

The gas trading arrangements
Reform of the gas balancing regime

Next steps

April 2003 21/03

Executive Summary

In this document, we set out Ofgem's views with respect to the development of the Transco's gas balancing arrangements. We explain Ofgem's conclusions that major reform of the gas balancing regime, including the introduction of shorter balancing periods, is not necessary at this point in time.

Ofgem's 2001 and 2002 proposals

In February 2001, Ofgem proposed shortening the balancing period such that shippers' inputs and offtakes would be measured and allocated on an hourly basis. Industry participants were not supportive of Ofgem's proposals. Transco agreed with Ofgem that there were significant shortcomings with the daily balancing regime but did not support the introduction of shorter balancing periods on the basis that it would involve considerable cost and might detract from many of the benefits of the daily balancing regime.

In February 2002, Ofgem published a further review of the gas balancing regime. This suggested balancing periods shorter than one day (for example, four or six hours).

Developments since February 2002

Network Code Review Group 0513

The majority of participants believed that the existing gas balancing regime was operating effectively despite Transco concerns about within-day linepack variation. Transco offered assurance that it was currently able to operate the system safely. The review group concluded that fundamental reform was not necessary at this time.

NGC and Transco's analysis of security of supply for winter 2002/03

Transco confirmed that it could operate the gas system during winter 2002/3 without any further significant changes to the gas balancing regime.

Brattle's assessment of the operation of the NTS

Ofgem asked the Brattle Group to evaluate the severity of the operational difficulties that Transco could face under the current daily balancing arrangements. In carrying out their assessment, Brattle worked closely with Transco. Brattle's analysis suggests that the current patterns of within-day gas flow profiling on the NTS do not pose an unacceptable threat to system security.

However, in the light of the potential for future increases in the risk of supply interruptions, Brattle has proposed a set of "leading indicators" that would give some advance warning of such an increased risk.

International gas balancing arrangements

Ofgem commissioned Brattle to review gas balancing arrangements around the world. The report concluded that gas balancing regimes around the world are moving away from, or do not exhibit, sub-daily arrangements.

Information issues

Incentivised nomination scheme (INS)

Ofgem approved this modification for implementation on 1 October 2002. Shippers have raised concerns that INS is not better informing Transco's energy balancing actions or improving energy balancing performance.

Offtake profile information

In September 2002, Transco and shippers decided to implement a monitoring scheme on the discrepancies between nominated and actual offtakes.

Information disclosure

In recent years, market participants have raised concerns about limited and asymmetrical access to gas system operation information and offshore information. Ofgem shares many of these concerns. Over the past year, there have been a number of developments with respect to the information disclosure that have implications for the gas balancing regime. The Department of Trade and Industry is also considering the

release of offshore information arising from its November 2001 consultation on gas prices.

Costs of reforms to the gas balancing regime

A consortium of gas shippers commissioned ILEX to undertake an assessment of the costs of implementing Ofgem's February 2001 proposed reforms. ILEX concluded that the costs of introducing balancing periods of one hour would be between £1 billion and £3.5 billion.

Ofgem's views

Network Code Review Group 0513

Ofgem considers that the 0513 review group process made an important contribution to the review of the balancing regime. We note that Transco considers it important that market participants continue to develop proposals that could improve the daily balancing regime and which could address the within-day problems that Transco continues to experience.

Ofgem has a number of comments to make on the incremental reforms which were contained in the final recommendations provided by the group:

- ◆ Within-day scheduling incentive scheme:
 - Ofgem is not opposed to the further development of this proposal.
- ◆ Transco information release:
 - Ofgem is generally supportive of proposals that are intended to increase the level of information released to industry participants regarding Transco's operation of the gas system.
- ◆ Gas flexibility contracts
 - Ofgem is of the view that the development of flexibility contracts is worthy of further consideration and development.

NGC and Transco's analysis of security of supply for winter 2002/03

Ofgem is satisfied with Transco and NGC's confirmation that they are confident in their ability to operate their transmission systems consistent with their statutory duties. We also note that Transco did not consider that further action was required to alter the gas balancing regime before the winter 2002/3.

Brattle's assessment of the operation of the NTS

Ofgem considers that the conclusions of the Brattle Group indicate that the risks to security of supply highlighted in previous proposals documents are not as great as previously expected. Ofgem recognises that indicators could be helpful to provide an advance warning of any increased risks to security of supply on the gas transmission system.

International gas balancing arrangements

Ofgem considers that the trend for other countries to move away from hourly balancing requirements suggests that Great Britain should at present be cautious in pursuing the introduction of a regime that requires shippers to balance within-day. This is particularly relevant given the importance to GB of effective gas liberalisation in Europe.

Information issues

Incentivised nomination scheme (INS)

Ofgem believes that there is little evidence to suggest that INS is providing additional information to Transco that could assist it in taking more efficient balancing actions. On this basis, Ofgem considers that the continuing operation of the INS scheme should be reviewed by Transco through the workstream process. The review should consider whether to extend, remove or amend the scheme.

Information disclosure

Ofgem believes that there is scope for the release of offshore information to both Transco and market participants, including shippers, to improve the ability of the market to react and adjust to address supply shortfalls. Ofgem will continue working with the

DTI to facilitate offshore information disclosure as a means of facilitating competition, operational efficiency and security of supply.

Costs of reforms to the gas balancing regime

We acknowledge the analysis that has been undertaken by ILEX. Ofgem has reviewed this analysis and considers that in some instances ILEX has over estimated the costs of implementing shorter balancing periods (e.g. with respect to the calculation of IT and infrastructure (linepack) costs). In other areas, we consider the methodology used by ILEX to be flawed. However, on the basis of the conclusion that there is no immediate need to move to shorter balancing periods, it is not necessary to form a final view on the costs of reforms of this nature.

Conclusions

Ofgem has concluded that fundamental reform of the gas balancing regime is not, at this time, necessary. This is based on a number of factors, namely:

- ◆ the conclusions of the work undertaken by the Brattle group;
- ◆ Transco's view that it can balance the system without the introduction of shorter balancing periods; and
- ◆ developments in the gas and electricity markets since the release of Ofgem's February 2001 and February 2002 documents.

Ofgem continues to believe that there could be significant benefits to customers associated with the introduction of shorter balancing periods. These include enhanced competition between shippers, greater operational efficiency and security of supply. However, as we have explained, our analysis shows that there is no longer any immediate threat to security of supply associated with the present daily balancing regime. As such, Ofgem considers that the justification for moving to shorter balancing periods is not as strong as previously stated. On this basis, we do not believe that it is necessary to proceed with any fundamental reform of the balancing regime at this time.

Ofgem considers that the problems experienced by Transco with respect to linepack depletion within-day should continue to be monitored on an ongoing basis. In the event

that the risks associated with within-day linepack depletion increase, the introduction of more fundamental reforms to the gas balancing regime may need to be considered.

With this in mind, Ofgem proposes to develop a set of indicators to give advance warning of the potential for Transco to face increased difficulties in balancing the system. We propose to undertake a periodic six monthly review of the gas balancing arrangements against these indicators.

Ofgem considers that although fundamental reforms of the gas balancing arrangements are not warranted at this stage, it would seem important that the industry considers incremental reforms of the regime that may address some of the problems identified by Transco.

Further, Ofgem will continue to argue for the release of offshore information and increased offshore transparency. In particular, Ofgem considers that the release of offshore information relating to outages to Transco should address some of its concerns about the difficulties it faces in determining when flow rate changes will occur within-day.

Although a move to shorter balancing periods is not required at this time, Ofgem is still of the opinion that Transco should consider offering end-of-day linepack services to shippers as a management tool to help them balance their gas inputs and offtakes over the day.

Before finalising our views on indicators, we would welcome views on our proposals, together with any other comments you may have on this report. These views are requested by 27 May 2003.

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1 Introduction

Purpose of this document

- 1.1. The purpose of this document is to set out Ofgem's views and proposed way forward with respect to the development of the gas balancing arrangements on Transco's National Transmission System (NTS).
- 1.2. The document outlines Ofgem's conclusions that major reform of the gas balancing regime including the introduction of shorter balancing periods is not necessary at this point in time. The document outlines the basis on which Ofgem has formed this view and draws on a number of developments that have occurred since the release of Ofgem's February 2002 gas balancing proposals¹. These developments include the Brattle Group's analysis of the materiality of Transco's concerns on the operation of the gas balancing regime, Transco's present view of the risks associated with the regime as well as a number of other developments relating to matters such as Transco's incentivised nomination scheme and information disclosure.
- 1.3. Ofgem has also drawn upon the conclusions reached by Transco's network code review group 0513 "Reform of the Energy Balancing Regime".
- 1.4. The document also sets out a review of international gas balancing arrangements undertaken by Brattle. This review was intended to assist Ofgem in developing its views on the gas balancing regime in Great Britain.
- 1.5. The document seeks views about the proposed introduction of a number of indicators to monitor the performance of the gas balancing arrangements to review whether major reform is necessary on an ongoing basis.

¹ 'The New Gas Trading Arrangements: Reform of the gas balancing regime, Revised proposals', Ofgem, February 2002.

Outline of the document

- 1.6. Chapter 2 summarises Ofgem's proposals of reform to the gas balancing arrangements as outlined in its February 2001² and February 2002 documents. Chapter 3 sets out the recent developments relating to the gas balancing arrangements, including the work of network code review group 0513 and the conclusions of Brattle's analysis of current system operations. Chapter 4 presents Ofgem's views on the developments surrounding the gas balancing regime. Chapter 5 outlines a way forward and explains how the operation of the gas balancing regime should continue to be monitored in the future to assess whether any major reform such as the introduction of shorter balancing periods would be necessary.
- 1.7. Appendix 1 summarises the existing gas balancing arrangements. Appendix 2 reports Brattle's assessment of the materiality of Transco's concerns about the uncertainty and magnitude of within-day linepack swings. Appendix 3 sets out Transco's response to the Brattle analysis. Appendix 4 presents a survey of gas balancing regimes around the world, which was produced by Brattle. Appendix 5 sets out a brief analysis of the performance of the Incentivised Nomination Scheme (INS) to date.

Views invited

- 1.8. Ofgem would welcome views on the proposed introduction of performance indicators for the purposes of monitoring the regime on an ongoing basis. Ofgem also welcomes views on any of the issues raised in this document upon which respondents wish to comment.

² 'The New Gas Trading Arrangements. Further reform of the gas balancing regime. A consultation document', Ofgem, February 2001.

- 1.9. Responses to this document are requested by 27 May 2003. Responses should be addressed to:

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- 1.10. Electronic responses may be sent to kyran.hanks@ofgem.gov.uk

- 1.11. Respondents are free to mark their reply as confidential, although we would prefer, as far as possible, open responses that can be placed in the Ofgem library. If you wish to discuss any aspect of this paper, Mark Feather (telephone 0207 901 7437), Samanta Padalino (telephone 020 7901 7033) and Ayesha Uvais (telephone 020 7901 7307) will be pleased to help.

2. Ofgem's February 2001 and 2002 proposals

- 2.1. In this chapter, we summarise the main elements of the current gas balancing regime. We also outline Ofgem's February 2001 and February 2002 proposals for the reform of the gas balancing regime.

