitative judgements and the results of past modelling which did look explicitly at the likelihood of consumer interruptions.
- 2.4. Previously we commissioned Redpoint to conduct modelling looking at the potential merits of cash-out reform. The results of that modelling suggested that the unfreezing of cash-out and the incorporation of payments for firm consumer interruptions based on domestic VoLL produced net benefits.
- 2.5. These reports provide useful insights into the likelihood and impact of a GDE. However some stakeholders disagreed with the modelling approach and elements of the policy design. Appendix 2 provides a summary of how the modelling for this IA differs from that done previously by Redpoint and how we have sought to address previous stakeholder concerns. We have also amended elements of cash-out reform and therefore Ofgem's previous CBA analysis is no longer directly comparable. A stakeholder also produced an alternative CBA which, given the changes to the proposed reforms, is no longer relevant.

## 3. Impacts on Consumers

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### Chapter Summary

This chapter assesses the impacts of our proposed reforms on consumers. We consider the impacts of cash-out reform separately to those resulting from the introduction of a DSR mechanism. We also address the impacts on gas-fired power stations explicitly here as the interactions with the electricity market are a key issue.

- 3.1. If a GDE were to occur the implications for consumers would likely be severe. For most domestic households a loss of gas supply will mean a loss of access to essential services such as heating and cooking. Clearly this could have severe consequences, particularly during winter and for the most vulnerable consumers.<sup>2</sup> For industrial and commercial (I&C) consumers reliant on gas as a fuel or feedstock a loss of supplies could mean a major loss of output and even irreversible damage to machinery and equipment.<sup>3</sup> With the ongoing importance of gas for electricity generation, a loss of gas supply to gas-fired power stations could have knock on impacts on electricity security of supply. The modelling conducted by Pöyry indicated that the direct costs to the economy of a GDE could be in excess of £50bn, and this is without accounting for enduring upstream or downstream effects.
- 3.2. We have identified a number of reasons why the current arrangements are inadequate with respect to GB's security of supply. Here we set out those weaknesses, how our reforms would alleviate them and what the impact of these changes would be on the consumers.

### Cash-out reform impacts

#### Efficient price signals for security of supply

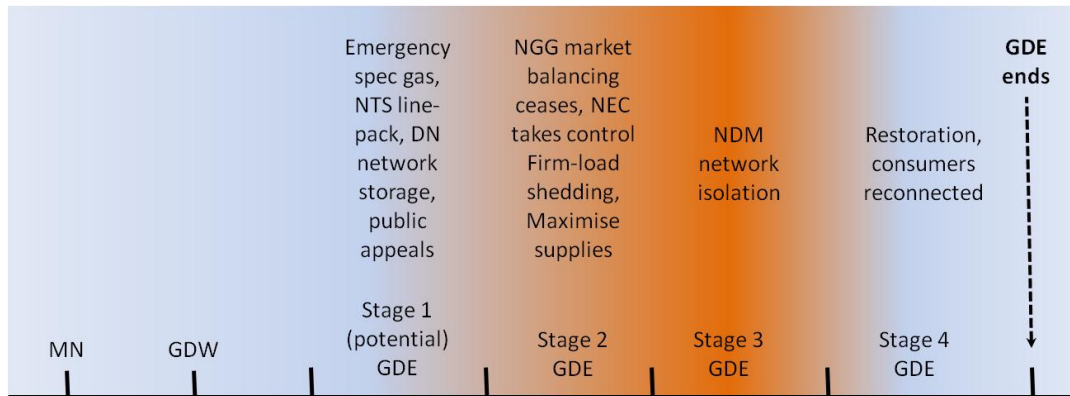
- 3.3. At present cash-out prices would be frozen following the declaration of a Stage 2 GDE. The various stages of a GDE are set out in Figure 1 below:

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<sup>2</sup> Earlier in the SCR process we held discussions with our Consumer First Panel on the importance of gas security of supply for domestic consumers. The 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>

<sup>3</sup> An Ilex report for Government in 2006 used industry surveys and interviews to assess the impacts that a loss of gas supply could have on different sectors. The report is available here: <http://webarchive.nationalarchives.gov.uk/+http://www.berr.gov.uk/files/file28936.pdf>

Figure 1- Stages of a Gas Deficit Emergency<sup>4</sup>



- 3.4. The consequence of freezing the cash-out price is that the incentive to bring gas to GB could be weakened at precisely the time when it should be sharpest. Our proposed changes would help ensure this does not happen by unfreezing the cash-out price and introducing a price for non-daily metered (NDM) network isolation of £14/therm (NDM VoLL – see box 1) for the first day of any such isolation. This reflects the value that domestic consumers place on maintaining supplies.<sup>5</sup> NDM VoLL effectively creates a floor on cash-out prices should network isolation ever be initiated at a level that is intended to reflect the VoLL of domestic consumers.
- 3.5. A further concern with the current arrangements is that a frozen price is unable to change as market conditions change which could result in prices being frozen too high for too long. This is because any frozen price persists until the formal end of an emergency, which could be well after market conditions have returned to “normal”. Our reforms unfreeze cash-out prices during a GDE such that cash-out prices would be free to rise and fall for the duration of an emergency. This would avoid the problem of an excessively high cash-out price being locked-in for too long.
- 3.6. An illustration of how moving away from a frozen price results in more efficient price signals can be seen in Figure 2 below.

<sup>4</sup> See glossary for acronym definitions. Full details of the National Gas Emergency Plan can be found here: [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/65596/6913-national-emergency-plan-gas.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65596/6913-national-emergency-plan-gas.pdf)

<sup>5</sup> It is important to note here that the risk of cash-out prices being frozen too low will likely be reduced by reforms to the electricity market, irrespective of the reforms to the gas cash-out arrangements proposed here. These electricity interactions are discussed in more detail later. Importantly though, this does not mean that situations cannot still arise where cash-out prices could be frozen too low, even after any of the proposed changes to the electricity market come into effect (eg if a GDE escalates very quickly).

Box 1: The Value of Lost Load

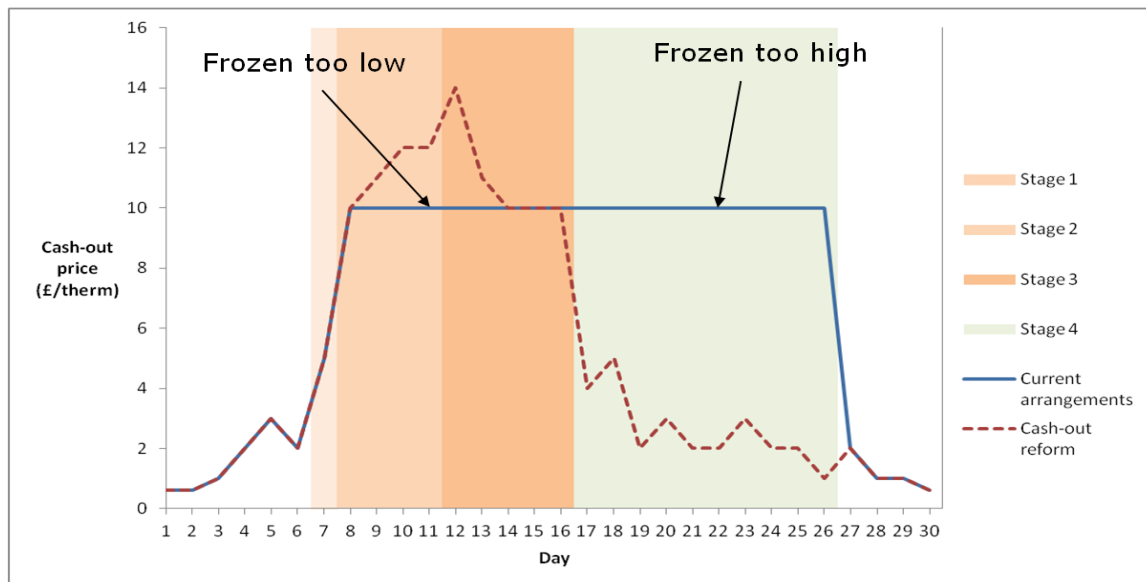
The value of lost load (VoLL) is the value that consumers place on maintaining their gas supplies. It is efficient for shippers to supply a consumer with gas as long as the price of that gas is below the consumer's VoLL. Generally a consumer's VoLL will be based on the costs that a consumer incurs when they are interrupted.

For a domestic household these will be the costs a consumer incurs in finding alternative sources of heating and cooking. This includes relatively certain costs (eg purchasing an electric cooker) and relatively uncertain ones (eg inconvenience).

For larger industrial and commercial consumers their VoLL will depend on the manner in which they use gas as an input and the availability of alternatives. If they have alternative energy sources (eg distillate back-up) their VoLL will be the cost of switching. If they do not their VoLL will be the opportunity cost associated with any lost output. They may also incur additional costs for prolonged outages (eg perishing of raw materials in the food industry). There may also be costs when shutting down or starting up production. In industries which incur potential equipment damage if they shut down too quickly (eg, ceramics or chemicals) these costs could be very significant.

We commissioned London Economics to undertake a study on consumers' VoLL.<sup>6</sup> Based on their findings we calculated a proxy estimate of the VoLL of domestic consumers (£14/therm). Domestic consumers are NDM and so any instances of NDM network isolation would entail the interruption of domestic households. It would therefore be inefficient for NDM network isolation be initiated when prices were still below the VoLL of NDM consumers (NDM VoLL, or £14/therm).

Figure 2: Impact of a frozen cash-out price on price signals



<sup>6</sup> <https://www.ofgem.gov.uk/ofgem-publications/40961/london-economics-estimating-value-lost-load-final-report-ofgem.pdf>

- 3.7. Where shippers face inefficient price signals they will be incentivised to either over- or under-supply. Any resulting imbalance must be resolved by the System Operator (SO) and this entails additional costs. Some or all of those additional costs would likely be passed on to consumer bills. The impact of unfreezing cash-out prices and introducing NDM VoLL will be to ensure there are the correct price signals for shippers to achieve an efficient level of security of supply for consumers.

### **Transferring risks from consumers to shippers**

- 3.8. As well as cash-out prices being frozen during an emergency, current arrangements also mean it is consumers rather than shippers that incur the risks of NDM interruptions. This is in part because under current arrangements the interruption of NDM consumers would result in shippers' imbalance positions being improved. This could create a perverse incentive whereby it is in a shipper's interest to actually worsen an emergency and force the SO to involuntarily curtail some NDM consumers.
- 3.9. Our proposed reforms seek to resolve this issue by effectively extending the Emergency Curtailment Quantity (ECQ) arrangements to NDM consumers.<sup>7</sup> This will ensure shippers' imbalance positions are not improved by the interruption of NDM consumers, thereby placing the correct incentives on shippers to resolve their imbalances and meet consumer demand.
- 3.10. Incorporating NDM VoLL on the first day of network isolation ensures shippers face the correct price signals. However, this effect would be blunted if the funds that arise from cash-out charges reaching £14/therm were then smeared back to the shipper community.
- 3.11. To resolve this issue our proposed reforms ensure that when prices are set at £14/therm on the first day of network isolation, NDM consumers will be paid at this level for the gas they would have consumed. On an average winters day this would usually entail a payment of approximately £30 for a domestic household. Even though consumers will not receive this payment for several months, this payment may enable NDM consumers to offset some of the costs of being curtailed.
- 3.12. We believe that the two changes described above will ensure a proportionate transfer of risks from consumers to shippers. If these new risks incentivise shippers to take mitigating actions to better secure their supplies, consumers will benefit from a reduction in the likelihood and duration of a GDE. The quantitative modelling for this IA has not been able to fully capture the

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<sup>7</sup> The ECQ arrangements adjust imbalances such that a shipper's imbalance position does not benefit from the emergency curtailment of demand (the "DR ECQ quantity"). It also ensures shippers are paid for the gas they are then obliged to deliver to the system, even though their consumers have been curtailed. Currently ECQ only applies to DM consumers.

potential benefits from sharper price signals and the transfer of risks. This is why these issues have been assessed qualitatively here.

- 3.13. Finally, we acknowledge that our reforms do not result in a complete transfer of risks from shippers to consumers and so consumers are still exposed to some of the risks of a GDE. This is because consumers are only paid for the first day of any network isolation and because they do not receive payment at the time of the emergency. Both of these factors reduce the extent to which our reforms are able to help protect consumers, particularly vulnerable consumers. However, we maintain that our rationale for taking these steps is sound. This is because paying domestic consumers in full for any interruption at the time of curtailment would entail excessive costs being placed on shippers and suppliers. Given the low probability of an emergency, the upfront impact this would have on consumer bills would be hard to justify.

### **Impact on consumer bills**

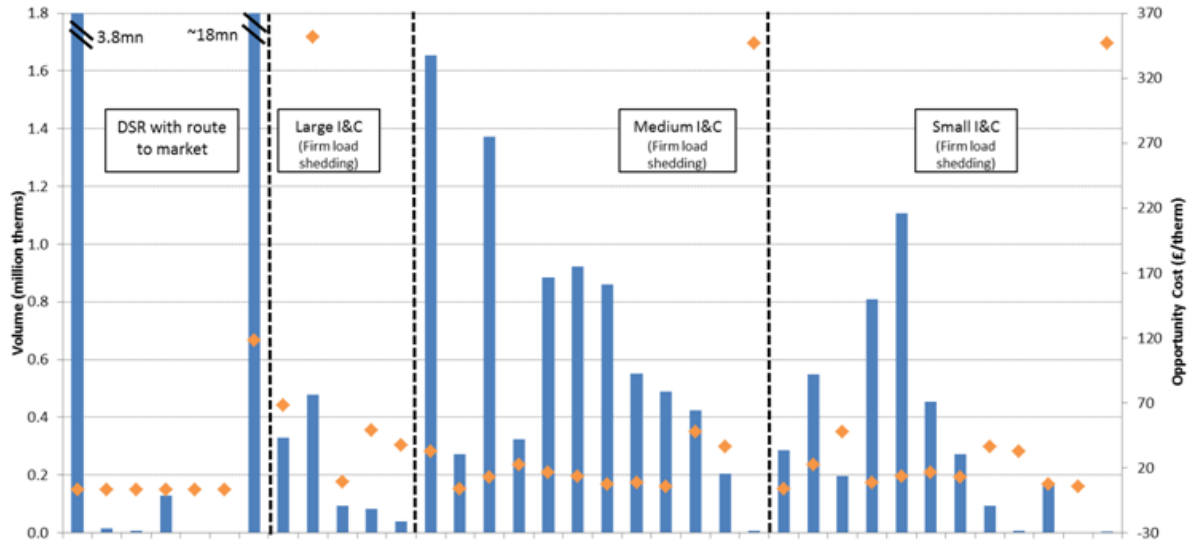
- 3.14. Our cash-out reforms are intended to ensure shippers face the correct price signals and risks such that they are incentivised to provide an efficient level of security of supply for GB. As has been noted above, the costs of consumer interruptions would almost certainly be severe. Where our cash-out reforms lead to a sharpening of incentives on shippers we would expect this to incentivise improvements in security of supply. To the extent that this is the case, the likelihood of consumers being interrupted would be reduced.
- 3.15. There are some small costs associated with our proposals that will impact on consumer bills. This has implications for two of Ofgem's key aims: ensuring consumers get value for money and eradicating fuel poverty. The true cost to consumers of these reforms is uncertain because a number of the risks being placed on shippers can only be assessed qualitatively (see chapter 4). Some or all of the costs associated with those increased risks may be passed through to consumer bills. However, the impact of the costs that can be quantified suggests any bill increase would be very low. Pöyry estimate the cost of cash-out reform to be 1p on the average annual domestic consumer bill. We believe that given the security of supply benefits this increase represents good value for money.