The current gas balancing arrangements

- 2.2. The current gas balancing arrangements consist of:
- ◆ regulatory, contractual and commercial obligations and incentives on shippers to provide Transco with accurate nomination information ahead of, and on, the gas day about their intended inputs and offtakes to the network;
 - ◆ commercial incentives, set out in Transco's network code, on shippers to balance their inputs and offtakes each day;
 - ◆ an anonymous, 24 hour, screen-based within-day gas market, the On-the-day Commodity Market (OCM), that allows shippers to trade out imbalances on the day with each other and allows Transco to undertake residual balancing of the system;
 - ◆ contractual obligations on shippers, under the network code, to use reasonable endeavours to flow gas onto the system consistent with a uniform flow rate obligation;
 - ◆ scheduling charges on shippers for differences between their final nominations and actual flows at input and offtake;
 - ◆ administered tools available to Transco, known as terminal flow advices (TFAs), to request a delivery facility operator (DFO) to reduce flows onto the network for a specified period of time;
 - ◆ contractual obligations on some large offtake points (such as power stations) set out in Network Exit Agreements (NexAs) that limit the extent

to which shippers increase or decrease offtakes within specified time periods, to reflect the physical limitations of the gas system; and

- ◆ commercial incentives on Transco to undertake its role as residual gas balancer in an efficient manner.

- 2.3. The introduction of the OCM and commercial incentives on Transco to reduce the costs of gas balancing was part of the introduction of the New Gas Trading Arrangements (NGTA) in October 1999. The NGTA reforms also improved incentives on shippers to balance their own positions through a phased reduction in imbalance tolerances. All such tolerances have now been removed.
- 2.4. Transco's residual gas balancing incentive is set out in its Gas Transporter's (GT) licence and comprises a price and a linepack component. Under the incentive, Transco is encouraged to take balancing actions at prices close to the System Average Price (SAP) (price component) on the OCM and to maintain a stable level of linepack day on day (linepack component). Caps and collars limit Transco's daily and annual revenue and payments under its incentive.
- 2.5. Transco's incentives are due to be reviewed as part of its System Operator (SO) incentives review. This will start following the publication of this document and will result in revised incentives with effect from April 2004.
- 2.6. A more detailed summary of the present gas balancing arrangements is set out in Appendix 1.

Ofgem's February 2001 proposals

Reasons for reform

- 2.7. Ofgem set out initial proposals of reforms to the gas balancing regime in its February 2001 consultation document. The proposed reforms were designed to address a number of problems identified with the current balancing arrangements.

- 2.8. Specifically, Ofgem was concerned that the profiling of gas flows by shippers at beach entry points and by gas fired power stations (also referred to as combined cycle gas turbines or CCGTs) at exit points, was causing Transco to undertake inefficient balancing actions and to experience within-day operational problems. Ofgem believed that the difficulties faced by Transco could threaten security of supply. Ofgem reported that if the current regime continued Transco would need to take a higher level of balancing actions within-day potentially increasing volatility in prices which could ultimately impact on the forward curve and prices paid by customers.
- 2.9. Ofgem stated that a lack of accurate targeting of the costs of shipper profiling was a major factor underlying profiling behaviour. Ofgem also stated that Transco's difficulties were further compounded by the poor quality of information it received about shippers' intended gas flows.
- 2.10. In particular, Transco indicated that the quality of information it received from shippers and producers about their intended gas flows had been deteriorating. Evidence of this deterioration was found in the increased discrepancy between shippers' AT-link nominations, daily flow notifications³ (DFNs) and forecast demand early in the gas day. Ofgem raised concerns that the informational problems experienced by Transco made it difficult to efficiently balance and operate its system.
- 2.11. Ofgem also stated that there was potential for profiling to increase as a result of the incentives on generators with gas fired plant to arbitrage between gas and electricity markets following the implementation of the New Electricity Trading Arrangements (NETA) in March 2001.

³ DFNs are the notifications about the intended daily gas flows that Transco receives from the delivery facility operators.

Ofgem's proposals

- 2.12. In response to these concerns, Ofgem proposed shortening the balancing period such that shippers' inputs and offtakes would be measured and allocated on an hourly basis. Shippers would be required to balance their inputs and offtakes each hour and would be able to purchase storage in Transco's system (known as linepack) in order to allow shippers to use this flexibility to balance. Under the proposals, a shipper's imbalances would be cashed-out at an imbalance price if its linepack inventory was exhausted.
- 2.13. Ofgem considered that a shorter balancing period than one day would better reflect the period over which Transco could manage the system within its operational limits. This proposal was also expected to bring more dynamic pricing within-day and better targeting of Transco's energy balancing costs to those companies that had caused them to be incurred. In addition, shorter balancing periods would make the gas trading arrangements more consistent with the electricity trading arrangements (half hourly balancing) thereby reducing the scope for distortions in the behaviour of participants in both markets.
- 2.14. Industry participants were not supportive of Ofgem's proposals. Several respondents argued that the proposed reforms would lead to substantial additional costs to the industry. Respondents indicated that these costs would potentially include additional metering to measure gas flows, upstream contract renegotiations, new IT systems and the need for additional linepack in Transco's system. Some respondents also stated that there could be different ways to address input profiling and questioned whether offtake profiling was likely to become a significant problem.
- 2.15. Transco agreed with Ofgem that there were significant shortcomings with the daily balancing regime but did not support the introduction of shorter balancing periods. This was on the basis that it would introduce substantial costs and that such a move would prejudice many of the benefits arising from the daily balancing regime that had generated, in its view, the most efficient gas market in Europe. Transco believed that a combination of incremental reform and, in the

meantime, continued reliance on existing daily markets was the most appropriate way forward.

Ofgem's February 2002 proposals

- 2.16. In February 2002, Ofgem published a further review of the gas balancing regime which included revised proposals for reform taking into account the responses received to the initial February 2001 consultation. In releasing its February 2002 document, Ofgem indicated that if the balancing arrangements were not reformed Transco would continue to be unable to balance its system efficiently and, in some circumstances, security of supply may be threatened.

Further review of the gas balancing regime

- 2.17. This review reported that Transco was continuing to experience within-day input profiling problems on the NTS as well as continued concerns regarding the quality of information it received on intended flows. Ofgem reiterated its previous conclusions that these problems made it difficult for Transco to balance its system efficiently and also repeated concerns that increased arbitrage between gas and electricity markets could further worsen the problems for Transco and potentially threaten security of supply.
- 2.18. In developing its revised proposals, Ofgem considered that the problems identified with the operation of the current gas balancing regime could not be addressed effectively within a daily balancing regime and that gas balancing costs were not accurately targeted to those companies that cause them to be incurred.
- 2.19. Ofgem also reported on the results of its investigation into the wholesale market in August and September 2000. This investigation found evidence of profiling. However, Ofgem could not identify which shippers were profiling gas flows, or whether profiling was a legitimate response to shippers closing out positions on the day or an attempt to force Transco to taking balancing actions on the opposite side of the market. Ofgem expressed its concern that the lack of

within-day information about actual shippers' flows meant that some shippers might have been able to exploit their commercial incentives to profile gas flows.

- 2.20. The investigation concluded that the uniform flow rate obligation on shippers in the network code could not be sensibly interpreted or enforced, in the light of within-day trading, within-day changes in demand forecasts and the lack of information on shippers' intended gas flows.

Ofgem's revised proposals

- 2.21. In issuing its revised proposals, Ofgem recognised that a move to shorter balancing periods would not be without costs to Transco and market participants. However, Ofgem also considered that reforms to the regime needed to be developed to address the ongoing problems.
- 2.22. With this background in mind, the new framework for reforms outlined in February 2002 included four main elements:
- ◆ balancing periods shorter than one day (for example, four or six hours) to reflect the timeframe within which Transco's system could be safely managed and market participants can alter their gas flows;
 - ◆ the choice for shippers to consider whether their gas flow allocations should be determined on an 'actual' or 'deemed' basis;
 - ◆ the sale of system linepack to allow shippers to manage their imbalances across a number of balancing periods; and
 - ◆ improved commercial incentives on shippers to provide better information to Transco of intended gas flows.
- 2.23. Ofgem's proposal that the gas balancing period should be set at four to six hours was intended to reflect respondents concerns regarding the costs likely to be imposed by the introduction of hourly balancing.

- 2.24. Similarly the proposal to allow shippers the choice to be cashed-out on the basis of 'actual' or 'deemed' flows was also intended to address the industry's concerns about the costs of implementing the February 2001 proposals.
- 2.25. Under the revised proposals, Ofgem considered that the costs associated with re-negotiating offshore contracts and investing in new metering technology to monitor hourly flows would only be incurred if the individual shipper concerned could justify them. For example, where it was more economic for a shipper to measure actual flows than to bear the costs of deemed flows the shipper could choose to avoid these costs by submitting 'actual' rather than 'deemed' flows for the purposes of the allocation process.
- 2.26. As part of these revised proposals, Ofgem believed that Transco should continue to act as residual gas balancer and that it would do so through the sale and purchase of gas and linepack. Linepack could be unbundled and sold via price auction, with firm linepack rights to be tradeable between shippers. In addition, it was envisioned that financial incentives could be developed for Transco to provide additional linepack in response to prices that indicated a high level of demand for the product.
- 2.27. Ofgem believed that the proposed reforms to the gas balancing regime would:
- ◆ enhance short and long term security of supply on the gas system;
 - ◆ better facilitate competition between shippers by ensuring that energy balancing costs were targeted to those shippers who caused them to be incurred and by removing cross-subsidies; and
 - ◆ lead to more efficient transmission operations by lowering the direct and indirect costs of balancing the system (ie for shippers, Transco and, ultimately, customers).

3. Developments since February 2002

- 3.1. In this chapter, we summarise the major relevant developments since February 2002.

Network Code Review Group 0513

Background

- 3.2. In December 2001, Transco raised network code review proposal 0513 “Reform of Energy Balancing Regime” to establish a review group with the remit to assess the effectiveness of the current gas balancing arrangements and to consider, if appropriate, further reform.
- 3.3. Transco raised review proposal 0513 in the context of its continued concerns regarding the effects of the increased extent and unpredictability of within-day linepack variation. These concerns arose from uncertainties regarding within-day nomination information and the within-day variation of entry and exit flows on the NTS.
- 3.4. Review group 0513 first met in March 2002 and its final report was submitted to the August 2002 Network Code Modification Panel.⁴ The remit of the group included an appraisal of the historical development of the gas balancing regime, an assessment of the performance of the regime against agreed objectives, and the investigation of alternative proposals to enhance the efficiency of the operation of the regime.

⁴ The final review group 0513 report “Reform of energy balancing regime” is available at <http://www.rgta.co.uk/mod513main.htm>.

Review group's views

Conclusions on the existing regime

- 3.5. The majority of participants believed that the existing gas balancing regime was operating effectively and that fundamental reform was not necessary at this time, particularly given the assurances expressed by Transco, as part of the 0513 process, that it could operate its system safely.
- 3.6. The review group noted the concerns raised by Ofgem about both the direct and indirect costs of the existing arrangements, including the potential for the current regime to induce higher wholesale gas market prices, which might feed into spot, forward and storage prices. However, the review group agreed that whilst there were inefficiencies in the current arrangements, these were relatively minor and that balancing costs, such as neutrality, were low.
- 3.7. The review group also considered that if reform was necessary it should preserve the benefits of daily balancing and allocation. As a result, most participants indicated that fundamental reform should only be explored in the event that incremental reform within the framework of a daily balancing regime was found to be ineffective. In this context, a number of participants thought that it would be more appropriate, before proposing further changes to the current arrangements, to assess whether the INS⁵ arrangements were able to resolve Transco's operational concerns.
- 3.8. Nevertheless, the group recognised that if within-day linepack variation were to increase, the effectiveness of Transco's actions could be compromised.
- 3.9. Transco noted that the regime would benefit from reforms aimed at improving the quality of information provided to it, better aligning nominated and actual gas flows within-day and providing more effective balancing tools to deliver within-day flow rate changes.