### **DSR mechanism impacts**

- 3.16. Encouraging daily metered (DM) consumers to reduce their gas demand at times of system stress has repeatedly been identified as offering potentially significant security of supply benefits. Essentially this is because it helps ensure gas continues to flow to the consumers that value it most. This could be either to gas-fired power stations that are needed to keep the lights on, or other I&Cs who need to maintain a constant supply of gas to avoid incurring equipment damage.
- 3.17. Interruptions to DM consumers during firm-load shedding are generally inefficient with respect to the economic costs incurred by society. This is

because they are done in order of size rather than in order of interruption cost (ie in order of VoLL). Figure 3 sets out the current arrangements' disconnection order used in the modelling.

**Figure 3: Inefficient firm-load shedding disconnection order**



Source: adapted from Pöyry

- 3.18. The figure shows that several very costly loads are interrupted well before a large proportion of relatively cheap loads. By providing DSR ahead of firm-load shedding, DM consumers also have the potential to protect critical loads. This minimises the cost of demand interruptions and reduces the likelihood of a GDE. As a starting point, it is therefore important to understand the extent to which voluntary DSR is available under current arrangements.
- 3.19. It is difficult to tell the extent to which I&C consumers would provide DSR if an emergency was imminent (and the price at which they would do so). In part this is because there are a significant number of factors that influence the balance of payoffs for an I&C consumer between providing and not providing DSR. These factors vary greatly between different consumers and sectors.
- 3.20. Moreover there are additional barriers that could be obstructing the provision of DSR from I&C DM consumers. For example consumers have indicated there is a lack of trust between I&C DM consumers and shippers, particularly regarding being interrupted for commercial non-emergency reasons.
- 3.21. In light of the above we have opted for a conservative assumption for our base case modelling whereby only 1.2% (0.4mcm/day) of total I&C DM volumes are available to provide DSR under current arrangements. This is reflected in Figure 3 where the vast majority of I&Cs are only interrupted during firm-load shedding. This assumption is in large part based on feedback from stakeholders who claim there are virtually no consumers on interruptible



contracts in the market at present. Moreover, even if consumers wished to provide DSR on an ad-hoc basis when an emergency arose, it is not clear that they would be able to overcome any timing or coordination issues with their shipper such that they could bring their volumes to market in time.

### **DSR and cash-out reform**

- 3.22. Under current arrangements shippers potentially have blunted incentives to negotiate with DM consumers for voluntary demand turn-down prior to an emergency. This is in part because the cost of involuntary demand interruptions is not currently factored into cash-out prices and DM consumers do not presently receive any payment for the service they provide to help balance the system. This means firm-load shedding is effectively a 'free option' for the industry when it comes to balancing the network in a GDE.
- 3.23. Where our proposed reforms sharpen the incentives on shippers near or during a GDE, they should result in stronger incentives on shippers to negotiate for commercial DSR. For example, where shippers know that prices will be at least £14/therm in the event of network isolation, they will likely factor this into prices. As the probability of NDM interruptions increases, so will the weight that shippers give to prices reaching £14/therm. This escalation in prices should in turn create mutually beneficial opportunities for DM consumers and their shippers to negotiate to provide DSR.
- 3.24. In our previous modelling we used demand side response as a proxy to measures that shippers may take to mitigate the risks associated with sharper cash-out signals. Some stakeholders questioned whether it was appropriate to assume no DSR would come forward under current arrangements and as high as 27mcm/day would come forward under cash-out.
- 3.25. We have listened to stakeholders and acknowledge that our proposed reforms to the cash-out arrangements will likely have less of an impact on the provision of commercial DSR than we previously envisaged. We have reflected this by assuming only a small incremental increase in I&C DSR volumes resulting from cash-out reform (an increase relative to current arrangements of 2.3%, or 0.8mcm/day, of total I&C volumes). We consider this to be a conservative assumption.

### **DSR and a centralised mechanism**

- 3.26. The key benefit of a centralised DSR mechanism is that it brings forward additional volumes of voluntary DSR ahead of an emergency. These volumes are over and above any that may be expected as a result of cash-out reform. Our modelling suggested a DSR mechanism could result in between 13 and 25 mcm/day of additional DSR volumes becoming available from I&C consumers to be used to help avert a GDE.

- 3.27. As already noted, voluntary DSR is exercised efficiently in price order, whereas involuntary DSR is exercised inefficiently in size order. The increase in voluntary DSR would therefore mean a reduction in the likelihood and severity of an emergency. Furthermore, a DSR mechanism should increase market participant diversity and reveal the VoLLs of DM consumers. This will mean that should NGG have to exercise any DSR from the mechanism, cash-out prices will reflect the cost to consumers of being interrupted.
- 3.28. Additional volumes are expected to be brought forward by the DSR mechanism because only NGG is able to exercise the volumes it procures. As such it resolves the key barrier to commercial DSR arising which we have identified through our ongoing consultation work: the trust issue between consumers and shippers. The extent to which the DSR mechanism brings forward new DSR volumes and the costs it incurs in doing so will vary depending on design. This is discussed in chapter 5.

### **Impact on consumer bills**

- 3.29. Just as with our cash-out reforms the introduction of a DSR mechanism entails costs. These are the costs of setting up and running a DSR mechanism. There are also the costs incurred by consumers that participate (eg costs in formulating a bid, training staff etc). Lastly there are the payments made to those consumers that are successful. These will be the exercise fees when DSR is utilised, as well as any option fees where these are included.
- 3.30. Whilst there remains some uncertainty regarding the exact level of these costs, they are still easier to quantify than some of the costs associated with cash-out reform. Pöyry estimate the overall impact on average annual domestic consumer bills to be as low as 7p (for our preferred design) and 30p (where option fees are included).

### **Impacts on gas-fired power stations**

- 3.31. Trading gas is a core part of any gas-fired power stations business. Gas-fired power stations are also some of the largest consumers and so most of them are directly connected to the National Transmission System (NTS) and hold shipper licences. This means they are already very price responsive and capable of providing significant volumes DSR where it is profitable to do so.
- 3.32. For gas-fired power stations with distillate back-up their cost of providing DSR is relatively straightforward: it will generally be based on the cost of distillate. However, the number of gas-fired power stations with back-up is small and is likely to decline as those with back-up are generally older, less efficient sites.
- 3.33. The vast majority of gas-fired power stations (either operational or proposed) do not have distillate back-up capability. As such their cost of providing DSR

is much less certain. Essentially their cost will depend on the level of stress in the electricity market if a potential emergency arises in the gas market.

- 3.34. On the one hand, if the electricity market is well-supplied gas-fired power stations would likely not be pivotal to meeting electricity demand. In the past this has generally been the case which is why gas-fired power stations have been able to provide significant volumes of low cost DSR to date. The cost of that DSR has generally been based on the cost of switching to alternative generation sources (eg coal).
- 3.35. On the other hand, if the electricity market is under stress gas-fired power stations would likely be pivotal to meeting electricity demand. Box 2 sets out how future changes in the generation mix and proposed reforms to the electricity market have the potential to significantly increase the cost of DSR from gas-fired power stations in these situations of dual-market stress.
- 3.36. The issues set out in this section have two key implications. Firstly, the projected changes in the GB generation mix will mean an increase in the interdependency of these two markets with respect to security of supply. Secondly, if the proposed reforms to the electricity market are introduced this will necessarily result in a sharpening of incentives in both the gas and electricity markets, irrespective of the reforms proposed by the Gas SCR.
- 3.37. Reforms that can mitigate the effects of this interaction and/or reduce the probability dual market stress events arising could have significant benefits. The introduction of a DSR mechanism or emergence of more commercial interruptions as a result of sharper incentives will result in reduced likelihood, severity and duration of an electricity event due to a tight gas market. This is because as gas fired generators are likely to have a high VoLL and therefore more likely to be at the back of the disconnection order in a stack that was organised on a price basis.

## Box 2: Electricity market reforms and the cost of DSR from gas-fired power stations

In the event of dual market stress gas-fired power stations would likely be pivotal to meeting electricity demand. Importantly, if a gas-fired power station reduces its gas demand under these circumstances (either by commercial interruption or via a centralised DSR mechanism) electricity consumers may be curtailed. Proposed reforms to the electricity market, either via the Capacity Mechanism (CM) or the Electricity Balancing Significant Code Review (EBSCR) introduce new costs for failing to generate when consumer disconnections arise. These electricity charges are substantial and so a gas-fired power station that provides DSR under these conditions will likely base their cost of providing DSR on their potential exposure to any such charges. For modelling purposes it has been assumed that any gas-fired power station providing DSR in these circumstances would do so at £118/therm.<sup>8</sup>

The results of the modelling we have conducted showed that further into the future when gas-fired power stations provided DSR, they generally did so at a price of £118/therm. This was for the following reasons:

- All gas-fired power stations were assumed to participate in the CM.
- As coal generation is replaced by inflexible sources such as wind and nuclear, gas is increasingly the only source of flexible electricity generation. As such gas-fired power stations will become less able to provide low cost DSR as they are increasingly pivotal to meeting electricity demand.
- It was assumed in the modelling for simplicity that NGG would accept any bid below £196/therm as this is the true cost of NDM isolation.

Importantly though, there are several reasons why it is very uncertain whether such high prices would actually end up feeding through to the gas market.

- Reforms to the electricity market are *proposed*. They are not yet *confirmed*.
- NGG is required to act in an economic and efficient manner therefore could justify not taking an action priced at £118/therm on the grounds that it is too costly and that it could not have averted firm-load shedding.
- Given the incentives being placed on them and the uncertainty as to whether they can hedge those risks in the gas market, gas-fired power stations may choose to invest in mitigation measures such as installing distillate back-up capability. This would necessarily reduce their cost of providing DSR.
- The modelling assumed no electricity interconnector flows with the Continent. Accounting for GB's ability to import electricity from the Continent could reduce the likelihood of gas-fired power stations being pivotal to meeting electricity demand, thus reducing their cost of providing DSR.

<sup>8</sup> It is assumed that the CM penalty for non-delivery is  $z \times \text{VoLL}$  – cash-out. Electricity VoLL in the CM is set at £17,000/MWh and cash-out rises to £6,000/MWh as a result of EBSCR if consumer voltage reduction or load-shedding occurs. The 'z' value is assumed to be 0.47 such that the CM penalty is £8,075/MWh (a £2,075/MWh premium on the £6,000 cash-out charge). For a 50% efficient gas-fired power station, these electricity figures translate into the following equivalent gas prices: £6,000/MWh = £88/therm and £8,075/MWh = £118/therm. We note that both the CM and EBSCR policies are currently being developed and the penalty regime is not finalised.

## 4. Impacts on Competition

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### Chapter Summary

This chapter assesses the impacts of our proposed reforms on competition. This entails looking at the impacts of our proposed reforms on prices, and how this may affect credit requirements, liquidity and shipper liabilities. We consider whether these changes could lead to increased barriers to entry or risks of financial distress. We then conclude by assessing the steps shippers can take to respond to our reforms.

### Credit, liquidity, liabilities and prices

#### Impact on prices

- 4.1. Were a GDE to occur gas prices would almost certainly rise significantly above those observed during “normal” market operation. For example, on March 13<sup>th</sup> 2006 prices spiked up to over £1.80/therm in response to a fire at the Rough storage facility. This was approximately 3 times the average level observed so far during that winter. This reflects the market price factoring in increased scarcity as more expensive supplies are needed to meet demand.
- 4.2. Our proposed reforms have the potential to affect the prices that would be observed in the market near or during a GDE in two key ways: by moving from a frozen to a dynamic cash-out price and by allowing an increased volume of DSR to reveal its VoLL to the market, potentially before a GDE. Understanding whether these changes would result in higher or lower prices at any given point *relative to current arrangements* is crucial to understanding the impact of our proposals on the market during a GDE.
- 4.3. On the one hand our proposed reforms have the potential to lead to higher prices in a tight market. Generally speaking this would be as a result of consumers revealing their cost of providing DSR where they were previously unable to do so or, this would be as a result of NDM consumers being priced at £14/therm. With respect to the introduction of a centralised DSR mechanism, this would be as a result of additional I&C consumers providing DSR ahead of an emergency.
- 4.4. On the other hand, our proposed reforms also have the potential to lead to lower prices. With respect to cash-out reform, this would be because our proposed reforms avoid a high frozen price being locked in for a matter of weeks should NDM interruptions occur (as set out in
- 4.5. Figure 2). With respect to the introduction of a centralised DSR mechanism, this would be because our proposed reforms bring forward additional DSR.

This reduces the likelihood of more expensive consumers being interrupted and setting the price.