⁵ The INS arrangements were introduced on 1 October 2002 and intended to improve the quality of the information received by Transco from shippers. The arrangements are described in more detail in chapter 3. Reform of the gas balancing regime: next steps 20
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Alternative proposals for reform

3.10. The review group outlined a number of other proposals for development and discussion including:

- ◆ the development of a within-day scheduling incentive scheme;
- ◆ the modification of residual gas balancing incentive arrangements;
- ◆ the release of additional information after the gas day to improve the transparency of its actions; and
- ◆ potential establishment of gas flexibility contracts as an additional balancing tool.

3.11. Of these proposals the review group considered that, whilst they may assist regime operation, only a within-day scheduling incentive scheme could potentially address Transco's identified weaknesses.

3.12. The review group also considered that it would be prudent to set up a sub-group to discuss fundamental reforms to the gas balancing regime in the event that incremental reforms were unable to deliver the appropriate regime changes.

Within-day scheduling incentive scheme

3.13. A proposal to further develop the existing scheduling regime was raised to incentivise shippers to provide timely notifications of intended gas flows. It was also intended to encourage shippers to input and offtake gas in line with their nominations, thus facilitating the efficient balancing of the NTS by Transco.

3.14. It was proposed that at several times during the day a snap shot of current physical input and offtake nominations should be compared to the corresponding actual daily allocations. The incentive scheme would rank shippers on the basis of how close their within-day nominations of gas flows at the specified times in the day were to the actual end of day allocations. Those shippers who were closer to the target would receive a payment, whilst those further away from the target would pay a penalty.

- 3.15. Some participants believed that further consideration of the proposal was necessary as its implementation would be likely to shift shippers' commercial incentives to trade out imbalances from the within-day market to the day ahead market. Under this scheme, shippers would be encouraged to trade in the day ahead market in order to optimise steady flows throughout the day, whilst within-day trading would tend to be linked to physical demand changes, as re-nominating within-day would count against a shipper's scheduling performance.
- 3.16. The review group concluded that the within-day scheduling incentive scheme was the only proposal likely to address Transco's concerns about linepack variation and the effectiveness of its residual balancing tools. It was therefore agreed that the proposal would be further developed with a view to raising a network code modification proposal.

Transco's balancing action policy

- 3.17. The review group proposed that Transco provide additional information after the gas day to improve the transparency of its residual balancing actions.
- 3.18. It was also proposed that gas flexibility contracts could allow Transco to strike bilateral agreements at entry and exit points to turn up or turn down gas flows within-day as means of addressing some within-day linepack depletion concerns. The review group recommended that these proposals should be discussed further whilst noting that there may be limited scope for such contracts given the problems associated with monitoring the gas flows of individual shippers at co-mingled gas streams.

Transco's residual gas balancing incentive arrangements

- 3.19. The review group also considered whether Transco's price and linepack balancing incentives were providing appropriate signals to Transco. In particular, participants were concerned that the price incentive was encouraging Transco to delay taking a balancing action until it had more certainty about the end of day SAP, thereby causing significant within-day linepack swings.

- 3.20. Some participants to the review group also stated that, by incentivising Transco to minimise the difference between opening and closing linepack, the linepack component of the incentive did not recognise the potential changes to linepack requirements for the following day. They claimed that if the linepack target could not be met on a given day a large surplus (deficit) could follow, encouraging Transco to perpetuate such surplus (deficit).
- 3.21. The group recommended that Transco's incentives should be further discussed as part of the SO incentives review.

NGC and Transco's analysis of security of supply for winter 2002/03

Background

- 3.22. On 20 May 2002, Ofgem requested Transco and NGC⁶ to provide an analysis of the operation of the national electricity and gas systems for the 2002/3 winter, in the light of their general duties and licence conditions. This followed a similar request to NGC and Transco in relation to winter 2001/2.
- 3.23. Ofgem asked NGC and Transco to co-ordinate the underlying assumptions in their analyses and to ensure that they considered the actual and potential behaviour of market participants under the existing gas and electricity trading arrangements. Ofgem specifically asked Transco to confirm that it could operate the gas system during winter 2002/3 without any further significant changes to the gas balancing regime.

Summary of NGC and Transco's Report

- 3.24. On 23 July 2002, NGC and Transco sent Ofgem the joint report "Interactions between gas and electricity national transmission networks, winter 2002/03"⁷. NGC and Transco stated that they could operate the gas and electricity systems

⁶ Transco and NGC now form part of National Grid Transco plc following last year's merger of the National Grid Group plc with the Lattice Group plc.

in a safe, economic and efficient manner for the coming winter. Their conclusion was subject to some concerns about reliance on secondary fuel capabilities if certain locational transmission constraints were to develop.

- 3.25. Transco confirmed that 'adequate tools are available to enable Transco to meet its licence obligations for the 2002/03 winter', without alteration to the existing gas balancing regime. It also stated that 'it has adequate balancing tools available to ensure safe and secure operation of the network for the forthcoming winter'. However, Transco maintained that the extent and unpredictability of within-day variations in flow rate at both network entry and exit points continued to cause some concern.
- 3.26. In September 2002, Transco sent Ofgem a further report entitled, "Potential Gas Supply Shocks Outside Transco's Control"⁸, which set out the factors that Transco believed could affect the reliability of gas supply over the coming winter, and which it believed it could not fully control. These factors referred to low probability but high impact events that, in Transco's view, may require implementation of its emergency procedures, including offshore failures, failure of liquids systems, loss of access to gas-in-store, failures at terminal level, or transmission pipe-breaks.
- 3.27. Under emergency conditions associated with a large-scale gas supply failure, NGC and Transco suggested that security of supply for both gas and electricity consumers could be improved by making better use of the electricity load duration curve, which suggests that if gas supply interruptions to gas fired power station were restricted to 20 hours a day (i.e. no interruptions over the electricity demand peak) the risk of supply emergencies would be significantly reduced. To implement this option and to protect the security of supply for both electricity and gas customers, NGC and Transco stated that the following actions should be taken:

⁷ This report appears on Ofgem's website at www.ofgem.gov.uk.

⁸ This document can be located on Ofgem's website at www.ofgem.gov.uk

- ◆ consider amendments to the 'Fuel Security Code' to ensure that the provision for alternative fuels at gas-fired power stations will allow their operation to be optimised in an emergency; and
- ◆ establish detailed cross-industry working arrangements and emergency powers such that both networks can be operated to maximise security of supply.

3.28. In their report, Transco and NGC also proposed:

- ◆ the sharing (as between Transco and NGC) of certain commercially sensitive information in relation to power station supplies; and
- ◆ rigorous interruption procedures and shared information for forecasting interruption.

Brattle's assessment of the operation of the NTS

Background

- 3.29. In September 2002, Ofgem asked the Brattle Group⁹ to evaluate the severity of the operational difficulties that Transco could face under the current daily balancing arrangements. Specifically, Ofgem asked Brattle to review the materiality of Transco's concerns and to perform a probabilistic assessment of different scenarios depicting the potential effects on system operation of within-day linepack swings originating from different sources. Brattle was also asked to consider what quantitative measures could be used to monitor whether the problems that Transco faces are likely to lead to significant costs or risks to security of supply.
- 3.30. In carrying out their assessment, Brattle worked closely with Transco in developing its analysis through a series of regular meetings. Transco provided data, explained details of their operating practices, and shared their own previous and ongoing modelling of linepack usage. Brattle also provided

Transco with the opportunity to comment on their ongoing work. As a result, Transco has indicated that it endorses the underlying inputs and methodology adopted by Brattle. Transco has indicated that it believes the conclusions of the Brattle report are appropriate whilst noting that the modelling undertaken by Brattle does not necessarily capture all complexities associated with the present gas balancing regime.

- 3.31. The conclusions of Brattle's analysis are summarised in this section, and reported in full in Appendix 2.

Brattle's analysis and findings

- 3.32. Brattle's analysis suggests that the continuation of similar patterns of within-day gas flow rate variations as experienced during the period covered by the Brattle analysis on the NTS do not pose an unacceptable threat to system security as, based on its quantitative analysis, the probability of supply interruptions resulting from within-day linepack depletion is low. Brattle indicates that the probability of supply interruption is less than might be expected on one day in twenty years¹⁰.

⁹ The Brattle Group is a consultancy firm that specialises in the provision of economic policy advice.

¹⁰ Brattle notes that the analysis it used to reach the 1 in 20 year measure is less sophisticated than the analysis and modelling undertaken by Transco relating to its traditional 1 in 20 planning methodology and, as such, the two methodologies are not directly comparable.

- 3.33. Brattle concluded that while simultaneous extreme swings from multiple sectors (beach, Local Distribution Zones (LDZs) and CCGTs) could pose a risk of supply failures, such occurrences would be inconsistent with shippers and Transco's incentives and current behaviour. In particular, Brattle stated that at present, high depletion of linepack by LDZs and CCGTs is compensated by high build-up of linepack from beach and storage. In addition, linepack depletion by different sectors tends to occur at different times of day. Finally, although the linepack flexibility available to manage input and offtake flow rate disparities narrows and LDZ depletion is high on days of high demand, the analysis suggests that Transco has been able to compensate by opening with higher than usual linepack on such critical days.
- 3.34. According to Brattle's analysis, while within-day linepack swings have increased since the introduction of NGTA, it is difficult to determine whether this is part of an ongoing trend or a one-off shift in behaviour. Brattle stated physical factors such as the increasing age of offshore equipment could reduce offshore reliability and increased variation in beach flows and that the availability of free diurnal storage on the NTS reduces the incentives for offshore operators to invest in and maintain offshore infrastructure. Brattle also indicated that short term commercial incentives could lead to front loading of gas onto the NTS early in the day to take advantage of the free option to increase daily input relative to forecast in response to OCM prices. However, Brattle stated that it was difficult to draw conclusions on future trends.
- 3.35. In terms of CCGTs, Brattle commented that with these generators operating as baseload plant (i.e. running at full capacity for a large part of the day) they have relatively little impact upon within-day linepack depletion. Brattle however concluded that future deterioration in within-day profiling could increase the risk of supply failure to unacceptable levels to the extent that CCGTs shift away from baseload to 'mid-merit'. Brattle commented that this would be likely to increase the probability of supply interruption to a figure above one day in twenty years.
- 3.36. In the light of the potential for future increases in the risk of supply interruptions, Brattle has proposed a set of "leading indicators" that would give some advance

warning of such an increased risk. On the basis of its analysis, Brattle has identified the following potential indicators:

- ◆ the gas-coal forward spread;
- ◆ the expiration or renegotiation of CCGT's gas supply "legacy contracts";
- ◆ changes in UK electricity generation installed capacity;
- ◆ changes in patterns of gas use in Ireland;
- ◆ spot and forward spreads across the Bacton-Zeebrugge interconnector;
- ◆ information on reliability of offshore infrastructure;
- ◆ within-day swings on a sector-by-sector basis; and
- ◆ the correlation of linepack depletions across sectors.

3.37. Brattle also recommended that Transco engage in more detailed modelling of within-day flows and their security of supply implications. It added that Transco should also be encouraged to consider proposing incremental reforms to the gas balancing regime and its own operations that could be implemented while imposing minimal burdens on shippers.