- 4.6. Bearing in mind these points regarding the effect of our proposals on prices during a GDE it is now possible to assess the implications for market participants; notably with respect to credit, liquidity, liabilities and gas costs. Also, for further background on this subject, some examples of how Pöyry’s modelling generated variations in prices can be found in Appendix 3.

**Cost of spot gas**

- 4.7. One stakeholder noted in their response to our previous IA that higher cash-out prices would likely result in higher spot gas prices. This would mean that suppliers who procured some portion of their gas on spot markets would face increased costs if our reforms resulted in higher prices.
- 4.8. We have taken these comments on board and sought to quantify the impact of our proposals on the cost for suppliers of procuring spot (ie unhedged) gas. On days where our reforms result in lower prices, this will necessarily entail lower costs for suppliers. On days where our reforms result in higher prices the reverse will be the case. The results of this analysis are shown below. Further details on the assumptions made can be found in Appendix 3.

**Table 1: Benefits of reducing the cost of procuring spot gas (change in NPV)**

Policy scenario ->	Current	Cash-out reform	Cash-out reform + NGG platform	Cash-out reform + Straw Man 2		Cash-out reform + Straw Man 3	
				Inc.	Exc.	Inc.	Exc.
Gas-fired power station eligibility ->	N/A	N/A	N/A	Inc.	Exc.	Inc.	Exc.
Gas-fired power stations priced (base case)	0	50.5	115.6	115.6	107.4	93.4	109.3
Gas-fired power stations not priced (for comparison)	0	-55.9	-70.7	-70.7	-34.4	-83.7	-150.3

- 4.9. As can be seen from the results above, in the base case modelling where gas-fired power stations are effectively priced at £118/therm, the various cash-out reform scenarios actually all result in reduced costs for suppliers procuring gas on the spot market. This necessarily results in net benefits (ie, a positive net present value (NPV)) as shown in the table. The greater the extent of supplier exposure to spot prices, the greater the potential benefits of moving away from a frozen price and facilitating the increased provision of DSR.
- 4.10. Importantly, these results are heavily dependent on the level that prices reach under current arrangements. This is in turn dependent on whether or not gas-

fired power stations price their DSR at £118/therm. For comparison then, the table contains the estimated impact if we put the effect of changes in the electricity market to one side. In this situation modelled prices under current arrangements only reach ~£3/therm. As such the reform scenarios result in higher prices and thus higher costs for suppliers.

- 4.11. It should be noted here that these figures should be used with caution as they entail significant simplifications (more detail is set out in Appendix 3.) They provide a useful upper and lower bound of how our reforms may influence prices and thereby alter spot gas costs for suppliers. We consider that the price incentives suppliers can expect following cash-out reform are far more efficient than those that would prevail under current arrangements, particularly if NDM network isolation were to occur.

### **Credit**

- 4.12. If a GDE were to occur the costs resulting from high prices could be significant. With respect to credit, high prices could increase both balancing security requirements, and collateral requirements for trading. This may result in shippers and traders breaching trading limits or receiving cash calls. Shippers and traders would then have to delay or limit their trading whilst they seek approval from senior management or lodge additional credit. This could affect liquidity and the ability of shippers to balance their positions. Large shippers may be better placed to cope than small shippers. We acknowledge that this has the potential to create additional barriers to entry and reduce competition.
- 4.13. The impact of our proposals on credit hinges on whether they would result in higher or lower prices relative to current arrangements. As already noted, the impact of our proposals on prices is uncertain. Given the price implications of reforms to the electricity market, it is entirely plausible that our proposals could reduce the credit requirements on shippers, rather than increase them.
- 4.14. We would also point out that many of the arguments we have made previously regarding the impact of NDM VoLL on credit still apply here; particularly given the reduction we have made in our estimate of NDM VoLL (ie, limiting imbalances for the first day of network isolation and revisions to the value of NDM VoLL.)
- 4.15. It is also worth noting that previous Gas SCR proposals published in the draft and proposed final decision (November 2011 and July 2012 respectively) did look at effectively capping the cash-out price that would prevail from Stage 2 onwards by fixing the short cash-out price at our estimate of NDM VoLL. This would have limited the scope for prices to rise to levels above NDM VoLL and thus limited the potential credit implications of a GDE. However, stakeholders were opposed to any such of capping of cash-out. In particular shippers expressed concerns that a known cash-out price could act as a target for traders and the known price would impact the forward curve. NGG argued that any cap on cash-out could limit their ability to take actions that would balance

the system. Lastly, large consumers expressed concerns that a cap on cash-out would prevent them from fully pricing their DSR in the event that their VoLL was above any cap. We have taken on board those views in formulating our updated proposals which no longer include an administered price for cash-out.

- 4.16. Lastly, all shippers have access to measures to mitigate the risks created by high prices during a GDE, some of which are discussed later in this chapter. If shippers are of the view that these risk mitigation measures are insufficient, they may wish to consider whether the existing credit arrangements are fit for purpose in the case of a GDE.

### **Market liquidity**

- 4.17. Another impact of high prices is their effect on market liquidity. Liquidity is important for the market to remain competitive and for shippers to be able to balance their positions through trading.
- 4.18. As has just been mentioned, higher prices during a GDE may result in increased credit and collateral requirements on shippers and traders. The result of this may be that market liquidity is reduced as fewer and fewer participants are able to trade. It is also likely that small shippers would be affected more than large shippers by increased credit requirement. Furthermore, it is small shippers that potentially require market liquidity the most as they lack alternative means of balancing their portfolios (eg, through vertical integration). Once again, we acknowledge that this has the potential to create additional barriers to entry and reduce competition.
- 4.19. However, we would note here that the impact on market liquidity of a GDE would likely be severe no matter what the market arrangements in place. Additionally as has already been noted, the impact of our proposed reforms on prices remains uncertain.

### **Liabilities**

- 4.20. Should a GDE occur the potential liabilities that short shippers could incur would be significant. To the extent that our proposals result in cash-out prices that are sharper than they would be under current arrangements, our proposals will mean shippers incur greater liabilities on any short imbalance. Once again though, situations could equally arise where our proposals reduce the liabilities incurred by short shippers on any imbalance (eg, where current arrangements have frozen in an inefficiently high cash-out price).
- 4.21. Perhaps more important than the level that cash-out prices reach is the proportion of the funds collected from short shippers that are then passed on to consumers. Our proposed reforms look to introduce greater payments to consumers for the provision of DSR in the following ways:



- Payments to an increased number of DM consumers for voluntary interruptions before a GDE, either through increased commercial interruption or the establishment of a centralised DSR mechanism.
  - Payments to firm-load shed DM consumer for involuntary interruptions.
  - Payments to isolated NDM consumers for involuntary interruptions.
- 4.22. The overall transfer of monies from shippers to consumers necessarily entails a transfer of risks from consumers to shippers. Of particular interest are the payments made to consumers that are involuntarily disconnected. This is because these are a direct result from our proposed cash-out reforms. Moreover, consumers that are involuntarily disconnected would generally be those that a shipper would be unable to contract with to provide DSR. As such the industry must necessarily take alternative measures to reduce the likelihood of these costs arising.
- 4.23. The modelling conducted by Pöyry indicated that in the outage events modelled, there were fourteen instances where involuntary disconnections were necessary. The total payments made in each of these modelled emergencies ranged from £1million to £1,332million, with an average of £680m. It also should be noted that the liabilities associated with payments are very small compared to the economic costs of a GDE eg incurred by I&Cs and domestic consumers.
- 4.24. A final point to make regarding shipper liabilities and payments to consumers for DSR is that any such payments would only have to be made if the industry failed to adequately secure gas supplies and a GDE occurred. It is therefore important to note that the probability of a GDE occurring is actually very low. This was the result of the modelling conducted by both Pöyry and Redpoint. The potential impact of any liabilities should therefore be weighted by the probability of those liabilities actually arising.

### **Competition, barriers to entry and risks of financial distress**

- 4.25. In light of the potential impacts on liquidity, credit and shipper liabilities it is clear that there are risks of financial distress for shippers, particularly small shippers, in the event that a GDE occurs. Similarly, the costs that could be incurred in the event of a GDE may act as a barrier to entry, thus reducing competition in the market.
- 4.26. In seeking to reform the cash-out arrangements such that they provide price signals that are efficient, we are mindful that any sharpening of incentives could exacerbate these problems. However, we would note that at present almost all of the risks of a GDE sit with consumers who have little to no means of mitigating those risks. Our reforms transfer some of those risks to shippers. However, we consider that transfer to be proportionate and have taken a number of steps to ensure that shippers are not unduly burdened:

- The true cost of a GDE with respect to NDM interruptions is the cost to NDM consumers for a single day (£14/therm) multiplied by the number of days that they are interrupted. Any NDM interruption is likely to last a number of weeks. By limiting payments to first day of any NDM network isolation we have stopped short of transferring all the risks of NDM interruptions to shippers. We consider this to be prudent as shippers have no control over the speed at which NDM consumers are reconnected.
  - Compared with previous proposals, we have reduced the payments due to both DM and NDM consumers who are involuntarily interrupted.
  - In the event that there is a shortfall in the monies collected from short shippers during a GDE we have taken a number of steps to ensure that this is not smeared across the rest of the shipper community.
  - Lastly, we have refrained from obliging suppliers to pay consumers at the time of an emergency. Instead we have agreed to allow consumer payments to be made after several months, in line with the processing of other monies (ie, the receipt by suppliers of payments from Xoserve).
- 4.27. In light of these steps we have taken to mitigate the impact on shippers and given that most of the risks of a GDE currently sit with consumers, we consider the impact of our reforms on competition to be entirely consistent with our goal of protecting the interests of present and future consumers.

## Shipper responses

- 4.28. In making changes to the arrangements that would prevail near or during a GDE we are potentially exposing shippers to new risks. We are mindful that shippers must have ways to respond for these new incentives to be proportionate and have the desired effect. In this section we set out a number of possible measures shippers can take in response to our proposed reforms.

### **Negotiation of interruptible contracts**

- 4.29. We are aware that feedback from stakeholders has been that a commercial market for DSR would not emerge which is why we are proposing to introduce a centralised DSR mechanism. Nevertheless, we still see consumers and shippers as being well placed to negotiate for commercial DSR.
- 4.30. We have taken the view that any DSR mechanism should help rather than hinder or foreclose the development of commercial DSR in the long-run. Therefore we view this as a tool to kick-start the commercial market that can be withdrawn in the long run. Shippers that do sign interruptible contracts with DM consumers in their portfolio would have a useful tool to mitigate the risks of stress events in the gas market.

### **Investment in new infrastructure**

- 4.31. Shippers have argued that cash-out reform would not bring forward any new investment in and of itself. We acknowledge that at present it is highly unlikely that a piece of infrastructure would go ahead with the sole purpose of dealing with the risks of a GDE. However, it is still entirely rational for a shipper considering such an investment to account for the value of the facility in all possible circumstances. Our proposed reforms would likely increase the value of new infrastructure near or during a GDE. Whilst such a situation is unlikely to arise, we question whether a shipper would discount this possibility completely. Moreover, if the risks of a GDE were to increase we would expect the value of new infrastructure to necessarily increase as well.

### **Other responses**

- 4.32. Rather than investing in new infrastructure or contracting for DSR, shippers may opt to alter the manner in which existing infrastructure is utilised. For example this may be through holding more storage capacity. Shippers may look to diversify their supplies so as to avoid having their balance position being overly reliant on one piece of infrastructure. To further protect themselves from the effects of a supply failure, shippers may look to sign more firm physical contracts than they do at present.
- 4.33. All of these are steps shippers can take to mitigate the effects of a GDE and thus cope with the impacts of our proposed reforms. It is possible that some shippers may opt to do nothing. However, if the potential costs of a GDE have materially increased as a result of our proposed reforms and the probability of a GDE occurring is non-zero, we would question whether this is a rational response. Crucially then, to the extent that shippers respond to our proposed reforms in the ways described above, they will reduce the likelihood of a GDE occurring in the first place, thus improving GB security of supply.

## 5. DSR Mechanism Design

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### Chapter Summary

This chapter discusses the impact of different DSR mechanism designs on participation, DSR volumes accepted and costs incurred.

- 5.1. As set out in the policy decision document and draft licence condition Ofgem will specify some principles that the design and methodology of the tender must meet.
- 5.2. We have modelled the impact of a range of DSR mechanism designs in order to understand the potential benefits and costs of a centralised approach to DSR. The designs we modelled are in part based on those that we consulted on in July 2013 and are shown in Table 2 below.
- 5.3. In the July 2013 tender consultation Ofgem proposed 3 potential tender designs. There was little support for Ofgem’s “Strawman 1” proposal amongst stakeholders and therefore we did not pursue modelling the option. In response to NGG proposed an alternative DSR mechanism which has been modelled.<sup>9</sup>
- 5.4. A key feature of all the designs is that only NGG is able to exercise any DSR volumes procured in the mechanism. Moreover, the intention is that those DSR volumes would only become available to NGG upon the declaration of a Gas Deficit Warning (GDW). This is a pre-emergency warning issued by NGG when there is a concern that supplies may be insufficient to meet demand.

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<sup>9</sup> <https://www.ofgem.gov.uk/ofgem-publications/83700/gasscrdsrtendernggresponse.pdf>

**Table 2: Summary of modelled DSR mechanism designs**

Design component	NGG platform	Straw Man 2	Straw Man 3
Pay-as-clear vs. pay-as-bid	Pay-as-bid	Pay-as-bid	Pay-as-bid
Exercise / Option fees	Exercise only	Exercise only	Exercise and variable option fee
Decision criteria	None. Acceptance and exercise are purely based on NGG's decisions in a GDE.	Volume cap (accept cheapest x% of bids based on exercise fees)	Volume cap (accept cheapest x% of bids based on option fees)
Contract duration	Real-time	One year	One year
Format	Real-time updated platform	Sealed-bid annual tender	Sealed-bid annual tender
Gas-fired generation eligibility	N/A	Included [sensitivity where they are excluded]	Included [sensitivity where they are excluded]

5.5. Before proceeding it should be noted that whilst the quantitative analysis presented here does provide useful insights, it also has some key limitations. Many of these limitations are due to simplifying assumptions. A fuller explanation of the assumptions made and the limitations of the analysis can be found in Pöyry's report. Furthermore, there are a number of design impacts and features that were not captured by the quantitative modelling. These are addressed in chapter 6 and the appendices.