Transco's view of the Brattle report

3.38. Transco has stated that the Brattle report endorses the concerns that Transco has raised about the operation of the gas balancing regime. Transco also states that, based on experience to date, Brattle is correct to conclude that under most circumstances Transco can expect to be able to manage its system with the current patterns of flow rate variation and with existing balancing tools. In view of this, Transco believes that a move to shorter balancing periods is not appropriate in the foreseeable future.

3.39. Transco states that it is undertaking more analysis of its own to assess the implications of within-day linepack variation and the potential impact of sectoral behavioural change. Transco also agrees that it is appropriate to develop a set of

leading indicators that might be used to help identify whether further regime reform is likely to be justified.

- 3.40. Transco says that subject to the outcome of further modelling, incremental reform of the regime may be necessary to address the prospective increased risks associated with the operation of the gas balancing regime.
- 3.41. Transco believes that potential incremental reforms should continue to be developed such that, if regime performance were to deteriorate significantly, reform could be quickly implemented to ensure the integrity of the network and the efficient commercial operation of the regime. Transco however notes that it is important that such changes do not impose inappropriate burdens that would frustrate the operation of the market.
- 3.42. Transco's response to the Brattle report and the conclusions reached in this document are set out in full in Appendix 3.

International gas balancing arrangements

- 3.43. In December 2002, Ofgem commissioned Brattle to review gas balancing arrangements around the world with the purpose of assisting the development of Ofgem's views and way forward with respect to the gas balancing regime in Great Britain. In particular, Ofgem asked Brattle to provide:
- ◆ a general overview of gas balancing regimes around the world, summarising emerging themes, trends and regions;
 - ◆ summary information on gas balancing arrangements in Europe, North America and Australia, including settlement periods, cash-out prices, tolerances and provision of flexibility services wherever possible; and
 - ◆ two case studies focussing on the Netherlands and Southern California.
- 3.44. The Brattle Group's report is contained in Appendix 4. The report concluded that gas balancing regimes around the world tend not to employ pure sub-daily arrangements, but to favour regimes that require balancing at daily levels with

larger tolerances at the hourly level. This approach provides some safeguards against the effects of profiling on days of difficult demand and supply conditions, whilst limiting the costs of maintaining a within-day balance between gas inputs and offtakes (or be penalised) to the users of the transmission systems.

- 3.45. The example of the Netherlands, where the commercial incentives on shippers to balance were recently revised, shows how the Dutch regime opted for a compromise between maintaining system stability and avoiding unnecessarily stringent balancing rules. In January 2003, following complaints from the industry about the unnecessarily high costs implied by the sub-daily allocation balancing arrangements, the Netherlands moved from a regime with quite strict hourly balancing to a regime characterised by end-of-the-day balancing with hourly tolerances.

Information flow issues

- 3.46. Since the beginning of 2000, Transco has signalled to Ofgem and industry participants that it is receiving poor information from shippers and terminal operators on their intended flows onto and from the NTS.
- 3.47. In this context, Transco has highlighted the significant disparity between actual and expected flows on the NTS and has raised concerns regarding the divergence between shippers' AT-link nominations and DFNs as well as differences between nominations, DFNs and forecast end of day demand. Transco has indicated that poor information can make it difficult for Transco to efficiently balance and operate its transmission system.
- 3.48. Transco considered that the deterioration in the quality of information available to Transco coupled with input profiling under the existing daily balancing regime could, in some circumstances, threaten within-day system security on the NTS.

Incentivised nomination scheme

- 3.49. Network code modification proposal 0479 "Incentivised Nomination Scheme (INS)" was raised by Transco with the purpose of introducing sharper incentives

on shippers to provide more accurate information to Transco about their intended end of day imbalance positions. Ofgem approved this modification for implementation on 1 October 2002.

- 3.50. The INS requires shippers to provide a projection of their end-of-day imbalance position at four designated times, ahead of and during the gas day. If a shipper's end of day imbalance position differs from each of the four projections, the shipper faces a charge on those days in which Transco takes a balancing action. The charge rate applicable for each of the four charging times is the difference between SAP and the relevant system marginal price (SMP)¹¹ multiplied by 0.25. Any revenue generated from the charges is credited to shippers through the daily balancing neutrality redistribution mechanism¹².
- 3.51. In approving modification proposal 0479, Ofgem considered that it would, on balance, improve the information Transco receives in order to make balancing decisions and would be likely to reduce the need for Transco to take balancing actions which are potentially unnecessary.
- 3.52. Since the implementation of this modification, Transco has been presenting monthly reports to the workstream meetings outlining the developments in the balancing performance of its transmission system.
- 3.53. During the workstream meetings, shippers have raised concerns that since October 2002, Transco has often been taking quite small gas balancing actions, which have triggered INS charges. Shippers have questioned whether these actions contribute to the efficient balancing of the NTS. In light of these concerns, some shippers have suggested the introduction of a *de minimis* rule, by which INS charges would be triggered only by balancing actions that are greater than an agreed minimum volume.

¹¹ System average price (SAP) is the weighted average price of all trades on the on-the-day-commodity market (OCM) in a day, while system marginal price buy (sell) is the highest (lowest) Transco bid (offer) from gas on the day. If Transco does not take any bids (offers), the system marginal price buy (sell) are calculated as SAP plus (minus) a fixed differential.

¹² The balancing neutrality charge is designed to recover from shippers all costs associated with Transco buying and selling gas to maintain residual system balance. It includes the net costs associated with Transco buying and selling gas on the OCM, the net costs of buying and selling gas to and from participants through the cash-out mechanism, and the revenue received through the application of scheduling and INS charges.

- 3.54. Shippers have also raised concerns that INS is not better informing Transco's energy balancing actions or improving energy balancing performance.

Offtake profile information

- 3.55. In January 2002, Transco raised modification proposal 0527 "Introduction of a within-day exit profiling charge and an exit failure to notify charge". The proposal was intended to introduce greater incentives on shippers to provide more accurate information to Transco about their offtake rates. It was also designed to encourage shippers to adhere to the notice periods required under the terms of their NExAs to inform Transco of any changes to their offtake rates.
- 3.56. Transco was concerned about the increased tendency for large loads that are directly connected to the NTS to change their offtake rates with little or no notice. Transco stated that large unexpected changes in offtake could jeopardise the safe and secure operation of the system when Transco does not have accurate nomination information to enable it to manage linepack variations or to maintain linepack within acceptable levels.
- 3.57. In September 2002, Transco and shippers decided to implement a monitoring scheme on the discrepancies between nominated and actual offtakes. Under the monitoring scheme, Transco publishes a weekly report containing, for each day, any deviations where the metered hourly flow differs from the hourly-notified rate in the offtake profile notice (OPN) by more than either a variation allowance of 135 MWh or the prevailing tolerance for any given NExA site if this tolerance is larger than 135 MWh.
- 3.58. The report is also intended to monitor the time at which OPNs are provided to Transco ahead of the gas day. Transco requires prompt submission of this information to enable it to estimate system demand and prepare its operational strategy for the next day.
- 3.59. The report is sent by e-mail to the nominated contact for each NTS exit point. Recipients are required to provide written explanation for any deviations and late submission of initial OPNs within five working days. In addition to the weekly reports, Transco collects and presents evidence on the effectiveness of

this monitoring scheme to the monthly Operational Forum meetings. Transco and the holders of NExAs expect to meet again in spring 2003 to discuss the success of this scheme. Following the NExA meeting in September, Transco withdrew modification proposal 0527.

Other developments in information disclosure

- 3.60. In recent years, certain market participants, including both customers and shippers, have raised concerns about limited and asymmetrical access to gas system operation information and offshore information.
- 3.61. In addition, in the context of the gas balancing regime, Transco has indicated that many of the operational uncertainties it faces in predicting gas flows on the day are exacerbated by its inability to consistently access reliable offshore outage information both ahead of the day and within-day.
- 3.62. Over the past year, there have been a number of developments with respect to the information disclosure that have implications for the gas balancing regime. These include Transco's information exchange project which has made significant progress in the release of operational information relating to the NTS as well as modifications to Transco's licence to facilitate market and operational information disclosure.
- 3.63. The Department of Trade and Industry is also considering the release of offshore information arising from its November 2001 consultation on gas prices¹³.

Costs of reforms to the gas balancing regime

- 3.64. Respondents to Ofgem's February 2001 proposal document raised concerns that the proposals to introduce shorter balancing periods would impose significant costs on industry participants.

¹³ 'Gas: A consultation on concerns about gas prices and possible improvements to market efficiency', DTI, November 2001.

- 3.65. In response to the February 2001 gas balancing proposals, a consortium of gas shippers commissioned ILEX to undertake an assessment of the costs of implementing Ofgem's February 2001 proposed reforms. In January 2002, ILEX published an executive summary of its main findings but decided not to publish the full report. However, a copy of the report entitled, "What are the costs of introducing shorter balancing periods, A report to the Shipper Consortium" was subsequently sent to Ofgem.

The ILEX report

- 3.66. The ILEX report considered two main scenarios for reforms to the gas balancing regime. The first scenario was based on Ofgem's February 2001 proposals, and assumed balancing periods of one hour and the use of metered flows. The second scenario assumed balancing periods of less than one day, but not as short as one hour. This scenario assumed the use of deemed flows.
- 3.67. For the first scenario, ILEX concluded that the costs of introducing balancing periods of one hour would be between £1 billion in the most conservative case and £3.5 billion in the central case. These costs would include additional metering to measure gas flows, upstream contract renegotiations, new IT systems and the need for additional linepack in Transco's system. By assuming that these costs will be passed through to customers, ILEX estimated that that they would translate into an additional average annual gas cost for the subsequent ten years of nearly 1.5 pence/therm in the central case and of 0.6 pence/therm in the conservative case.
- 3.68. Under the second scenario, with shorter balancing periods of four or six hours, ILEX estimated that the implementation costs and the average annual gas cost would be significantly lower¹⁴.

Other changes to the existing gas balancing regime

¹⁴ The aggregate figures of costs in this second scenario were not included in the published executive summary and therefore we are not allowed to disclose them in this document.

Removal of cash out tolerances

- 3.69. On 1 October 2002, network code modification proposal 0511 “Removal of NDM forecast deviation from imbalance calculations” was implemented, thus removing the last of a number of tolerances which were in place prior to implementation of the NGTA in October 1999. Shippers’ imbalances within these tolerances were cashed-out at SAP rather than the relevant SMP, in recognition of what were considered to be the difficulties of managing some of the risks associated with imbalances during the early days of NGTA. In particular, the non daily metered (NDM) forecast deviation tolerance¹⁵ was intended to mitigate the imbalance risk of shippers with NDM supply points arising from errors in Transco’s demand forecasting.
- 3.70. In approving modification proposal 0511, Ofgem stated that, within a competitive market, shippers should take full responsibility for their own supply and demand balance. This would include the forecasting of demand, either by investing in internal resources or by acquiring forecasting services from external providers. The removal of the NDM deviation tolerance should generate a strong incentive on shippers to improve the demand forecasts they use in making their business decisions.

Reform of cash out arrangements

- 3.71. In August 2002, AEP Energy Services raised modification proposal 0575 “Revisions to cash out pricing and the methodology for recovery of OM cost”, which proposed that when operating margins¹⁶ (OM) gas is withdrawn for end-of-day gas balancing purposes, the full cost of OM gas should be included in the calculation of cash-out prices for that gas day. The purpose of the proposal was to improve cost targeting and provide better incentives on shippers to balance

¹⁵ Under the NDM forecast deviation tolerance, when a shipper’s end of day NDM nomination deviated from its final allocation by an amount less or equal to the difference between Transco’s NDM forecast of the shipper’s NDM demand and the shipper’s final NDM demand allocation, this volume was cashed out at SAP, provided that the shipper’s error was in the same direction as Transco’s error.