5.6. As can be seen from the table below, considerable volumes of gas-fired power station DSR are available under all scenarios irrespective of the introduction of either cash-out reform or a DSR mechanism.<sup>10</sup> As has already been discussed, it has been assumed that very limited volumes of I&C DSR are available in the absence of a DSR mechanism. It has also been assumed that there is only a small incremental increase as a result of cash-out reform.

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<sup>10</sup> 50mcm/day is the average daily gas consumption by the power sector over the modelled years. This gives a rough indication of the volume of DSR they could offer on-the-day.

**Table 3: Likely available volumes of voluntary DSR (mcm/day)<sup>11</sup>**

Policy scenario ->	Current	Cash-out reform	Cash-out reform + NGG platform	Cash-out reform + Straw Man 2		Cash-out reform + Straw Man 3	
Gas-fired power station eligibility ->	N/A	N/A	N/A	Inc.	Exc.	Inc.	Exc.
Gas-fired power stations	50	50	50	50	50	50	50
I&C	0.4	1.3	26	24	18	14	25
<b>Total</b>	<b>50.4</b>	<b>51.3</b>	<b>76</b>	<b>74</b>	<b>68</b>	<b>64</b>	<b>75</b>

### NGG platform

- 5.7. The introduction of the NGG platform results in the volumes of I&C consumers that are willing to provide DSR increasing significantly. This represents a large proportion of I&C consumers revealing their cost of interruption (ie their VoLL) by participating in the DSR mechanism. I&C consumers were assumed to be more willing to offer DSR for any gas consumption that could be replaced by back-up or that was relatively dispensable.
- 5.8. However, not all of the potential I&C volumes are willing to offer DSR in the NGG platform due to the lack of option fees. Essentially to participate in an exercise only mechanism, any consumer must effectively write-off the upfront costs they would incur in formulating a bid and contracting to provide DSR. Generally speaking these costs would be lower both in absolute and relative terms for larger sites and so the non-participating volumes are generally from smaller consumers who are less willing to write these costs off. Obviously the lower the costs of participating the greater the likely levels of participation.
- 5.9. The potential benefits of these greater volumes of voluntary DSR (see Chapter 3) are offset by the costs of setting up and running the platform (incurred by the SO) and the costs of participating (incurred by consumers). The final results of the modelling suggest that on balance the benefits of the NGG platform do have the potential to outweigh the costs.

### Straw Man 2

- 5.10. In many respects Straw Man 2 is very similar to the NGG platform. As such it engenders similar levels of participation and similar benefits should a GDE occur. A key difference is that a smaller proportion of I&C consumers tend to be accepted as there is an x% volume cap. Also, the inclusion or exclusion of

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<sup>11</sup> 'Total likely available volumes' combines the likely available DSR volumes from gas-fired power stations with whatever I&C DSR volumes are available as a result of either commercial negotiation or the DSR mechanism. It should be noted that *participating* volumes would exceed the *available* volumes shown here. This is because not all consumers that participated were successful (eg those that fell above the x% volume cap).

gas-fired power stations now makes a difference to modelling outcomes. This was not the case with the NGG platform because it was effectively indistinguishable from the on-the-day commodity market (OCM) in modelling terms.

- 5.11. Including gas-fired power stations significantly increases the volumes of DSR accepted in the tender. Notably though, it has no effect on the actual levels of DSR available from gas-fired power stations should an emergency actually arise. This is because gas-fired power stations already have a route to market to provide DSR commercially anyway. Including gas-fired power stations increases the volume of I&Cs that are accepted. This is due to the x% volume cap. Whilst this may seem to result in an improvement, the inclusion of gas-fired power stations also has negative implications (eg removing liquidity from the OCM or strategic bidding). These are not captured in the quantitative modelling and could distort the outcomes of the tender.
- 5.12. Importantly, any annual tender is likely to result in higher fixed costs than the NGG platform. This is because it requires new back-to-back contracts whereas the NGG platform functions using the existing contractual relationships between consumers and shippers. This means that the NGG platform has the potential to result in similar benefits to Straw Man 2 but at lower cost.

### **Straw Man 3**

- 5.13. Straw Man 3 succeeds in bringing forwards the greatest volumes of DSR as it contains option fees. This means consumers are able to recoup the costs of participating through an option fee and so all I&C consumers (including the smallest sites) are willing to offer DSR. These larger DSR volumes mean Straw Man 3 yields some of the greatest benefits in the event that a GDE arises.
- 5.14. However, Straw Man 3 has a number of drawbacks. Firstly, allowing gas-fired power stations to participate crowds out a significant proportion of I&C volumes. Given gas-fired power stations already have a route to market this outcome seems to run contrary to the purpose of the tender. Secondly, the actual costs incurred in terms of option fees are substantial (£6.4-13.5 million/annum). Admittedly this appears to be a reduction relative to Pöyry's estimate of the equivalent cost of the previous transportation regime (£12 million-18million/annum). However, it is still questionable whether this represents a good deal for consumers given the low probability of a GDE. This is substantiated by the final CBA results which show Straw Man 3 would not produce net benefits.

## 6. Risks, Unintended Consequences and Other Impacts

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### Chapter Summary

This chapter assesses the key risks and unintended consequences associated with our proposals. We also consider additional impacts and interactions not yet covered.

### Inefficient DSR mechanism outcomes

#### Impact on commercial interruption

- 6.1. Stakeholder feedback has suggested a commercial market for DSR would not emerge as a result of our previous proposals, which is why we are looking to introduce an SO-run DSR mechanism. Nevertheless, we still see consumers and shippers as being well placed to negotiate for commercial DSR. In light of this, we are mindful that both our cash-out reforms and any DSR mechanism do have the potential to crowd out commercial DSR.
- 6.2. Our proposals for cash-out reform introduce payments for DM consumers that are firm-load shed, even in the absence of a DSR mechanism. By paying consumers for DSR where they previously received no payment our proposed reforms necessarily reduce the willingness of consumers to negotiate for voluntary DSR ahead of firm-load shedding. However, we consider the level that we have set payments at will continue to allow for consumers and shippers to both benefit from providing voluntary commercial DSR (see Appendix 4). Also, where our reforms sharpen the incentives on shippers relative to current arrangements they will be more willing to contract for DSR.
- 6.3. There is a greater risk that a DSR mechanism could crowd out commercial interruption. This would be the case if consumers participate in the mechanism when they are already willing to provide DSR via their shipper. This is a concern because commercial DSR is effectively available to all shippers. Centralised DSR is only available to NGG. As such, if centralised DSR crowds out commercial DSR it will limit the ability of shippers to balance their own portfolios. We are keen to preserve the principle that shippers should self-balance in the first instance and the SO should act as residual balancer.
- 6.4. For I&C consumers we would note that the initial rationale for a centralised DSR mechanism was that there would be very little commercial DSR from I&C consumers in the first place. In the short-run then, we would expect minimal crowding out to occur if I&C consumers participate in the DSR mechanism. This is because the DSR mechanism will encourage I&C consumers to offer DSR where they would not have previously.



- 6.5. In the long-run I&C DSR crowding out will become more likely. This is because in order to participate in a DSR mechanism, consumers will need to make informed estimates of their interruption costs (ie, calculate their VoLL) and set up any necessary systems to ensure they can respond when needed. This should help familiarise consumers with providing DSR. It should also reduce the hurdles to offering DSR commercially. Once they have participated in the simple centralised DSR mechanism, I&C consumers may realise the benefits of seeking more bespoke arrangements with their shipper(s). At this point we would consider whether a DSR mechanism was still a necessary intervention.
- 6.6. Even if a consumer has successfully participated in a DSR mechanism, we would note that there are still clear circumstances where a shipper would have sufficient incentives to pay consumers more than they would receive via the DSR mechanism (see Appendix 4). If the risks of a GDE are high enough, shippers may even be willing to pay consumers an option fee which could increase the attractiveness of commercial DSR. This is one of the reasons that Ofgem does not believe that option fees should be included as part of the DSR mechanism.

### **Distortions to the Traded Market**

- 6.7. This issue of crowding out almost certainly arises with respect to gas-fired power stations and leads to significant distortions to the traded gas markets. We know that gas-fired power stations already have a route to market. If they chose to move their DSR to a new centralised mechanism this would almost certainly result in the volumes of commercially available DSR being crowded out.
- 6.8. Given the sheer size of the volumes of gas consumed by the power sector, this could have severe implications for the shipper community's ability to balance in the event of a GDE. Therefore we have concerns that inclusion of gas-fired generators in a separate mechanism where NGG is a sole buyer could remove significant amounts of liquidity from the traded markets. This would be an unacceptable consequence and it is because of this potential that we believe gas-fired power stations should be excluded from any DSR mechanism or the DSR mechanism designed such that gas-fired generators have no incentive to participate.

### **Distorted bidding and participation**

- 6.9. There are risks with any centralised DSR mechanism that it will produce inefficient and/or uncompetitive outcomes. These would generally result in bids failing to reflect true costs, which would in turn result in excess costs being incurred by consumers and market participants. This would also mean cash-out prices would fail to reflect the true cost of balancing the system and could be set at inefficient levels. Table 4 summarises some of the key potential causes of inefficient outcomes, and how these can be mitigated.

**Table 4: Key possible inefficient outcomes from a DSR mechanism**

Risk	Specific mitigating actions
<p>There is a risk that participants may enter a sleeper bid on the grounds that they are either unwilling to incur the costs of accurately estimating their VoLL or do not want to be interrupted at any cost.</p>	<p>NGG has an obligation to take 'economic and efficient' actions. As such it will likely be able to choose not to exercise an uncompetitive sleeper bid. Furthermore, both the tender designs contain an x% volume cap that is intended to engender competition and ensure the most expensive bids are rejected.</p>
<p>The NGG platform allows consumers to update their bids in real-time. As such consumers may seek to inflate their bids above true cost as an emergency situation approaches.</p>	<p>Part of the intended design of the NGG platform is that consumers' bid prices would be frozen ahead of any emergency. Depending on when this happens, this should limit the scope for bids to be inflated.</p>
<p>Gas-fired power stations represent a significant proportion of total DSR volumes and they are likely to have a fairly homogenous bidding strategy (eg bid at £118/therm). The combination of a 'known' bidding strategy and a high likelihood of being accepted may in turn lead to other bidders pricing themselves off their expectations of gas-fired power station bidding.</p>	<p>The effect of strategic bidding is unlikely to be significantly reduced by excluding gas-fired power stations. This is because NGG will still continue to take a range of market actions as it attempts to avert a GDE, including both commercial and centralised DSR. One of the few tools available to mitigate this risk is to opt for a pay-as-clear DSR mechanism. However, choosing pay-as-clear instead of pay-as-bid has both pros and cons (see Appendix 5).</p>
<p>For any DSR mechanism to be a success there must be sufficient participation. This is more of a concern with an annual tender because without competition inefficient bids are likely to be accepted in the annual bidding round. NGG would likely be obliged to exercise any such bids if they were accepted in an annual tender.</p>	<p>Emphasis has been placed on simplicity for all DSR mechanism designs so the barriers to participation should be low. Depending on the visibility of the bids to the market, the effects of low participation are also reduced in a real-time platform where consumers can engage as much or as little as they like. Options fees should increase participation but also entail costs as already discussed.</p>

## Impacts on health and safety

6.10. As in our earlier proposals, our approach to cash-out reform would retain the powers of the Network Emergency Coordinator (NEC) to direct physical delivery of supply in a GDE. Also, the intention is for any DSR mechanism to become available to NGG prior to an emergency following the declaration of a Gas Deficit Warning (GDW). For these reasons we would expect the impact of our proposed reforms on the NGG and NEC safety case to be limited.

- 6.11. The Health and Safety Executive (HSE) supports Ofgem’s approach and has indicated that it is broadly satisfied that our reforms to the cash-out arrangements and a centralised DSR mechanism will have no adverse effect on the health and safety standards associated with preventing or managing a network gas supply emergency.
- 6.12. Finally, some stakeholders have noted that potential electricity VoLL and/or electricity market penalties are greater than the NDM VoLL we are proposing to introduce in the gas market. They have therefore claimed that this creates an inherent bias towards the electricity market which would appear to run contrary to safety concerns (ie electricity fails safe where as gas does not).
- 6.13. It is true that the relative pricing created by proposed reforms to the electricity and gas markets would cause electricity security to be prioritised over gas security. Arguably this simply reflects the fact that consumers value electricity more than gas. Importantly though, this prioritisation only holds *as long as the gas market is functioning normally*. The moment gas consumers start being involuntarily interrupted (ie a Stage 2 GDE is declared) gas-fired power stations will always be some of the first to be taken off during firm-load shedding. This means gas safety is always paramount and domestic gas consumers are always protected ahead of electricity consumers.

## 7. Cost-Benefit Analysis

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### Chapter Summary

This chapter summarises the key costs and benefits discussed in the preceding chapters so as to arrive at an overarching cost-benefit analysis (CBA). The key uncertainties and risks with this CBA are also considered at the end of the chapter.

### Cost-benefit analysis

- 7.1. In seeking to weigh the costs and benefits of our proposed reforms it is best to consider the impacts in three distinct categories. These are 'price signals', 'transfer of risks' and 'efficient provision of DSR'. Due to the limitations of the analysis it was only feasible to *quantitatively* assess the impact of our proposed reforms on 'efficient provision of DSR'. It was not possible to quantitatively assess 'price signals' or the 'transfer of risks'. Similarly, it was also not possible to quantitatively assess the effects of a number of the risks identified in chapter 6. These have therefore been assessed *qualitatively*.

### Price signals

- 7.2. Our proposed reforms seek to reform the price signals that would prevail in the event of a GDE. This is done by: unfreezing cash-out prices throughout a GDE; introducing a proxy price for NDM consumers (ie NDM VoLL); and encouraging DM consumers to reveal their VoLLs via a DSR mechanism.
- 7.3. The key benefit of these changes is to ensure there are efficient price signals in place for shippers to bring gas to GB when a GDE is imminent or unfolding. This will mean shippers now factor the value that consumers place on their gas supplies into their efforts to avoid any imbalance and meet GB demand.
- 7.4. The key costs of these changes are where the reforms result in a discernible sharpening of incentives. This sharpening exposes market participants to additional risks when trading at high prices (eg increased credit requirements) which could in turn act as a barrier to entry for smaller participants.