¹⁶ Operating Margins gas is gas used by Transco to maintain system pressure under circumstances including compressor trips, pipe breaks or other failures of transmission plant, and including periods immediately after a supply loss or demand forecast change before other management measures become effective.

their inputs and offtakes, particularly on days of high demand when OM gas may be used as tool of last resort when the system is under stress. By including OM costs in cash-out prices, shippers' incentives would be strengthened thereby benefiting system security on the most critical days.

- 3.72. The proposal was extensively discussed and developed at workstreams. The issues raised in the discussions have led to two implementation options that could imply a significant change to the cash-out regime. Under the first option, when an OM action is deemed by Transco to be a 'market balancing action' for end-of-day energy balancing reasons (e.g. beach gas supply failure, or step increases in demand with no matching supply), a unit price for OM usage would be calculated to contribute to the determination of the SMP buy price.
- 3.73. Under the second option, when the system finishes the day short of gas, the SMP buy price would be set at the relevant point in an ordered net stack of system buy actions and compared with the net system imbalance. The resulting SMP buy price would not necessarily be the most expensive buy action on the day.

- 3.74. In January 2003, AEP withdrew modification proposal 0575 and replaced it with two new network code modification proposals, which reflected the two implementation options that were developed at the workstream meetings. Specifically, modification proposal 0606 “Reform of the cash out arrangements and the inclusion of costs of OM gas used for end of day balancing purposes using a stack process” proposes the implementation of the second option where SMP prices are set at the relevant point in a net stack of balancing actions. Modification proposal 0607 “Change to the cash-out arrangements where Transco defines Operating Margins (OM) gas usage for end of day balancing purposes” proposes the implementation of the first option where OM costs are unbundled and added to the existing calculation of cash-out price.

Transco’s role as the residual gas balancer

Revision of Transco’s energy balancing incentive

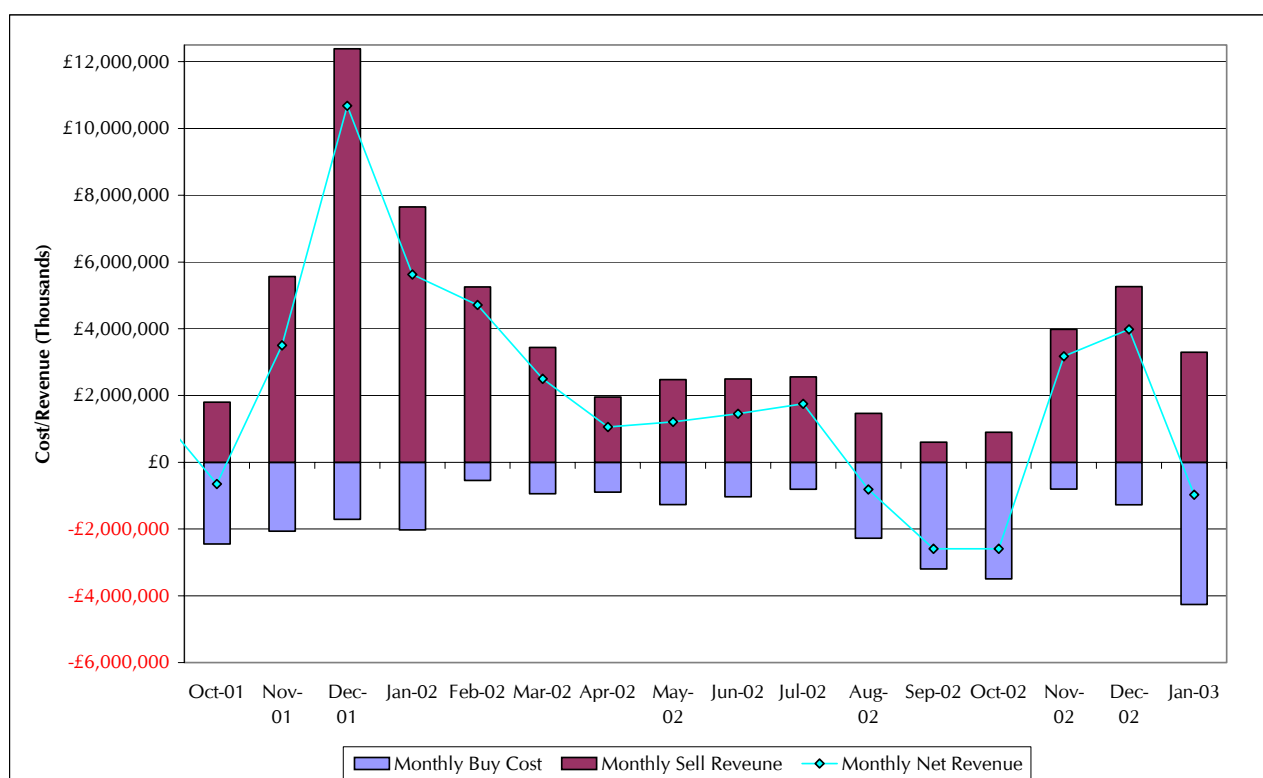
- 3.75. Transco’s residual gas balancing incentive was revised with effect from 1 April 2002 as part of the introduction of Transco’s NTS system operator incentives for the price control period April 2002 to April 2007.
- 3.76. The revision, which took effect in April 2002, affected the cap and collar of the incentive. In particular,
- ◆ the daily cap on both the price and linepack incentive was increased from £4,000 to £5,000; and
 - ◆ the annual cap was increased from £2million to £3.5 million and the annual collar was increased from -£2million to -£3.5 million.
- 3.77. These caps and collars are set for two years and are due to be reviewed as part of the review of Transco’s SO incentives.

Transco’s performance under its energy balancing incentive

- 3.78. Figure 3.1 shows the levels of balancing costs incurred by Transco in buy and sell actions between October 2001 and January 2003. The diagram broadly suggests a reduction in the monthly balancing revenue and costs for the months

between October 2001 and January 2002 when compared to October 2002 and January 2003. This may be an indication that the current commercial incentives on Transco are working to help reduce Transco's presence as a buyer and a seller of gas on the wholesale gas market for energy balancing purposes. However, a more detailed review of Transco's performance under its gas balancing incentive (employing a longer stream of data) will be undertaken as part of the review of the NTS SO incentives.

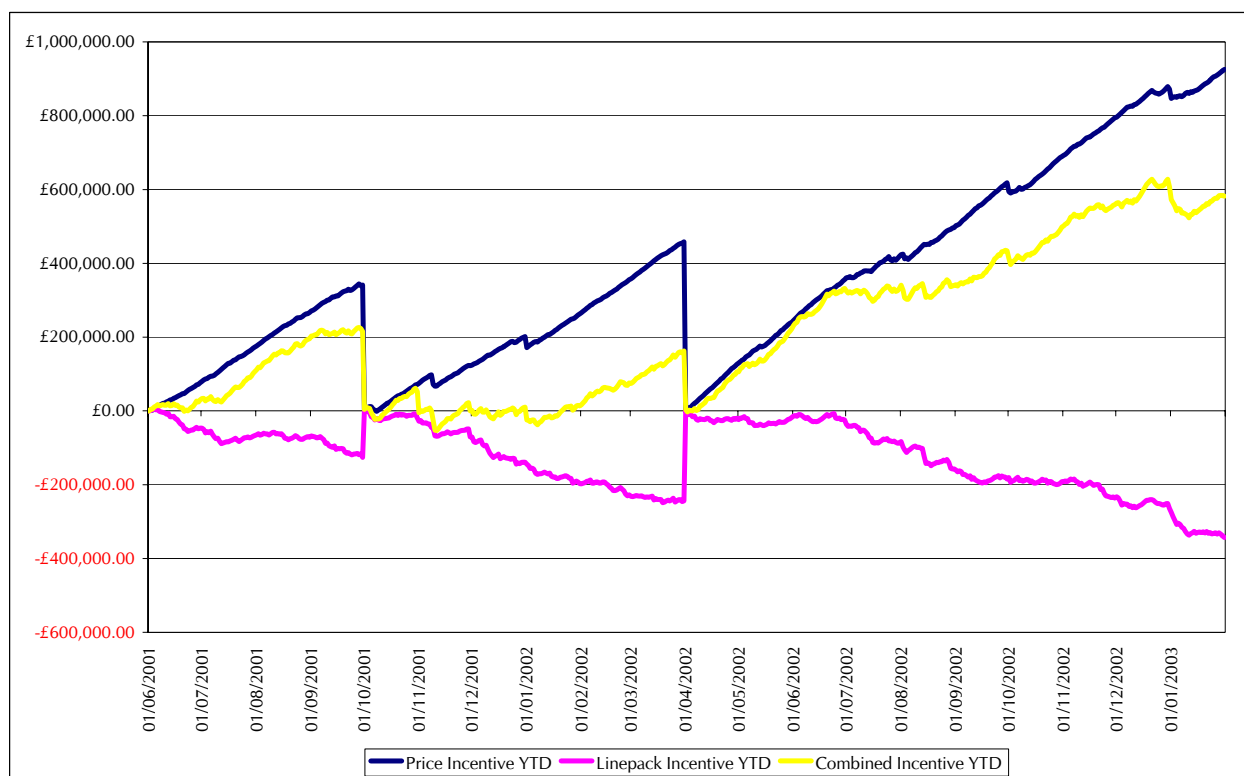
Figure 3.1 Imbalance gas revenue and costs from October 2001 to January 2003



3.79. Figure 3.2 illustrates Transco's cumulative performance under its price and linepack incentive targets. Transco's residual gas balancing incentive is described in more detail in Appendix 1. The discontinuities in Figure 3.2 indicate the times at which the parameters of the energy balancing incentive were changed. In particular, changes to the residual balancing incentive were introduced on 1 October 2001 and 1 April 2002, when the annual cap and collar was reset.

3.80. Overall, Transco has performed well against its incentive's targets. Although it continues to incur losses under the linepack incentive, Transco keeps gaining substantial net revenues due to its strong performance under the price incentive.

Figure 3.2 Transco's performance under its energy balancing incentive



4. Ofgem's views on the latest developments

- 4.1. Ofgem has carefully considered the latest developments in the current balancing arrangements outlined in chapter 3. In this chapter, we provide our views on these developments. We conclude that fundamental reform of the gas balancing regime is not necessary at this time.

Network Code Review Group 0513

- 4.2. Ofgem attended the meetings of review group 0513 and closely followed the developments of the discussions. Ofgem considers that the 0513 review group process made an important contribution to the review of the balancing regime and welcomes the efforts of those who participated in the discussions.
- 4.3. Ofgem limited its role in the discussions to ensure that both Transco and industry participants developed their own conclusions regarding the nature and degree of problems faced by Transco and whether or not any fundamental or incremental reforms were necessary.
- 4.4. Ofgem notes that the review group considered a number of potential reforms that could be developed to provide additional benefits to the gas balancing regime and which could assist in addressing the concerns regarding within-day linepack depletion and flow variations.
- 4.5. Whilst Ofgem considers that the NTS can be operated securely with the currently experienced variations in flow rate, we note that Transco considers it important that market participants continue to develop proposals that could improve the daily balancing regime and which could address the within-day problems that Transco continues to experience.
- 4.6. Any such proposals which were brought forward by Transco or shippers would need to be consistent with the objectives previously laid out by Ofgem with respect to the gas balancing regime, namely:

- ◆ accurate targeting of system balancing and operation costs to those that cause them to be incurred;
- ◆ strong commercial incentives on shippers to balance their own inputs and offtakes;
- ◆ strong commercial incentives on Transco to undertake efficient residual balancing of the system;
- ◆ improved flows of information to support efficient balancing for Transco and shippers; and
- ◆ the development of liquid and transparent spot and forward markets for gas.

4.7. With these objectives in mind, and without fettering its discretion with respect to future modification proposals, Ofgem has a number of comments to make on the incremental reforms which the group believed could warrant further consideration and which therefore were contained in the final recommendations provided by the group.

Within-day scheduling incentive scheme

- 4.8. Ofgem considers that there are merits in proposals that are intended to improve the information Transco receives in operating its system. However, proposals of this nature must be carefully assessed against any impacts they may have on the ability of shippers to fine tune their imbalance positions within-day and therefore the role that shippers take in facilitating system balancing on the gas day.
- 4.9. Ofgem is concerned that proposals of this nature may increase the role of Transco as gas balancer on a daily basis reducing the emphasis on within-day trading and fine tuning of shipper balance positions. In particular, Ofgem is not convinced that increasing the role of Transco, a system operator with regulatory as opposed to market based incentives, would improve operational efficiency. Ofgem would also be concerned were any proposals of this nature to weaken shipper incentives to balance.

- 4.10. Nevertheless, given that this proposal has not been developed in detail it is not possible to provide conclusive views. In view of this and in view of Transco's concerns regarding the quality of information it receives, Ofgem is not opposed to the further development of this proposal.

Transco information release

- 4.11. With regards to Transco's balancing policy, Ofgem is generally supportive of proposals that are intended to increase the level of information released to industry participants regarding Transco's operation of the gas system. Ofgem would note that the modifications made to Transco's GT licence requiring Transco to disclose certain information where this is required under its network code were intended to facilitate the release of operational information.
- 4.12. Ofgem however considers that the release of after the day information on Transco's residual balancing actions is unlikely to have a major impact in terms of addressing the weaknesses of the regime, including the quality of information received by Transco or within-day profiling.

Gas flexibility contracts

- 4.13. Ofgem is of the view that the development of flexibility contracts is worthy of further consideration and development.
- 4.14. Under such arrangements, Transco could develop a standard option contract separate from the OCM that grants it the right to call on the contracted party to inject gas into or withdraw gas from a specific network point within a set time limit. Of necessity, these contracts would be limited to those market participants with metering that would enable Transco to monitor the flow rate change and to verify that the counterparty had complied with its contractual commitments.
- 4.15. These option contracts could have a variety of lengths, exhibit a 'purchase' price and a 'strike' price and include penalties for non-compliance. Careful consideration would need to be given to the mechanism by which the costs associated with flexibility contracts are targeted and the nature of any incentives that should apply to Transco with respect to the use of these contracts.

- 4.16. Ofgem believes that this proposal could potentially address some of Transco's within-day problems by requiring a physical response and introducing a strict timing requirement for delivery that would enable Transco to address linepack depletion risks promptly thereby reducing security of supply risks. The proposals may also increase operational efficiency by reducing the potential for unnecessary or wasteful system balancing actions that have no immediate within-day effect.

Transco's residual gas balancing incentive

- 4.17. Ofgem notes the review group's concerns regarding Transco's residual gas balancing incentives. Ofgem will review Transco's residual gas balancing incentives as part of the SO incentives review. The issues raised by the review group regarding Transco's residual gas balancing incentive will be taken into account as part of this review process.

Consideration of fundamental reforms

- 4.18. The review group also recommended establishing a sub-group to consider fundamental reforms. Ofgem does not believe that, at this time, such a sub-group would be necessary in the light of the conclusions reached in this document. However, this situation may need to be reviewed in the future should the performance of the regime deteriorate.

NGC and Transco's analysis of security of supply for winter 2002/03

- 4.19. Following the release of NGC's and Transco's joint report on security of supply, Ofgem wrote to all interested parties indicating that it was satisfied with Transco and NGC's confirmation that they have carefully assessed their system operations for winter 2002/03 and are confident in their ability to operate their transmission systems consistent with their statutory duties. We also noted that Transco did not consider that further action was required to alter the gas balancing regime before the winter 2002/3.

- 4.20. As regards NGC and Transco's suggestions for reducing security of supply risk under emergency conditions, Ofgem is currently participating in the DTI's review of the 'Fuel Security Code' and will discuss with the DTI the appropriateness of NGC and Transco's suggestions about amending that code and establishing cross-industry emergency arrangements.
- 4.21. In terms of information sharing, Ofgem believes that it would be helpful for Transco to be able to share with NGC certain information about gas supplies to power stations as well as general operational information that may materially affect each other's transmission systems. Ofgem believes that such information exchange can provide benefits to customers by increasing operational efficiency and thereby facilitating security of supply. However, Ofgem understands concerns that any information sharing is appropriate for system security and not commercial reasons¹⁷.
- 4.22. Ofgem's views on information exchange are outlined in its decision document on the merger of National Grid Group plc with the Lattice Group plc¹⁸. Ofgem is currently exploring with NGC and Transco the facilitation of information exchange between the respective licensed businesses.

Brattle's assessment of the operation of the NTS

- 4.23. Ofgem has carefully considered the Brattle Group's views about the materiality of the impact of within-day profiling on security of supply and its conclusion that the probability of supply interruption resulting from within-day linepack depletion is less than one day in twenty years.
- 4.24. Ofgem considers that the conclusions of the Brattle Group indicate that the risks to security of supply highlighted in previous proposals documents are not as great as previously expected. For example, Ofgem notes the Brattle Group's conclusion that CCGTs are operating as 'baseload' plant and are therefore

¹⁷ Ofgem notes in this respect that both NGC and Transco have licence conditions that prohibit them from engaging in speculative trading activity.

¹⁸ 'Regulatory issues arising from the merger of National Grid Group plc with the Lattice Group plc to create National Grid Transco plc, Decision document and notice under section 11 and 11A of the Electricity Act

having relatively little impact upon within-day linepack depletion. Ofgem has previously been concerned that there was significant potential for exit profiling to increase as a result of incentives on generators with gas fired plant to arbitrage between the gas and electricity markets following the implementation of NETA. However, based on the Brattle Group's analysis there is little evidence to suggest that CCGT exit profiling is increasing to the extent expected by Ofgem in its previous documents.

- 4.25. For the purpose of monitoring the system operation performance and any evolution in the risks to security of supply, Brattle has identified a set of possible indicators, which are reported in chapter 3 and fully explained in Appendix 2.
- 4.26. Ofgem recognises that several of these indicators could be helpful to provide an advance warning of any increased risks to security of supply on the gas transmission system. Ofgem notes that many of the indicators are based around CCGTs and their position in the 'merit order' under the present electricity trading arrangements. Whilst useful, Ofgem does not accept that a movement of CCGTs away from baseload output will of itself necessarily increase the level of exit profiling experienced on the NTS. Any such movement would need to be considered in conjunction with other factors such as CCGT contracts. As such, whilst relevant, these indicators need to be treated with some caution.
- 4.27. Ofgem also considers that the indicators should also have regard to the quality of information received by Transco. With this in mind, the indicators could include amongst other things differences between DFN nominations, AT-link nominations and demand.
- 4.28. In chapter 5, we set out a number of possible indicators that could be used to give advance warning of any increased difficulties in operating the transmission system within the existing daily balancing arrangements.

Ofgem comment on Transco position

- 4.29. Ofgem notes Transco's view that it is able to safely manage the transportation with the current patterns of flow rate variation and that a move to shorter balancing periods is not justified at this point in time. Ofgem considers that Transco's view further confirms that the risks to security of supply highlighted in previous proposals documents are not as great as previously expected.

International gas balancing arrangements

- 4.30. Ofgem has considered Brattle's survey of gas balancing arrangements around the world. We note that there is some evidence that countries are moving away from sub-daily balancing regimes.
- 4.31. This indicative trend for other countries to move away from hourly balancing requirements suggests that Great Britain should at present be cautious in pursuing the introduction of a regime that requires shippers to balance within-day, unless there is evidence that the secure operation of the GB national transmission system is at risk. This is particularly relevant given the importance to GB of effective gas liberalisation in Europe.

Information flow issues

Incentivised nomination scheme

- 4.32. Ofgem has given some initial consideration to the performance of the INS regime to date. This is contained in Appendix 5. It should be noted that the analysis has been undertaken on the basis of four months data and is therefore not intended to represent a formal review of INS.
- 4.33. Ofgem has considered Transco's monthly reports on the performance of the INS and the analysis in Appendix 5. Bearing in mind the limitations of the analysis, there is little evidence to suggest that INS is providing additional information to Transco that could assist it in taking more efficient balancing actions. In addition, the prevailing evidence tends to suggest that the INS charge is supplementing the cash-out charge. Ofgem is also cognisant of shipper concerns regarding the number of small individual balancing actions taken by Transco.

- 4.34. On this basis, Ofgem considers that the continuing operation of the INS scheme should be reviewed by Transco through the workstream process. This review should commence as soon as all necessary data from 1 October 2002 to 31 March 2003 is available. As part of this review, Ofgem would expect Transco to develop an objective set of criteria against which the success of INS could be measured. Such criteria could have regard to factors such as trends in INS charges, INS nominations behaviour and the number and volume of Transco's balancing actions. The review should consider whether to extend, remove or amend the scheme.

Information disclosure

- 4.35. Ofgem shares many of the concerns identified in chapter 4 with respect to offshore information. We consider that insufficient market and operational transparency has a number of detrimental impacts. In particular, Ofgem considers that an absence of operational and offshore information disclosure can impede the ability of the market to react in an efficient and timely manner to market events such as supply shortfalls and may increase the market's reliance on Transco as gas balancer to deal with these events. Increasing the market's reliance on the residual gas balancer may increase gas balancing costs.
- 4.36. In addition, the inability of Transco to access offshore information relating to events such as outages restricts its capacity to assess within-day flow rate changes which may lead to unnecessary and costly balancing actions. It may also exacerbate the risk of security of supply events.
- 4.37. Ofgem believes that there is scope for the release of offshore information to both Transco and market participants, including shippers, to improve the ability of the market to react and adjust to address supply shortfalls. In particular, Ofgem considers that the provision of forecast outage information could provide the market with early and reliable signals of shortages allowing it to respond in a more efficient and timely manner and thereby facilitating security of supply.

- 4.38. Increased transparency could reduce information asymmetries between shippers thereby enhancing competition, reducing the reliance of the market on rumours (and the consequent volatility that this may cause) and reducing barriers to entry.
- 4.39. In terms of the operational efficiency of the gas balancing regime, Ofgem believes that the release of offshore information relating to outages to Transco would address some of its concerns about the difficulties it faces in determining when flow rate changes will occur within-day. As a result, Transco would be better informed in determining its balancing requirements which should benefit customers by reducing balancing costs and minimising the risk of gas emergencies.
- 4.40. As such, whilst Ofgem does not intend to pursue major reform of the gas balancing regime as it presently exists, Ofgem intends to continue to argue for increased offshore transparency as a means of addressing some of the concerns that exist regarding the regime.
- 4.41. Ofgem recognises that it has limited powers to require the release of offshore information and that issues relating to offshore market transparency fall largely within the remit of the DTI. In this respect, Ofgem will continue working with the DTI to facilitate offshore information disclosure as means of facilitating competition, operational efficiency and security of supply.
- 4.42. Ofgem recognises the concerns of the offshore companies with respect to greater information disclosure. As such, we have prepared a position paper explaining, in considerable detail, the rationale for greater information offshore information disclosure. The DTI has requested that this paper is not published at this time. We hope however to be able to publish this paper shortly.