### Transfer of risks

- 7.5. Our proposed reforms entail transferring some of the risks of a GDE from consumers to shippers. This is done through cash-out changes which introduce payments to consumers for involuntary DSR and ensure that shippers' imbalances are not perversely affected by NDM interruptions.
- 7.6. The key benefit of these changes is to ensure shippers bear a fair proportion of the risks of a GDE. At present these risks sit with consumers who are poorly

placed to mitigate them. Consumers are also providing a service when their DSR is used to balance the system and at present this is unremunerated. Lastly, there are circumstances at present where shippers may actually benefit from the worsening of a GDE. Our reforms resolve these issues where appropriate. To the extent that shippers respond to the new risks being placed on them the likelihood of a GDE will necessarily be reduced.

- 7.7. The key costs of these changes are essentially any payments for involuntary DSR that arise in the event of a GDE and any costs shippers may incur when seeking to respond to the new risks being placed on them.

### Efficient provision of DSR

- 7.8. Finally, our proposed reforms seek to facilitate the efficient provision of DSR. Increasing the incentives on shippers to contract for commercial DSR via cash-out reform goes some way to achieving this. In the main though, this is facilitated by the introduction of a centralised DSR mechanism.
- 7.9. The key benefit of creating a more efficient disconnection order is that it results in consumers with very high interruption costs being better protected. By interrupting consumers with lower interruption costs instead, the severity of a GDE is reduced. This is because the economic costs of a GDE are reduced and fewer sites will be involuntarily interrupted for as significant duration in the event of a GDE. Moreover, a greater volume of voluntary DSR available to NGG pre-emergency gives the SO more certainty and reduces the likelihood of involuntary interruptions. This reduces the likelihood of a GDE.
- 7.10. The key costs associated with bringing forward more voluntary DSR are the costs of setting up and running any DSR mechanism. There are also the costs incurred by consumers in arranging to provide DSR. Lastly there are the payments made to those consumers that now provide DSR ahead of an emergency.
- 7.11. The impact of our proposed reforms on the efficient provision of DSR is the impact that Pöyry’s report has focussed on and their quantitative CBA is shown below. Further information on their methodology can be found in their report and in Appendix 2. As already noted, the other potential impacts of our proposed reforms have necessarily been assessed qualitatively.

**Table 5: NPV of various reform options (£ million)**

Policy scenario ->	Current	Cash-out reform	Cash-out reform + NGG platform	Cash-out reform + Straw Man 2		Cash-out reform + Straw Man 3	
				Inc.	Exc.	Inc.	Exc.
Gas-fired power station eligibility ->	N/A	N/A	N/A	Inc.	Exc.	Inc.	Exc.
Gone Green	£0.0	£0.0	-£34.3	-£41.0	-£41.0	-£91.3	-£162.3
High demand	£0.0	£2.7	£37.5	£30.8	£20.5	-£35.5	-£89.3

- 7.12. First and foremost, it is not surprising that under the Gone Green case all of the DSR reform options result in a negative NPV. For any of the reform options to result in benefits *with respect to the more efficient use of DSR* it is necessary for DSR to be required in the first place. Because the Gone Green scenarios result in no unserved energy, none of the reform options yield benefits. At the same time, any upfront or annual costs are still incurred. In the case of cash-out reform these are negligible. In the case of a DSR mechanism these are higher. Where that DSR mechanism includes option fees, the costs are very substantial indeed. A key point that the Gone Green results highlight then is that in a world where gas demand declines over time, GB remains very resilient to a range of shocks to supply and interventions with significant fixed costs are difficult to justify.
- 7.13. However, the CBA indicates that where the modelling did generate unserved energy, both cash-out reform and a centralised DSR mechanism can result in net benefits. Once again this is *purely with respect to the more efficient use of DSR*. This was the case in the High demand scenario which looked at an alternative view of the world where GB demand remains fairly constant over time. Here the availability of greater volumes of DSR to be utilised efficiently ahead of a GDE meant a reduction in the costs to society when consumer interruptions occurred. The larger the available voluntary volumes, the larger the benefits. These benefits must still be offset against the costs of the reforms. In the case of cash-out reform and the DSR mechanisms without option fees the modelling suggested the benefits outweighed the costs. For Straw Man 3, the option fee costs incurred were still too large to result in a positive NPV.
- 7.14. A final point on these results is that as with any quantitative assessment, these results should be considered alongside the range of qualitative arguments that have already been discussed. Pöyry acknowledge in their report that the results presented here are highly uncertain and sensitive to a number of key assumptions. The key uncertainties and risks surrounding the cost-benefit analysis presented here are discussed in the following section.

## Key uncertainties and risks

### Likelihood of a GDE

- 7.15. The benefits associated with our reforms largely depend on the likelihood of a GDE arising. Both the modelling conducted for this IA, and past modelling by Redpoint suggest that GB is resilient to a range of threats to security of supply. However, this is not to say that there is no risk of consumer interruptions. Even in the Gone Green case there is still a risk (however small) of a GDE occurring. In fact there remains significant uncertainty regarding the likelihood of a low probability, high impact event such as a GDE.
- 7.16. For cash-out reform, the low probability of a GDE is of less importance with respect to the rationale for proceeding. This is because both the benefits and the costs of cash-out reform are generally speaking in proportion to the

likelihood of a GDE.<sup>12</sup> When the probability of a GDE is high, the incentives introduced by cash-out reform will have a substantial effect both in terms of the benefits accruing to consumers and the costs incurred by shippers. The inverse will be the case when the probability of a GDE is low.

- 7.17. This is not the case for a DSR mechanism. Most of the costs associated with this element of our proposed reforms are incurred irrespective of the likelihood of a GDE. As such, when the probability of a GDE is high the benefits of a DSR mechanism will likely outweigh the costs (as in the High demand case). Conversely, when the probability of a GDE is low the benefits of a DSR mechanism will likely not outweigh the costs (as in the Gone Green case).
- 7.18. The final results are highly sensitive to the assumptions made regarding the likelihood of a GDE. Pöyry have acknowledged that their CBA methodology underestimates the extent of the threats to GB security of supply, thus underestimating the potential benefits of the reform options.

### **Implementation costs**

- 7.19. The implementation costs for a DSR mechanism are uncertain. For modelling purposes we have assumed a start-up cost of £1m and then an ongoing cost of £1m/annum to run the mechanism. This ongoing cost has been assumed to be lower for the NGG platform (£400,000/annum) because the platform does not require the negotiation of new back-to-back contracts in the same manner as the two tender designs.
- 7.20. Any DSR mechanism also entails costs for consumers that choose to participate. Once again, these are uncertain and will vary by consumer. For modelling purposes we assumed these would be roughly £10,000-20,000.<sup>13</sup> We would expect the cost of participation for consumers to decline over time as they become more familiar with offering DSR. For example, the costs of formulating a first bid are likely to be higher than for any subsequent bidding.
- 7.21. A final point is that the implementation costs of our proposed reforms are relatively low compared to other potential interventions to improve security of supply (eg, promoting storage investment). This highlights the flexibility of opting for cash-out reform and a DSR mechanism. By allowing industry to respond in line with the perceived risks to security of supply, the resilience and diversity of the system will be improved without significantly exacerbating path dependency or system lock-in.

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<sup>12</sup> This excludes the initial implementation costs, but these are relatively small.

<sup>13</sup> This is each time a consumer participates (ie per annum in an annual tender).

## Distributional impacts

- 7.22. The costs and benefits of our proposed reforms are unlikely to be spread uniformly across all types of consumers. In particular, where our reforms result in the more efficient use of DSR from DM consumers, those benefits will generally accrue to DM consumers. This is because altering the disconnection order of DM consumers will result in some DM consumer moving forwards in the queue and some moving backwards. However, it is unlikely to have much impact on the likelihood of NDM consumers being interrupted.<sup>14</sup> This is because NDM consumers will always be the last to be interrupted in a GDE.
- 7.23. The costs and benefits of our proposed reforms are also unlikely to be evenly spread between present and future consumers. Modelling conducted for both this IA and by Redpoint suggested that GB security of supply is likely to be more at risk in the 2020s and 2030s than it is at present.<sup>15</sup> The benefits of our proposed reforms (particularly the DSR mechanism) tend to increase as GB security of supply declines. This suggests the benefits of our proposed reforms are more likely to be felt by future consumers than by present consumers.

## High DSR sensitivity

- 7.24. Despite the potential benefits of a centralised DSR mechanism, it should be noted that these benefits are dependent on the levels of commercial DSR available under current arrangements. We are mindful that there is significant uncertainty regarding this assumption and there is evidence that our base case assumption is conservative (see Appendix 6).
- 7.25. To explore this issue we have conducted a sensitivity that looks at the impact of our proposed reform in a world where commercial DSR is significantly more forthcoming than is suggested by our base case assumption.

**Table 6: NPV of various reform options in the DSR sensitivity (£ million)**

Policy scenario ->	Current	Cash-out reform	Cash-out reform + NGG platform	Cash-out reform + Straw Man 2		Cash-out reform + Straw Man 3	
				Inc.	Exc.	Inc.	Exc.
Gas-fired power station eligibility ->	N/A	N/A	N/A	Inc.	Exc.	Inc.	Exc.
Gone Green	£0.0	£0.0	-£34.3	-£41.0	-£41.0	-£91.3	-£162.3
High demand	£0.0	£2.7	£8.2	£1.5	-£8.8	-£64.8	-£118.6

<sup>14</sup> However, it should be noted that if a DSR mechanism results in sharper price signals and that this could have an impact on NDM interruptions if it caused shippers to behave differently.

<sup>15</sup> The Pöyry modelling did not generate unserved energy in 2016. 2020 showed some unserved energy and 2030 showed the most unserved energy. Similarly, the likelihood of consumer interruptions in Redpoint's report for DECC progressively increased over time.



- 7.26. The results are as we would expect: if greater volumes of DSR are available at present, there are fewer benefits from establishing a centralised DSR mechanism. The implications of this sensitivity are linked to the concerns raised in Chapter 6, and the mitigating steps we proposed to take, with regard to the crowding out of commercial DSR.
- 7.27. Nevertheless given the very high costs associated with a GDE and the feedback from the demand side on the likely emergence of commercial interruption we conclude that it is prudent to proceed with the implementation of a DSR mechanism.

## Appendices

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## Appendix 1 - Consultation Response

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1.1. Further work on the Gas SCR will focus on the code and licence changes required to implement the policy decisions. We do not expect to change our policy decision.

1.2. We'd like to hear your views about any of the issues in this document.

1.3. It would be helpful if you could submit your response both electronically and in writing. Responses should be received by 9 April 2014 and should be sent to:

- Anjali Mehta
- Wholesale Markets
- 9 Millbank  
London  
SW1P 3GE
- 020 7901 1859
- [wholesale.markets@ofgem.gov.uk](mailto:wholesale.markets@ofgem.gov.uk)

1.4. Unless marked confidential, all responses will be published in our library and on our website, [www.ofgem.gov.uk](http://www.ofgem.gov.uk). You may ask us to keep your response confidential. We'll 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. If you'd like your response to remain confidential, mark it clearly to that effect and include your reasons. Please restrict any confidential material to the appendices to your response.

1.6. Please direct any questions about this document to:

- Stephen Jarvis and Anjali Mehta
- Wholesale Markets
- 9 Millbank  
London  
SW1P 3GE
- 0141 341 3990 / 020 7901 1859
- [wholesale.markets@ofgem.gov.uk](mailto:wholesale.markets@ofgem.gov.uk)

## Appendix 2 – Previous modelling and stakeholder feedback

### Modelling approaches



1.1. The key benefits of Pöyry's approach are that it focuses on specific plausible supply shocks. The approach is also more firmly grounded in observed data (eg historical weather patterns). Both these mean that it gives a clearer understanding of the supply shocks that could represent credible threats to GB security of supply. This approach also requires far fewer model runs. As such other aspects of the model can be made more complex and therefore more realistic (eg inclusion of limited foresight, more extensive modelling of non-GB regions, more detailed modelling of the electricity market etc).

1.2. The key drawbacks are that Pöyry's approach cannot account for any of the other possible outage events that could lead to a GDE (ie those not covered by the discrete number of pre-defined prognoses). It is therefore highly probable that the likelihood of a GDE is underestimated. It is very difficult to infer what the overall risks to GB security of supply are in a quantitative manner from a discrete set of pre-defined outage events. As such the probability of interruptions must be accounted for qualitatively.

1.3. The key benefits of Redpoint's approach are that it accounts for all possible supply outage events and combinations of supply outage events. It also generates estimates of the probability of interruptions arising. This is useful for gauging the threats to GB security of supply over and above simple qualitative judgements.

1.4. The drawbacks are that this approach is heavily dependent on the initial model parameters; specifically the probability distributions that are assigned to supply outages, weather profiles and so on. Whilst these will be based (where possible) on historical evidence, there is a distinct lack of historical evidence on supply outages and therefore a risk that the probability distribution may be incorrectly specified. This may lead to erroneous estimates of the threats to GB security of supply that appear accurate on the simple grounds that they are numerical. This modelling approach also requires a very large number of model runs to produce reliable results. As such complexity in other aspects of the modelling may have to be curtailed (eg assuming no foresight, simplified modelling of non-GB regions or the electricity market etc).

### **Stakeholder feedback**

1.5. We have endeavoured to ensure that stakeholder feedback on earlier modelling for the Gas SCR was taken into account in the modelling for this IA.

1.6. Table 7 sets out some of the key concerns stakeholders raised with respect to the modelling conducted for our previous IA. Many of these stakeholder concerns – as well as some not mentioned here – were also addressed in greater detail in the response document we published in July 2013.