Costs of reforms to the gas balancing regime

- 4.43. Ofgem recognises that there would have been costs associated with any move towards shorter balancing periods. In this context, we acknowledge the analysis that has been undertaken by ILEX. It was disappointing that the entire ILEX report (as opposed to just the executive summary) was not published. Ofgem has reviewed this analysis and considers that in some instances ILEX has over estimated the costs of implementing shorter balancing periods (e.g. with respect to the calculation of IT and infrastructure (linepack) costs). In other areas, we consider the methodology used by ILEX to be flawed. However, on the basis of the conclusion that there is no immediate need to move to shorter balancing periods, it is not necessary to form a final view on the costs of reforms of this nature.

Other changes to the gas balancing regime

Offtake profile information

- 4.44. Ofgem is concerned about the increasing number of breaches under the NExA arrangements to the extent that they endanger the safe and efficient operation of the NTS. Should the monitoring regime fail to address the concerns raised by Transco regarding exit output information, Ofgem would expect Transco to give consideration to the development of stronger incentives on shippers to provide better information regarding their proposed offtakes.

Reform of cash out arrangements

- 4.45. Modification proposal 0575 raised important issues regarding the design of the cash-out regime. These include the need for SMPs to reflect all of the costs incurred by Transco for energy balancing purposes and the appropriateness of the default price differentials currently used to determine cash out prices on days when Transco does not take any balancing action.

- 4.46. Ofgem is currently considering the potential merits of modification proposals 0606 and 0607 which replaced modification proposal 0575 and expects to release its decisions on these proposals shortly.

Default cash-out differentials

- 4.47. Ofgem notes that the current default price differentials are derived from the year 2000 auction for the one-year Hornsea storage product. Therefore, as they are based on outdated figures for storage prices, Ofgem considers that they should be reviewed. Such a review should consider whether the differentials should be updated to reflect the prices obtained in the 2002 auctions at Hornsea.

Transco's role as the residual gas balancer

- 4.48. Ofgem has considered the recent data on Transco's conduct as the residual gas balancer as outlined in chapter 3.
- 4.49. Ofgem will take this data into account when it commences its review of Transco's residual gas balancing incentive as part of the general review of Transco's SO incentives.

Conclusions

- 4.50. Ofgem has concluded that fundamental reform of the gas balancing regime is not, at this time, necessary. This is based on a number of factors, namely:
- ◆ the conclusions of the work undertaken by the Brattle group;
 - ◆ Transco's view that it can operate the gas transmission and distribution safely without the introduction of shorter balancing periods; and
 - ◆ developments in the gas and electricity markets since the release of Ofgem's February 2001 and February 2002 documents.
- 4.51. Ofgem continues to believe that there could be significant benefits to customers associated with the introduction of shorter balancing periods. These include enhanced competition between shippers, greater operational efficiency and

security of supply. However, as we have explained, our analysis shows that there is no longer any immediate threat to security of supply associated with the present daily balancing regime. As such, Ofgem considers that the justification for moving to shorter balancing periods is not as strong as previously stated. On this basis, we do not believe that it is necessary to proceed with any fundamental reform of the balancing regime at this time.

- 4.52. Ofgem however considers that the problems experienced by Transco with respect to linepack depletion within-day should continue to be monitored on an ongoing basis. In the event that the risks associated with within-day linepack depletion increase, the introduction of more fundamental reforms to the gas balancing regime may need to be considered.
- 4.53. With this in mind, Ofgem proposes to develop a set of indicators to give advance warning of the potential for Transco to face increased difficulties in operating the transmission system within the existing daily balancing arrangements. We also propose to undertake a periodic six monthly review of the gas balancing arrangements against these indicators. We would expect this review to form part of the six monthly security of supply report that Ofgem has agreed to undertake.
- 4.54. Ofgem also believes that consideration should be given to the development of proposals that could address some of the problems identified by Transco within the framework of the daily balancing regime. In this respect, Ofgem considers that gas flexibility contracts may provide Transco with an additional tool to ameliorate concerns regarding within-day linepack depletion. Further, we continue to believe that increased market transparency and, in particular, the release of offshore information to market participants and Transco would assist in improving the efficiency of the present daily balancing regime potentially reducing security of supply risks.

5. Way forward

- 5.1. In Chapter 4, we outlined our view that a move to shorter balancing periods was not presently necessary given the level of risks that within-day variations in entry and exit flows presently pose to security of supply. Transco has indicated that it agrees with this conclusion.
- 5.2. However, we also emphasised that there are incremental reforms that could be considered to mitigate some of problems faced by Transco under the present daily balancing regime. Further, we emphasised that the security of supply risks associated with within-day linepack depletion must be regularly monitored.
- 5.3. In order to assist in monitoring the regime, we suggest that a series of indicators be developed. These indicators would be used to give advance warning of any increased difficulties in operating the transmission system under the existing balancing arrangements.

Indicators

- 5.4. Although there does not seem to be an immediate risk of supply interruptions within the operation of the current arrangements, Ofgem believes that Transco's ability to manage the NTS could deteriorate if the transmission system were to experience:
 - ◆ an increase in supply swings at the beach;
 - ◆ increased opportunities for arbitrage between Great Britain and Europe through the Bacton-Zeebrugge interconnector;
 - ◆ a significant increase in arbitraging by CCGTs between the gas and electricity markets;
 - ◆ increased usage of linepack by the LDZs;
 - ◆ an increase in exit profiling within-day by CCGTs;

- ◆ a further worsening of the quality of information about shippers' intended gas flows; or
- ◆ a decline in the effectiveness of Transco's balancing tools.

5.5. Therefore, Ofgem concludes that it is important that we continue to closely monitor the performance of the current arrangements going forward to assess whether the risk to security of supply changes over time. For this purpose, we propose to establish a set of performance indicators that could give an advance warning of any deterioration in Transco's ability to manage the system and of any increased threat to security of supply.

5.6. The Brattle Group has suggested a series of indicators as part of their assessment of the impact of within-day linepack depletion on security of supply. These indicators are as follows:

- ◆ gas/coal forward spread;
- ◆ expiration/renewal of CCGT 'legacy contracts';
- ◆ changes in UK installed capacity;
- ◆ changes in patterns of gas use in Ireland;
- ◆ spot and forward spreads across the Bacton-Zeebrugge interconnector;
- ◆ available information on reliability of offshore infrastructure;
- ◆ within-day swing on a sector by sector basis (including at the beach, LDZs and by CCGTs); and
- ◆ correlation of depletions across sectors.

5.7. Other indicators that might be useful could include:

- ◆ DFN / AT-link / actual flow discrepancies; and
- ◆ overall balancing costs.

- 5.8. Before finalising our views on this list, we would welcome views as to these indicators, or any other indicators that might be seen as leading indicators.
- 5.9. Ofgem intends to review the performance of the gas balancing regime against these indicators as part of its six monthly security of supply report. In the event that the indicators suggested that balancing performance was likely to deteriorate this could be a trigger for consideration of fundamental reforms such as the introduction of shorter balancing periods.

Incremental reforms

- 5.10. Ofgem believes that although fundamental reforms of the gas balancing arrangements are not warranted at this stage, it would seem important that the industry consider incremental reforms of the regime that may address some of the problems identified by Transco. In this respect, Ofgem considers that active consideration should be given to the development of within-day gas flexibility tools to assist Transco in managing within-day linepack depletion risks.
- 5.11. Further, as noted in chapter 4, Ofgem will continue to argue for the release of offshore information and increased offshore transparency. We continue to believe that increased market transparency and, in particular, the release of offshore information to market participants and Transco would assist in improving the efficiency of the present daily balancing regime potentially reducing security of supply risks.
- 5.12. In particular, Ofgem considers that the release of offshore information relating to outages to Transco should address some of its concerns about the difficulties it faces in determining when flow rate changes will occur within-day. As a result Transco should be better informed in determining its balancing requirements which should benefit customers by reducing balancing costs and minimising the risk of gas emergencies.

Linepack service

- 5.13. Under the current arrangements, shippers pay for the flexibility provided by the NTS system linepack in a 'bundled product' with transmission services, whilst Transco uses system linepack as an energy balancing tool. Therefore, the costs of linepack are not properly targeted to those who use this flexibility the most by causing variations in within-day gas flows. As linepack is scarce, one participant's use of this flexibility (e.g. by inputting less gas than it offtakes within a given period) affects other parties in their ability to access the same flexibility. Therefore, accurate pricing of linepack could lead to its more efficient allocation and use within the transmission system.
- 5.14. Although a move to shorter balancing periods is not required at this time, Ofgem is still of the opinion that Transco should consider offering end-of-day linepack services to shippers as a management tool to help them balance their gas inputs and offtakes over the day. A shipper's imbalance would be cashed out at an imbalance price only to the extent that its linepack inventory was exhausted. Linepack would be allocated on the basis of price and could be traded among shippers.

Appendix 1 The current gas balancing arrangements

1.1 The current arrangements consist of:

- ◆ regulatory, contractual obligations and commercial incentives on shippers to provide Transco with accurate nomination information ahead of, and on, the gas day about their intended inputs and offtakes to the network;
- ◆ commercial incentives, set out in Transco's network code, on shippers to balance their inputs and offtakes each day;
- ◆ contractual obligations on shippers, under the network code, to use reasonable endeavours to flow gas onto the system consistent with the uniform flow rate obligation ('the 1/24 rule');
- ◆ scheduling charges on shippers for differences between their final nominations and actual flows at input and offtake;
- ◆ administered tools available to Transco, known as terminal flow advice (TFAs), to request the delivery facility operator (DFO) to reduce flows onto the network for a specified period of time;
- ◆ contractual obligations on some large offtake points (such as power stations) set out in NExAs, that limit the extent to which shippers increase or decrease offtakes within specified time periods; and
- ◆ commercial incentives on Transco to undertake its role as residual gas balancer in an efficient manner.

Shipper nominations

1.2 Shippers have an obligation under Standard Condition 3 of the gas shippers' licence not to knowingly or recklessly act in a manner likely to give a false impression to Transco as to the amount of gas to be delivered to Transco's

pipeline system by the shipper or taken at the shippers offtake points on a particular day. Shippers have a further obligation under this condition to use reasonable endeavours to make arrangements with relevant persons, e.g. terminal operators and other shippers, at each delivery point it uses on Transco's system, to secure prompt and accurate information is provided to Transco on the shipper's deliveries of gas each day.

- 1.3 Under Section C1.2 of the Network Code, by 13:00 on D-1, shippers must provide Transco with nominations for offtakes at daily-metered (DM) sites. By 16:00 on D-1, shippers must provide Transco with nominations for inputs at each entry point. From 17:30 on D-1 until 03:59 on the gas day, shippers can re-nominate for their inputs at each entry point and offtakes at each DM site.
- 1.4 Transco has an obligation to issue forecasts of demand for non-daily metered (NDM) sites in each LDZ for each shipper at 14:00, 19:00 and 02:00 for D-1 (day-ahead) and 12:00, 15:00, 18:00 and 21:30 within-day.
- 1.5 Shippers have an incentive to re-nominate following an On-day-commodity-market (OCM) physical transaction through the physical re-nomination incentive charge. Shippers can also re-nominate following a trade and may re-nominate inputs or offtakes at any time up to 03:59 within-day.