**Table 7: Steps taken in response to previous stakeholder feedback**

Stakeholder concern	Steps taken
The assumed infrastructure outage frequencies were too pessimistic, despite changes from the Draft IA.	Different approach as probabilities assigned to events rather than infrastructure.
The modelling of storage did not reflect diversity of short- and mid-range storage sites.	Pöyry’s approach models each GB storage site individually and allows for multiple cycling for short- and mid-range sites.
The assumed volume of gas-fired power stations with distillate back-up was likely to be higher than is actually available.	A much lower volume has been assumed for this modelling following extensive research by Pöyry to ascertain current likely levels.
The use of ‘Gone Green’ demand forecasts may not have been the most likely scenario for future gas demand.	We have used two different scenarios in the modelling for this IA: the ‘Gone Green’ scenario and a ‘High demand’ scenario which uses demand from NGG’s Slow Progression case.
The modelling did not account for stocks of gas at LNG re-gasification terminals, and the additional flexibility this could provide.	Our updated modelling also does not capture this. As such we acknowledge this could lead to the results potentially underestimating security of supply.
The modelling underestimated the level of DSR available to the market under current arrangements, as it effectively assumed no self-interruption takes place in response to rising prices. The modelling also overestimated the likely willingness of large consumers to offer DSR following cash-out reform.	In order to better understand the scope for and impact of DSR a more detailed assessment of I&C consumers was undertaken. This built on the London Economics study we commissioned. Moreover, we took on board stakeholder feedback (particularly from consumers) which suggested that a pessimistic view of current levels of DSR was justified.
The assumptions about imports from continental Europe did not properly reflect the lack of price responsiveness from interconnectors.	We took a different approach to assessing the responsiveness of interconnectors for this modelling. We would note that Ofgem is taking a number of steps to increase the efficiency of interconnector flows.
The modelling lacked foresight and so does not provide a realistic depiction of likely market conditions in the approach to a GDE. This also affected the modelling of storage.	Pöyry’s model makes decisions on which supplies to use to meet demand with limited knowledge of the future. This allows the model to more realistically simulate decision-making in the presence of uncertainty.

## Appendix 3 – Modelled impacts on prices

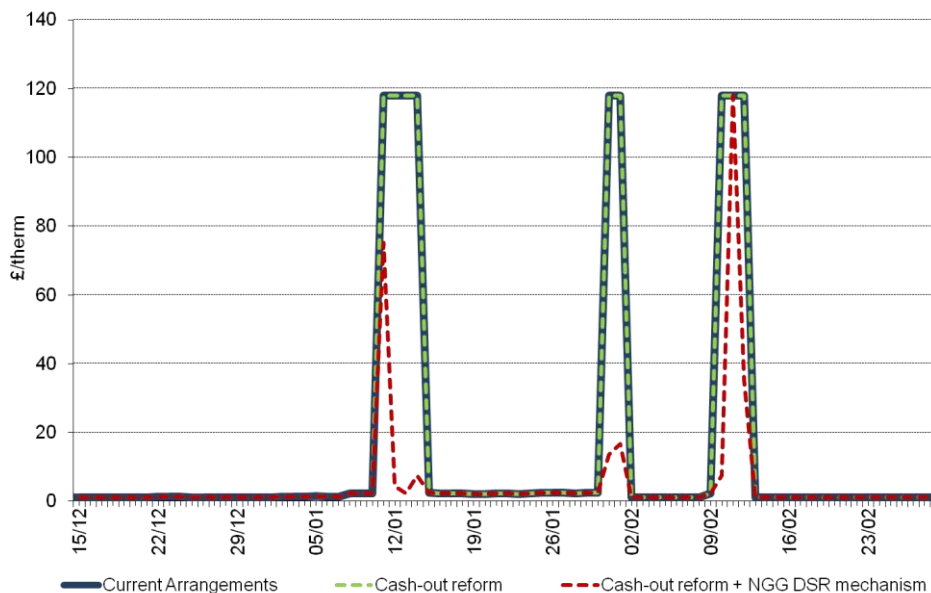
### Modelled prices

1.7. At the beginning of Chapter 4 it was noted that the impact of our proposed reforms on prices is uncertain. Here we present some examples from the modelling that illustrate how our proposals may have varying impacts on prices.

1.8. Figure 4 below shows an example of how the modelling produced variations in prices between different policy scenarios for a given gas market stress event. By prices, the model effectively means the cost of the marginal source needed to match supply and demand. This includes DSR.

1.9. Importantly, it should be noted that both our current and previous modelling have indicated that the probability of getting into such an event is very low (the outage event depicted in Figure 4 was weighted with a probability of 1 in 2500 years). Moreover, the modelling results presented here do not account for dynamic changes such as the impact of shippers taking mitigating steps to reduce the likelihood of an emergency arising.

**Figure 4: Prices for the Bacton outage in 2020<sup>16</sup>**



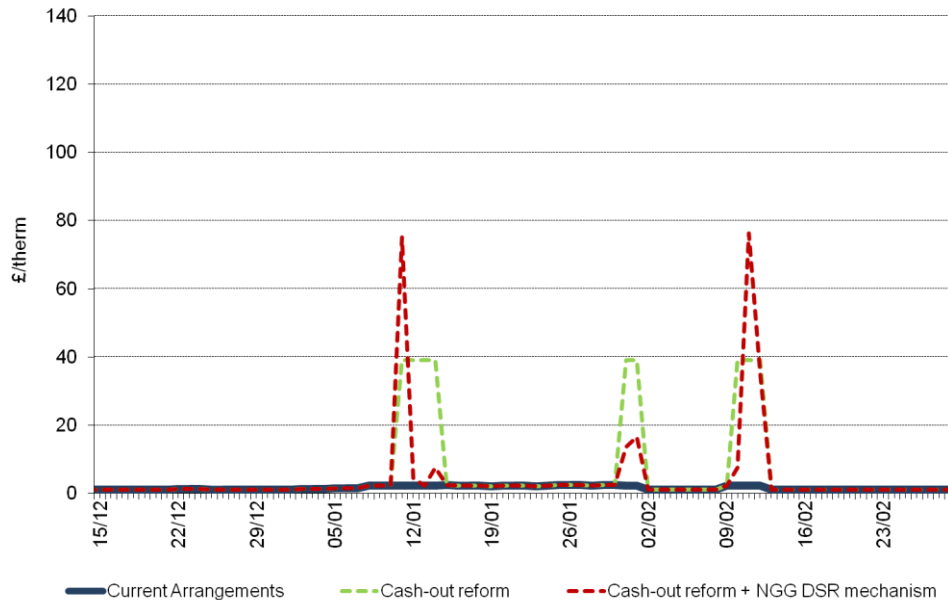
<sup>16</sup> This price track is taken from the 2020 results for the Bacton outage modelling. Only the NGG version of a DSR mechanism is shown for reference (the various other DSR mechanism designs all produce fairly similar price tracks).

1.10. In general it seems the modelling indicated that current arrangements tended to produce prices during a GDE that were higher than those that would result following our proposed reforms. In Figure 4 it is clear that the ability of gas-fired power stations to price their DSR based on proposed reformed electricity market penalties (ie at £118/therm) is very prevalent under current arrangements and is unchanged by cash-out reform. In this case the incentives provided by cash-out reform were insufficient to bring forward enough DSR to avoid interrupting gas-fired power stations. However, the DSR mechanism does succeed in bringing forward enough I&C DSR to reduce the likelihood of interrupting costly gas-fired power stations in some instances.<sup>17</sup>

1.11. It is important to point out here that the reason prices are so high in Figure 4 is largely due to the assumption that gas-fired power stations would all be able to offer DSR on the OCM prior to an emergency at a price of £118/therm. This clearly depends on the assumption that reforms to the electricity market proceed in the manner assumed. Moreover, it has already been noted that even if this is the case, there is no certainty that gas-fired power stations would in fact be able to set the price in the manner assumed in the modelling.

1.12. In light of this, Figure 5 shows the prices that would prevail if gas-fired power stations were not able to set the marginal price in the gas market.

**Figure 5: Prices for the Bacton outage in 2020 (gas-fired power stations not priced)**



1.13. This is a purely illustrative comparison, but shows quite clearly that depending on the pricing of gas-fired power stations the level that prices reach under current

<sup>17</sup> Notice that the red dashed lines rise later and fall sooner. This is due to additional I&C DSR.



arrangements can vary hugely.<sup>18</sup> This in turn has implications for the impact of our proposed reforms. In fact, contrary to Figure 4, Figure 5 shows that the impact of our proposed reforms would primarily be one of sharpening price signals by allowing DM and NDM consumers to reveal their VoLLs. This necessarily prevents prices from being frozen too low and is the case both with cash-out reform and with a DSR mechanism.

## Cost of spot gas calculation

1.14. On any given day where a reform scenario results in higher prices relative to current arrangements, the spot gas costs to suppliers on that day will necessarily be higher. The reverse will be the case on days where a reform scenario results in lower prices.

1.15. The variations in prices generated by Pöyry's modelling mean it is actually possible to calculate how these costs vary with different policy scenarios.

$\Delta$  costs = costs after reforms – costs under current arrangements

$$= (\text{reform price} - \text{current price}) * \% \text{ unhedged} * \text{volume of served demand}$$

1.16. These changes in costs have then been turned into a net present value (NPV) using the same methodology as the CBA results presented by Pöyry.<sup>19</sup> The results of this analysis were presented in Table 1, which is repeated below.

1.17. Where a reform scenario results in lower prices and thus lower costs, this translates into a net benefit. The table shows these net benefits in terms of a positive NPV (ie the first row). These can be viewed as an upper bound. Where a reform scenario results in higher prices and thus higher costs, this translates into a net cost. The table shows these net costs in terms of a negative NPV (ie the second row). These can be viewed as a lower bound.

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<sup>18</sup> Gas-fired power stations were generally the most expensive tranche of commercially available DSR in the modelling and therefore generally came off last (ie just prior to firm-load shedding). As such, the prices in Figure 5 effectively assume gas-fired power stations are taken off during firm-load shedding instead of setting the market price at the end of Stage 1. The peak prices are then based on the next highest priced tranche of voluntary DSR that is available under the various policy scenarios considered. This means that for current arrangements, the next highest priced tranche is valued at £2.70/therm in this example.

<sup>19</sup> First the changes in costs were linearly interpolated for any of the unmodelled years up to 2030. The probability of both the weather and the prognosis were then accounted for. Finally, all costs have been summed out to 2030 and discounted using a 3.5% discount rate in line with Treasury Green Book guidance.

Policy scenario ->	Current	Cash-out reform	Cash-out reform + NGG platform	Cash-out reform + Straw Man 2		Cash-out reform + Straw Man 3	
				Inc.	Exc.	Inc.	Exc.
Gas-fired power station eligibility ->	N/A	N/A	N/A	Inc.	Exc.	Inc.	Exc.
Gas-fired power stations priced (base case)	0	50.5	115.6	115.6	107.4	93.4	109.3
Gas-fired power stations not priced (for comparison)	0	-55.9	-70.7	-70.7	-34.4	-83.7	-150.3

1.18. A number of simplifying assumptions have been made for this analysis. In general these are consistent with the simplifying assumptions made by the stakeholder that initially raised the issue of the cost of unhedged gas.

- Firstly, spot gas prices have been assumed to equal the marginal price (ie the price of the most expensive source of gas or DSR that the market has utilised). This is clearly a simplification as the average market price that shippers and suppliers trade at will always be below the marginal price. However, the necessary abstractions of modelling mean making any distinction here between the marginal and average price is problematic.
- Secondly, it has been assumed that suppliers leave a fixed % of their total gas supply to be procured on spot markets on all days. It has been assumed that this does not vary between days or between the various policy scenarios.
- Thirdly it has been assumed that all suppliers leave unhedged the same proportion of their supplies (10%). Clearly this is a simplification as in reality suppliers pursue different hedging strategies (ie risk averse suppliers will likely hedge more of their supplies). A higher percentage would necessarily alter the magnitude of any net benefit or cost. However, it does not affect whether any NPV is positive or negative.
- Fourthly, these results only apply in the 'High Demand' scenario. This is because the Gone Green scenario did not produce any unserved energy and therefore did not produce any variations between the various policy scenarios.
- Fifthly, it has been assumed that spot refers to the price on-the-day, rather than any day-ahead (or further out) price.
- Lastly, it is important to understand that the calculation when the pricing of gas-fired power stations is ignored is purely included as an illustrative comparison. It does not represent a consistent scenario as it simply assumes gas-fired power stations are interrupted at the same point but at an effective market price of zero.

## Appendix 4 – Incentives for commercial interruption

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1.19. Chapter 6 set out the potential risk that our proposed reforms could harm the commercial market for interruptible contracts. This appendix gives some illustrative examples of how both with and without a DSR mechanism in place there are still clear circumstances where it would be mutually beneficial for both consumers and shippers to agree to commercially interrupt.

1.20. The diagrams<sup>20</sup> below show situations where a shipper would be incentivised to pay a consumer to commercially interrupt. Importantly, when a consumer is interrupted by NGG either during firm-load shedding or as part of the DSR mechanism the cost to NGG of taking the action is twofold. Firstly, the consumer will be paid for agreeing to cease consuming. Secondly, the shipper will be paid 30-day SAP for procuring the gas the consumer would have consumed (this gas is passed to NGG).<sup>21</sup> In order to convince the consumer to commercially interrupt (instead of being curtailed by NGG) the shipper must be willing to pay the consumer more than the payment that the consumer expects to receive from NGG.

### **With a DSR mechanism**

1.21. The diagram below shows how the shipper could still be incentivised to pay a consumer to self-interrupt even if the consumer has participated successfully in the DSR mechanism. The 30-day SAP the shipper receives from NGG is significantly below the market price of gas. Assuming the shipper's gas is procured or produced at lower cost, the shipper would want to sell its gas in the market as it could make significant profits. Moreover, in this example the profits it would receive from doing this are sufficiently large for the shipper to be able to pay the consumer more than the consumer would receive if it was exercised by NGG.

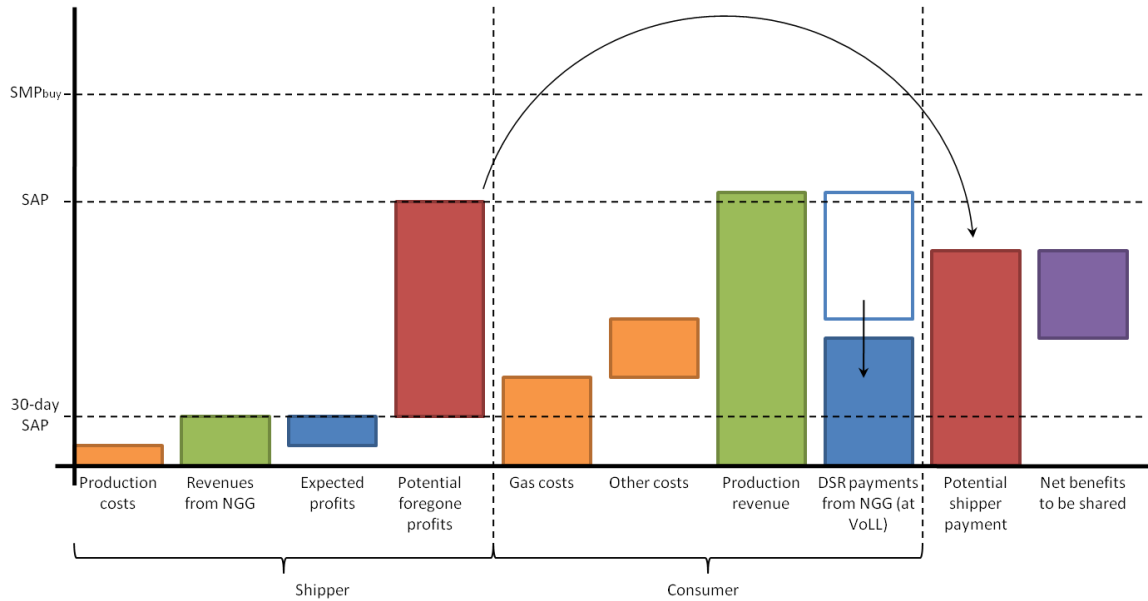
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<sup>20</sup> For simplicity assume the shipper has one consumer. All rectangles are of equal width indicating they all represent the same equivalent gas volume multiplied by some price. **Orange** = Costs. **Green** = Revenues. **Blue** = Normal profits. **Red** = Potential profits/payoffs. **Purple** = net benefits of commercial interruption. Lastly, it is assumed that the consumer:

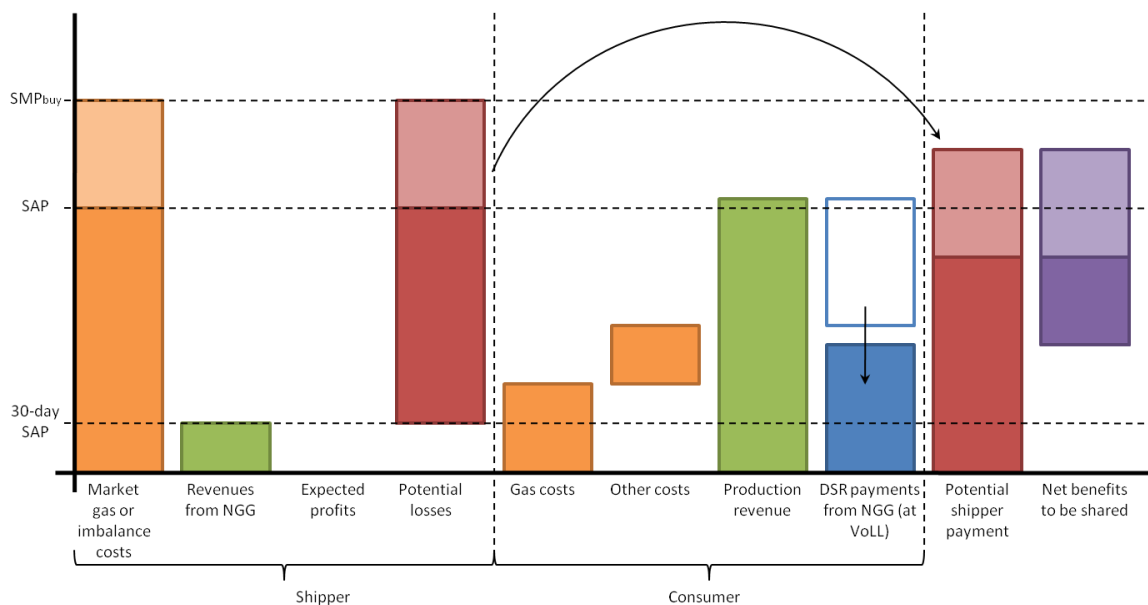
- a) Incurs their opportunity cost of not producing when interrupted.
- b) Does not incur any other costs such as start-up/shut-down costs when interrupted.
- c) Interrupts their entire load (importantly though, these diagrams could equally be thought of referring to a tranche of a consumer's load, rather than their entire load).
- d) Has a fixed gas price contract (interestingly, if their gas costs did increase as spot prices increased they would likely be even more willing to self-interrupt as their profits from continuing to produce would be reduced relative to their "normal" profits).
- e) Bids are at VoLL in a DSR mechanism (note that VoLL equals their "normal" profits).

<sup>21</sup> This effectively mirrors the ECQ arrangements. It has yet to be decided whether the shipper will be able to determine their own cost of gas in the case of a DSR mechanism. If they are able to, the cost of gas may be greater or smaller than the 30-day SAP that is assumed here.

## Gas Significant Code Review Impact Assessment for Final Policy Decision



1.22. Similarly, the next diagram shows another situation where it would be mutually beneficial for the shipper and consumer to agree to self-interrupt. As before, the 30-day SAP the shipper receives from NGG is significantly below the market price of gas. Assuming the shipper has to procure its gas at high cost (eg on the market) the shipper would want to avoid doing this and incurring significant losses. In this example the costs the shipper would avoid if it did not have to procure the consumer's gas are sufficiently large for the shipper to be able to pay the consumer more than the consumer would receive if it was exercised by NGG. The diagram shows two scenarios: where the shipper procures its gas on the spot market at SAP (darker shading) and the even worse situation where it has to leave the gas as an end-of-day imbalance paid at  $SMP_{buy}$  (additional lighter shading). Both result in potential net benefits for both parties.

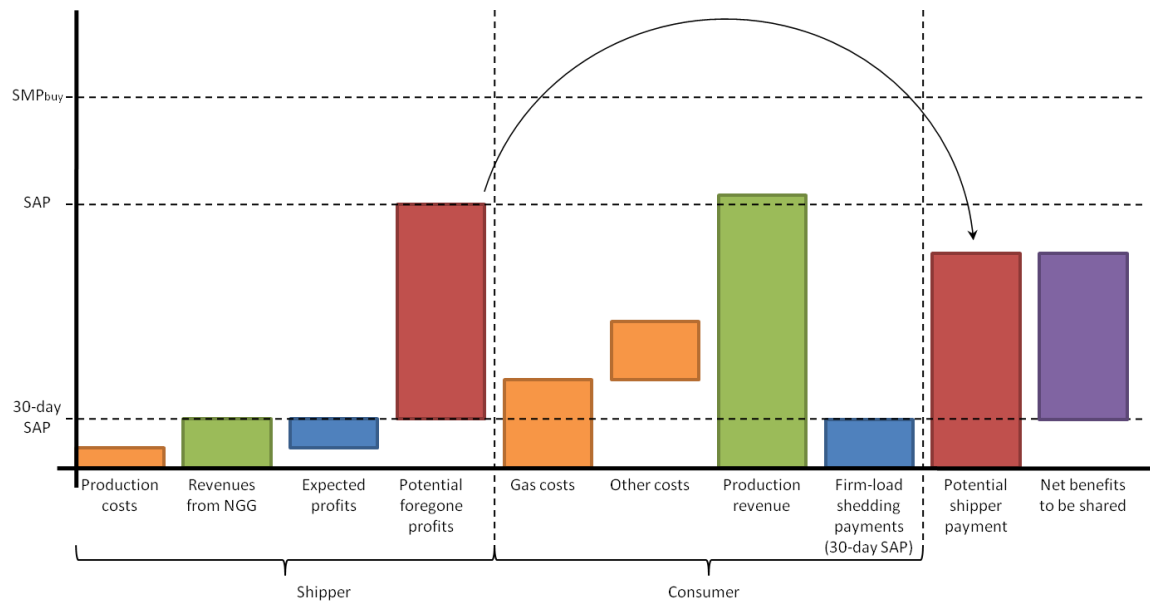


1.23. Lastly, our preferred DSR mechanism design does not contain an option fee. It was already noted in Chapter 6 that a shipper could incentivise a consumer to provide DSR commercially by offering an option fee. This option fee would be attractive to a consumer because a GDE is an unlikely event and consumers are likely to value certain upfront payments over uncertain future ones.

**Without a DSR mechanism**

1.24. In the absence of a DSR mechanism, DM consumers that are firm-load shed will be paid 30-day SAP in recognition of the fact that the involuntary DSR they have provided is still a balancing action. So, even without a DSR mechanism there is a risk that our proposed reforms will reduce the willingness of consumers to agree to commercial interruption. The examples below show how shippers can still be incentivised to beat the payments a consumer can expect during firm-load shedding, and thus incentivise them to self-interrupt prior to being firm-load shed by NGG.

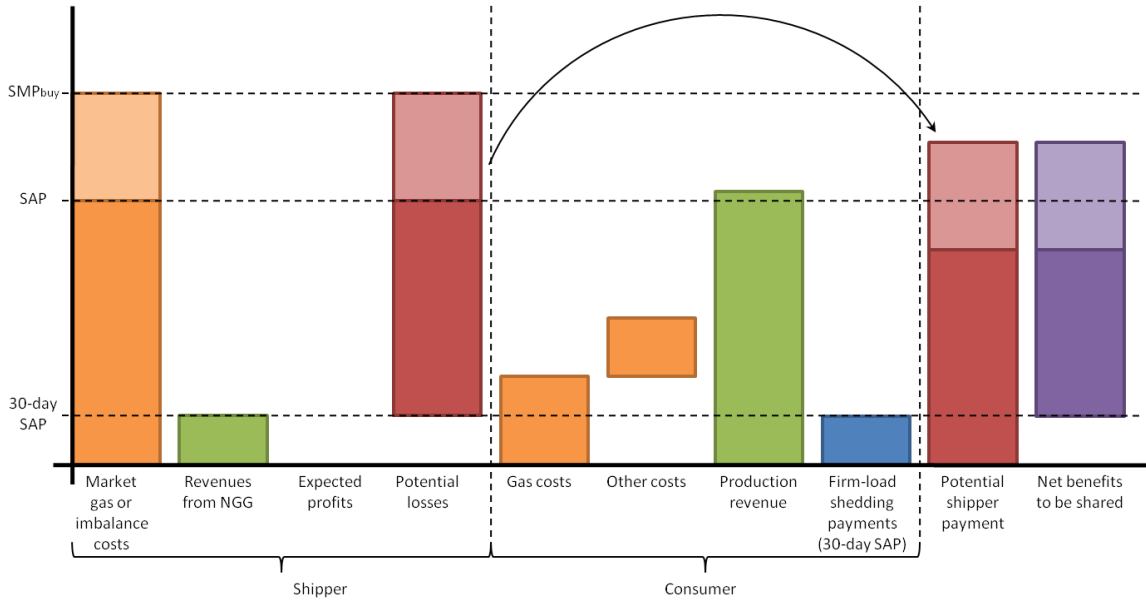
1.25. Once again, the diagram below shows how a shipper that produces/procures its gas at low cost can incentivise its consumer to self-interrupt using the profits the shipper can make by selling its gas in the market (at SAP).<sup>22</sup> Here the payments due to the consumer that the shipper must beat are a firm-load shedding payment of 30-day SAP. If the shipper agrees to pay the consumer more than 30-day SAP before the consumer is firm-load shed, both parties will stand to benefit.



<sup>22</sup> It should be noted that if the consumer was paid SAP instead of 30-day SAP for being curtailed during firm-load shedding, the shipper would not be able to offer a sufficiently large potential payment for it to convince the consumer to self-interrupt. This is the rationale for paying consumers 30-day SAP in the absence of a DSR mechanism, rather than SAP.



1.26. Similarly, the diagram below shows how a shipper that has to procure its gas at high cost would also be incentivised to pay the consumer enough to make self-interruption worthwhile. This is because the shipper would want to avoid incurring high losses when procuring the consumer's gas. The diagram shows two high cost scenarios: where the shipper procures its gas on the spot market at SAP (darker shading) and the even worse situation where it has to leave the gas as an end-of-day imbalance paid at  $SMP_{buy}$  (additional lighter shading). In both instances, both parties stand to gain significantly by agreeing to a bilateral self-interruption arrangement before the consumer is firm-load shed.



## Appendix 5 – Pay-as-clear vs. Pay-as-bid

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1.1. Pay-as-bid means paying bids at the price submitted in the bid. Pay-as-clear means paying bids a clearing price set by the highest exercised bid.

1.2. It was mentioned in Chapter 6 that a DSR mechanism could be either pay-as-bid or pay-as-clear. For modelling purposes it was assumed that all DSR mechanisms were pay-as-bid. However, there are potential reasons for opting for choosing pay-as-clear over pay-as-bid that were not captured in the modelling. The pros and cons of choosing pay-as-clear instead of pay-as-bid are therefore discussed below.

### **Advantages**

1.3. The modelling conducted by Pöyry assumed that all consumers bid at true cost. As was noted in Chapter 6 there are numerous reasons why this may not be the case in reality (eg strategic bidding, sleeper bids, increasing bids when an emergency appears imminent).

1.4. Economic theory has demonstrated that pay-as-clear ensures bidders' optimal strategy is to bid at their own true cost. This should therefore discourage any bidding above true costs. Chapter 6 set out why ensuring bids are efficient (ie that they reflect true costs) is essential to the success of any DSR mechanism.

1.5. There may also be additional benefits from pay-as-clear in terms of participation. Pay-as-clear generally increases the payouts that a successful consumer can expect from a DSR mechanism. As such they should be more inclined to participate.

### **Disadvantages**

1.6. Firstly, that consumers may seek to bid inefficiently is by no means certain. Providing DSR is not a core element of any consumer's business and so consumers are unlikely to place much emphasis on maximising their 'returns' from a DSR mechanism. Instead their bidding is far more likely to be based on the fundamentals of their business, their attitude to risk and so on. This is further confirmed by the fact that any DSR mechanism has a low probability of utilisation. As such the chance of actually realising the benefits of bidding away from true cost are slim, whilst the risks of failing to be accepted in the DSR mechanism are potentially huge.

1.7. Secondly, there is a risk in implementing a pay-as-clear DSR mechanism that this would severely inhibit any scope for commercial interruption to arise. This is

because it would make it almost impossible for a shipper to 'beat' the payments a consumer can receive from the DSR mechanism.<sup>23</sup>

1.8. Finally, any move to pay-as-clear necessarily comes at a cost. This is the cost of many consumers being paid at a level above their true cost. The results of the modelling suggest there is a wide range of potential consumer VoLLs and so paying all exercised consumers a clearing price could entail significant costs, with some consumers being paid more than ten times their true cost of interruption.<sup>24</sup> The level of consumer payments also has knock-on implications for the risk of there being a shortfall between the monies collected from short shippers and the monies due out to all long shippers and consumers. This is discussed in more detail in the decision document published alongside this IA.

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<sup>23</sup> This assumes that any DSR in a DSR mechanism would likely constitute the most expensive actions available to NGG and would therefore effectively always set the short cash-out price. If this is the case a shipper would have to be willing to pay more than the short cash-out price to induce a consumer to provide commercial DSR.

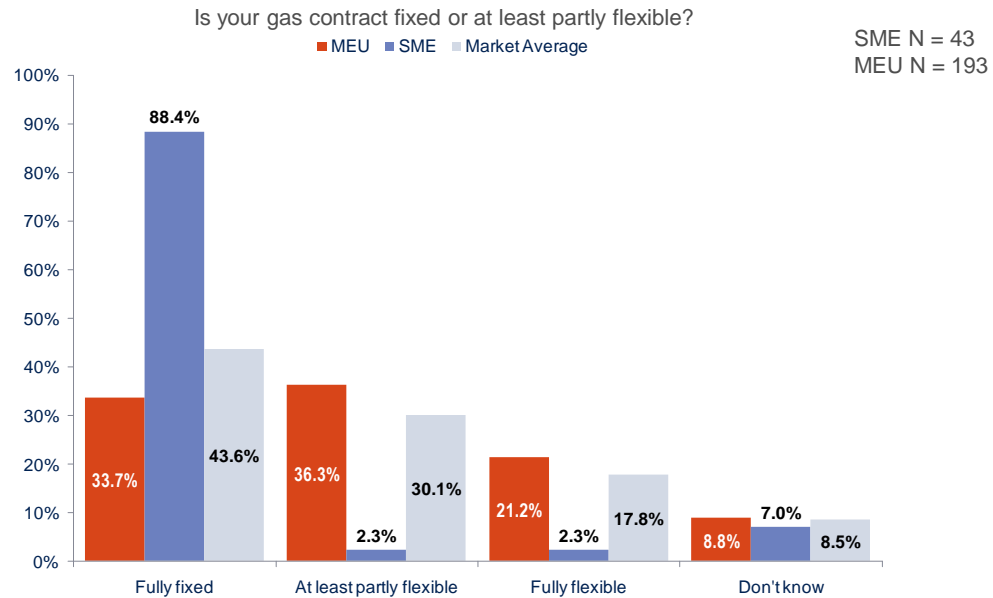
<sup>24</sup> For example, the opportunity cost (ie VoLL) of the Fertilisers sector was estimated at £3.22/therm. The same value for Iron & Steel was estimated at £39.03/therm.



## Appendix 6 – High DSR sensitivity

1.1. One of the key factors influencing an I&C consumer’s decision to provide DSR is the extent of consumer exposure to spot prices. Figure 6 shows the responses to the question ‘Is your gas contract fixed, or at least partially flexible?’ This question was asked in a 2012 Datamonitor survey of energy users.

**Figure 6: Flexible vs. fixed gas contracts for major energy users<sup>25</sup>**



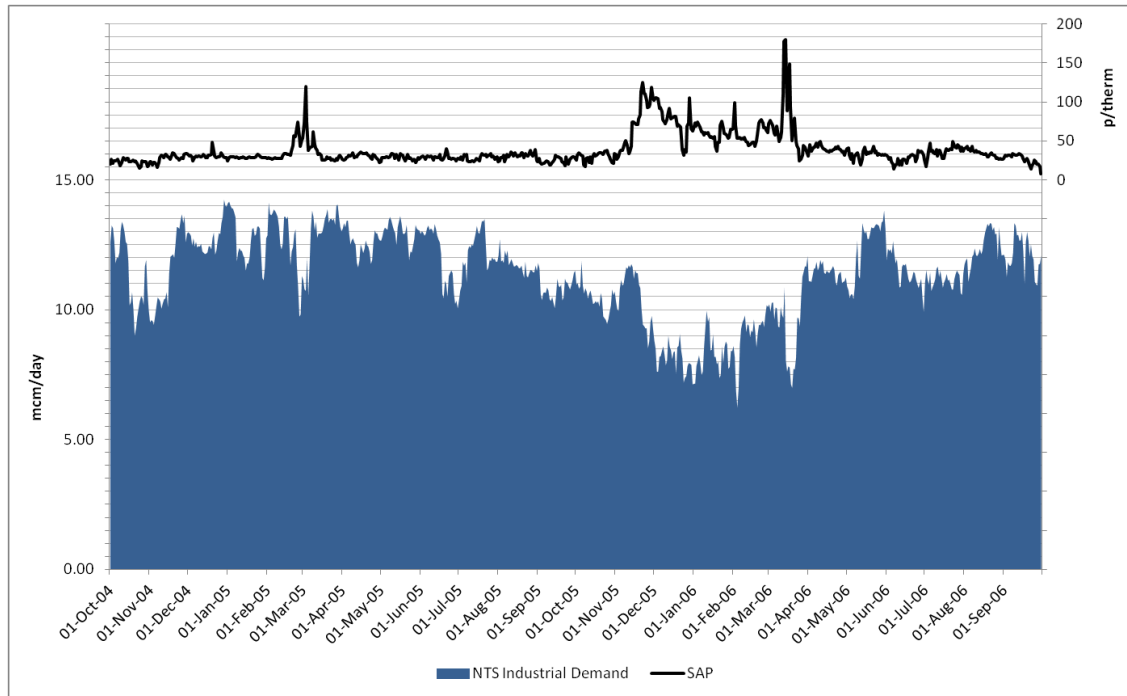
1.2. As can be seen from the chart, the majority of Major Energy Users (MEUs) surveyed were on flexible or partially flexible contracts. The chart also shows that larger users are more likely to be on flexible contracts than smaller users.<sup>26</sup> As such, this evidence would suggest a significant proportion of DM consumers are in fact exposed to spot prices in some way and so if prices were to rise in advance of a potential GDE they would be strongly incentivised to provide DSR.

1.3. As for historical evidence of I&C DSR, we have never had an emergency before and so there is limited data on which to base a view of the likely levels of DSR. However, two winters during which significant DSR provision was observed in the past were 2004/5 and 2005/6.

<sup>25</sup> Source: Datamonitor Energy Buyer Survey 2012

<sup>26</sup> The definition of a ‘Major Energy User’ (MEU) in the survey is a consumer that spends more than £50,000/annum on gas. For pretty much all DM consumers this is a relatively small sum to spend on gas and so it seems reasonable to assume that for DM consumers, the figures in the chart provide a conservative estimate of the proportion of them that would be on some form of flexible contract.

Figure 7: Industrial DSR during 2004/05 and 2005/6<sup>27</sup>



1.4. Clearly the above figure shows industrial demand declining at times of high prices.<sup>28</sup> The extent to which similar levels of DSR (let alone greater levels) would be observed today is unclear.

1.5. On the one hand, these declines occurred when there were prices of up to £1.80/therm, which is clearly well below the £14/therm NDM VoLL we are proposing and even further below the price that a gas-fired power station may price their DSR at in the event of a gas and electricity stress event coinciding. As such, DSR in a GDE situation could well exceed that witnessed in the past.

1.6. On the other hand, past data is not necessarily a decent indicator of the market today and could overstate the appetite for providing DSR. This is in part because industrial demand has fallen since 2006. This is also exacerbated by the fact that a far greater proportion of I&C consumers are now considered firm compared to 2006 following the changes to the transportation regime under Mod 90.

1.7. Still, what past data does show is that there is likely to be some I&C DSR under current arrangements and it is entirely plausible to think it will be greater than just 1.2% of total I&C DM volumes.

<sup>27</sup> Source: National Grid

<sup>28</sup> Importantly, Figure 7 only shows NTS Industrials demand, and NGG estimated significant DSR also came from DM consumers in the Local Distribution Networks (LDZs).

1.8. Bearing this additional information in mind, we have conducted a sensitivity that looks at the impact of our proposed reform in a world where commercial DSR is significantly more forthcoming than is suggested by our base case assumption. In line with the data on contract flexibility the sensitivity assumes that 22.5% of total I&C DM volumes (8.0mcm/day) are available to provide commercial DSR under current arrangements. Again, we consider this still to be a conservative assumption given the uncertainty on this subject and we can fully envisage a situation where significantly more commercial DSR than this is available under current arrangements.<sup>29</sup>

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<sup>29</sup> This is because DM consumers are more likely than those surveyed to be on flexible contracts (ie the percentage for DM consumers with 'fully flexible' contracts would likely be significantly greater than 21.2%). Also, we have assumed no price responsiveness for those on 'partially flexible' contracts which represented a further 36.3% of the consumers surveyed.

## Appendix 7 - Glossary

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### A

#### 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 residual balancing of the gas system. 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 (unfrozen)

Unfrozen cash-out means that the level of the cash-out continues to change in response to circumstances upon declaration of stage 2 of an emergency.

#### 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.

### D

#### Daily-metered (DM) consumer

This is a gas consumer 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.

### E

#### Emergency curtailment arrangements

The emergency curtailment arrangements provide for payments to be made to shippers in the event that transporters instruct, under the direction of the Network Emergency Coordinator, 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.

### Emergency Curtailment Trade Price

This is the price at which a shipper's emergency curtailment quantity is paid. This is determined as the 30 day average System Average Price.

## F

### Firm consumer

This is a consumer with a non-interruptible gas supply contract. These consumers cannot be instructed to reduce their demand or have their demand curtailed except for following the announcement of stage 2 or greater of an emergency.

### Firm load shedding

Upon declaration of stage 2 of an emergency, the Network Emergency Coordinator may instruct transporters of gas to instruct consumers stop using gas. This is known as firm load shedding. Firm load shedding starts with the largest consumers – who are typically large industrial users or power generators.

### Force majeure

Force majeure 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).

## 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 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.

### Gas Deficit Warning (GDW)

A Gas Deficit Warning is a warning given at the discretion of National Grid if there is a material risk to the physical end of day balance. The warning is intended to prompt shippers to balance their positions and will also entail National Grid making an assessment of all actions available to it to balance the system.

## 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 Health and Safety Executive.

## Gas Supply Emergency

A Gas Supply Emergency is defined in the Uniform Network Code 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 (Gas)

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 have the ability to ask a consumer to reduce its off-takes (generally daily metered consumers). 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.

### 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 National Grid Gas).

### Liquefied Natural Gas (LNG)

Liquefied Natural Gas is natural gas (predominantly methane, CH<sub>4</sub>) that has been converted temporarily to liquid form for ease of storage or transport.

### Liquidity

Liquidity is a measure of the number of times a given commodity is traded. A low liquidity can mean 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 National Grid Gas 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 prices at which these trades are made set cash-out prices.

### Modification (Code)

The Uniform Network Code (UNC) 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.

## **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 (NTS)

This is National Grid Gas' 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 consumer (NDM)

This is a gas consumer who does not have a meter which can be read on a daily basis. This includes small consumers, including domestic consumers.

### 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 recompense 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 being long.

### Project Discovery

Project Discovery is Ofgem's investigation published in 2010 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 National Grid Gas to consumers in the event of a Gas Supply Emergency to reduce gas use.

## 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 Health and Safety Executive. These safety cases must demonstrate the method by which



the holder will ensure the safe operation of its network. In the case of the Network Emergency Coordinator (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-coordinating actions across affected parts of the gas network.

#### Safety and Firm Gas Monitor Methodology (Safety Monitor)

The 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 (SCR)

The SCR is 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 anybody which introduces, conveys and takes out gas from the gas pipeline.

#### Smearred/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 Great Britain gas market.

#### System Average Price

This is the average price of all trades on a given day.

#### 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

This is the entity responsible for operating the Great Britain 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).

### 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 Great Britain. 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 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

DECC	Department of Energy and Climate Change
DM	Daily Metered (gas consumer)
DN	Distribution Networks
DR	Daily Read
DSR	Demand Side Response
EBI	Energy Balancing Invoice
ECQ	Emergency Curtailment Quantity
EMR	Electricity Market Reform
FM	force majeure
GBA	Gas Balancing Alert
GDE	Gas Deficit Emergency
GDW	Gas Deficit Warning
GS(M)R	Gas Safety (Management) Regulations 1996
HSE	Health and Safety Executive
I&C	Industrial and Commercial
IA	Impact Assessment
LDZ	Local Distribution Zone
LNG	Liquefied Natural Gas
MBA	Market Balancing Action
NDM	Non-Daily Metered (gas consumer)
NDR	Non-Daily Read
NEC	Network Emergency Coordinator
NGG	National Grid Gas
NGSE	Network Gas Supply Emergency
NTS	National Transmission System
OCM	On-the-day Commodity Market
OPN	Offtake Profile Notices
PEC	Post Emergency Claims
PSOs	Public Service Obligations
SAP	System Average Price
SCR	Significant Code Review
SO	System Operator
SMP	System Marginal Price
SOQ	Supply-point Offtake Quantity
SWCQ	Storage Withdrawal Curtailment Quantity Arrangements
UDQO	User Daily Quantity Output
UNC	Uniform Network Code
VoLL	Value of Lost Load

## Appendix 8 - Feedback Questionnaire

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1.1. Consultation is at the heart of good policy development. We're keen to consider any comments or complaints about the way we've conducted this consultation. In any case we would be keen to get your answers to these 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?

1.2. Please add any further comments and send your comments to:

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