- 1.6 In addition to these obligations, shippers are incentivised to provide Transco with an accurate forecast of their intended end of day imbalance position as part of the Incentivised Nomination Scheme (INS). At 02:00 D + 1 and 12:00, 18:00 and 22:00 on the gas day shippers nominate their end of day position. In the event that a shippers nominated imbalance differs from its allocated imbalance at these times, the shipper will incur a charge if Transco has taken a balancing action in that gas day. The INS charge for each of the predefined times is one quarter of the difference between system average price (SAP) and system marginal price (SMP).¹⁹ In particular, when a shipper's nominated imbalance position is greater than its allocated imbalance the charge is based on the difference between the SAP and the SMP sell. When a shipper's nominated imbalance position is lower than its allocated imbalance, the charge is based on the difference between the SAP and the SMP buy. Any revenue generated from the charges is smeared back to shippers through the balancing neutrality mechanism.

Commercial incentives on shippers to balance each day

- 1.7 The commercial incentives on shippers to balance are created through the application of the 'cash-out mechanism'. Shippers' inputs to and offtakes from the system are metered or allocated each day. Any imbalance is 'cash-out', with Transco buying or selling the imbalances from the shipper in its role as the residual gas balancer.

¹⁹ System average price (SAP) is the weighted average price of all trades on the on-the-day-commodity market (OCM) in a day, while system marginal price buy (sell) is the highest (lowest) Transco bid (offer) from gas on the day. If Transco does not take any bids (offers), the system marginal price buy (sell) is calculated as SAP plus (minus) a fixed differential.

- 1.8 Shippers face different cash-out prices depending on whether they end the day long gas (their inputs exceed their offtakes) or short gas (their offtakes exceed their inputs). The cash-out prices provide an incentive for companies to balance over the gas day and target the costs associated with any imbalances back to the companies causing them to be incurred. Cash-out prices for shippers who are long (short) gas are based on the lowest (highest) prices at which Transco has sold (bought) gas on the OCM, excluding trades made by Transco for locational gas. In the event that Transco has not taken any balancing actions, cash-out prices are determined using fixed differentials that are added to the weighted average price of gas traded on the OCM. These fixed differentials were calculated to be based on the costs of storage.

Shippers uniform flow rate obligations

- 1.9 Section I 3.10.1 and 2 of Transco's network code require shippers to use all reasonable endeavours to ensure that gas is delivered at the implied nomination flow rate each day. The implied nomination flow rate is defined in C 1.9 of the network code. It is one-twenty-fourth (i.e. uniform delivery throughout the gas day) for any nomination or re-nomination made for the start of the gas day. If Transco is notified of a re-nomination during the gas day, the implied nomination flow rate changes to reflect the deemed flow up to the time of the re-nomination and the remaining quantity of gas to be delivered by the shipper during the rest of the day, divided by the remaining hours in the gas day. This takes account of the deemed flow up to that time in the gas day, based on the prevailing nomination.

Scheduling charges

- 1.10 If a shipper's actual inputs or offtakes differ from its final nominations, it will pay scheduling charges if the difference is greater than its scheduling tolerance. Input scheduling charges are calculated as the difference between a shippers final nomination and final allocation at each entry terminal. Absolute differences between 3% and 5% attract a charge of 2% of SAP. Absolute differences of more than 5% are charged at 5% of SAP. Offtake scheduling

charges are levied on a site specific basis, with different charges for different types of sites.

Transco's administered tools

- 1.11 A terminal flow advice (TFA) is a request from Transco to a delivery facility operator (DFO) to reduce the flows through its NTS entry point by a specified amount for a particular period of time. Transco issues TFAs when pressures in its network exceed pre-determined trigger levels. In general, TFAs are required to protect the system from the risk of over-pressurisation.

Contractual arrangements at large offtakes

- 1.12 Offtakes taking in excess of 50 million therms per annum (including power stations) on Transco's system are required to have a NExA with Transco, unless Transco agrees otherwise. Connected System Exit Points are also required to have a NExA with Transco. The NExA sets out the terms of the connection, including the notice period sites have to give Transco to vary their gas offtake rate throughout the day, and the rate at which sites can vary their offtake volume throughout the day.

Transco's residual gas balancing incentive

- 1.13 Transco is responsible for taking residual gas balancing actions, by buying and selling gas to keep the system in balance overall. There is some flexibility in the system, through storage in the pipes, to accommodate imbalances within the day. This is known as system linepack. The costs associated with Transco's residual balancing of the system are recovered from all shippers through the neutrality charge.²⁰

²⁰ The balancing neutrality charge is the sum of the net costs of Transco's buying and selling of gas on the OCM, and the net costs of imbalance cash-out and revenue from scheduling charges. Shippers pay scheduling charges when their actual inputs or offtakes differ from their final nominations beyond their scheduling tolerance.

- 1.14 Transco's current gas balancing incentive has a price and a linepack component.²¹ The price component provides Transco with a daily financial incentive to buy and sell gas at prices close to the average market price. Under the incentive, Transco can receive up to £5,000 a day, if it minimises the spread between its marginal buy price and marginal sell price. Transco is exposed to a penalty of up to £30,000 a day when the differential between the marginal buy or sell price is two times SAP or more.
- 1.15 The linepack component of the incentive provides an incentive for Transco to manage daily changes in linepack. This linepack incentive is designed to discourage Transco from carrying over imbalances from day to day, as this would lead to less accurate cost targeting under the regime. In fact, shippers who were out of balance would not face the costs associated with Transco's actions.
- 1.16 Under this incentive, Transco can receive up to £5,000 per day if there is no difference between opening and closing linepack. It continues to benefit under the incentive so long as the absolute difference between opening and closing linepack is less than 2.4 mcm. If the difference is greater than 2.4 mcm, it loses money under its incentive up to a daily collar value of £30,000 for a difference of about 20.4 mcm or more.
- 1.17 Transco's overall exposure under the price and linepack components of its incentive scheme is limited by an annual cap and collar of +/- £3.5 million.

²¹ The energy balancing incentive has been changed with effect from 1 April 2002 as part of the NTS SO incentive arrangements.

Appendix 2 Brattle's assessment of the operation of the NTS

DOES DAILY BALANCING THREATEN

SECURITY OF SUPPLY ON THE NTS?

THE BRATTLE GROUP

APRIL 2003

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Executive Summary

Security of Supply

Our analysis suggests that *current patterns of within-day swing do not pose an unacceptable threat to system security*. NTS linepack (“LP”) is sufficient to cope with the LP swings from individual sectors (beach, LDZs, CCGTs). While simultaneous extreme swings from multiple sectors might risk supply failure, such behaviour would be inconsistent with shipper and Transco incentives and current behaviour: (i) at present, high depletion of LP by consuming sectors (LDZs, CCGTs) is accompanied by high build of LP from beach and storage; (ii) LP depletion by different sectors occurs at different times of day; (iii) although the “safety margin” narrows and LDZ depletion is high on days of high demand, Transco compensates by opening with higher than usual LP.

We have performed a number of quantitative analyses that support this conclusion. Based on these analyses, *we estimate the probability of supply interruption resulting from within-day LP depletion to be less than one day in twenty years*.

While within-day swing has increased since the introduction of RGTA, from the available evidence it is not possible to determine with any degree of certainty whether this is part an ongoing trend or a one-off “step” shift in behaviour. In particular, available evidence on beach behaviour and its underlying determinants is too weak to draw firm conclusions of any kind. However, *future increases in within-day swing could increase the risk of supply failure to unacceptable levels*. In particular, our analysis indicates that a shift in the merit order that saw CCGTs move to mid-merit would be likely to increase the probability of supply interruption from within-day LP depletion to a figure well above one day in twenty years.

Indicators of Increasing Risk

Because our analysis implies a potential future increase in risk, it makes sense to try to identify a set of “leading indicators” that would give some advance warning of such an increase. We have identified the following candidate indicators:

- The gas-coal forward spread.
- Expiration/renewal of CCGTs’ “legacy contracts”.
- Changes in UK installed capacity.
- Changes in patterns of gas use in Ireland.
- Spot and forward spreads across the Bacton-Zeebrugge interconnector.

- Available information on reliability of offshore infrastructure.
- Within-day swing on a sector-by-sector basis.
- The correlations between depletions across sectors

Finally, there may also be a case for Transco to engage in much more detailed modelling of within-day flows and their security-of-supply implications, as a next step beyond the kind of analysis contained in this report. The analysis in this report is necessarily simplified. For example, our analysis of supply failure does not reflect the same sophistication considered by Transco concerning the one-year-in-twenty security standard. We have also been unable to analyse localised network issues that are relevant to security of supply. The main text of this report discusses additional limitations to the analysis, which could be overcome by more detailed modelling. In addition to performing detailed modelling, Transco should also be encouraged to consider proposing incremental reforms to the balancing regime and its own operations that can be implemented while imposing zero or minimal burdens on shippers.

Introduction

Daily balancing allows shippers to use linepack within-day free of charge.²² In effect, the network provides the service of within-day (“diurnal”) storage, and the associated costs (capital and operating) are currently socialised across all system users. While some use of linepack may be viewed as costless to the system, incremental provision is likely to entail costly actions such as OCM trading, use of a compressor, purchase and use of LNG capacity and gas, etc.

Economic theory predicts in these circumstances:

1. *Excess Demand*: Diurnal storage will be over-utilised, *i.e.*, used to a level where the marginal cost outweighs the marginal benefit.²³
2. *Cross Subsidies*: Differential use of diurnal storage across different shippers may give rise to cross-subsidies that could distort competition.
3. *Security of Supply Concerns*: At the most extreme, excess demand for LP could raise the probability of forced supply interruptions (“supply failure”) to an unacceptably high level.²⁴

However, the theoretical claim of over-utilisation says nothing about the magnitude of any potential problem. The fundamental question therefore is whether these theoretical problems are in practice large enough to justify incurring the various costs and risks associated with a shift to sub-daily allocations. This report focuses on the last of the three potential problems, the possible risk of reduced security of supply.²⁵

Crudely speaking, the essential concern is that even if a shipper is in balance over the day, it may cause a within-day dip (“depletion”) in LP, in one of two ways:

- Postponing injection of gas until late in the day.

²² That is, individual shippers do not face the cost of their individual use of NTS LP. The total costs imposed by shippers’ within-day use of NTS LP are smeared across all shippers.

²³ Theory also suggests that LP may be under-supplied, *i.e.*, Transco may not have appropriate incentives to provide the appropriate amount of diurnal storage. Analysis of this potentially interesting question would require careful analysis of the complex set of mechanisms that Transco faces with regard to investment and operating decisions, and is beyond the scope of our study.

²⁴ Note that no system can provide an absolute security of supply guarantee. Transco currently aims to provide security to a 1-day-in-20-year standard (a typical value for modern natural gas pipeline systems). The concern would be that excess use of LP within-day could increase the risk to above that level.

²⁵ Analysis of the other two problems seems extremely difficult, because it would require some assessment of the incremental use of diurnal storage resulting from its pricing. For example, if demand for diurnal storage is extremely inelastic then a shift to sub-daily allocations, while creating transparent price signals, would produce little or no actual efficiency benefits.

- Concentrating withdrawal of gas early in the day.

A combination of such behaviours from many shippers could in principle cause LP to fall so low at some point during the day that, despite Transco balancing actions, one or more users holding firm exit capacity would not be able to offtake gas. Security of supply would therefore be compromised.

We have worked closely with Transco to analyse the security of supply implications of the current balancing regime. The work has focussed on the extent of linepack variation and its causes. This report describes in detail our analysis of existing data, and modelling of future trends, to assess the probability that within-day profiling by power stations could lead to supply interruptions now or in the future, given Transco's existing policies concerning balancing actions.

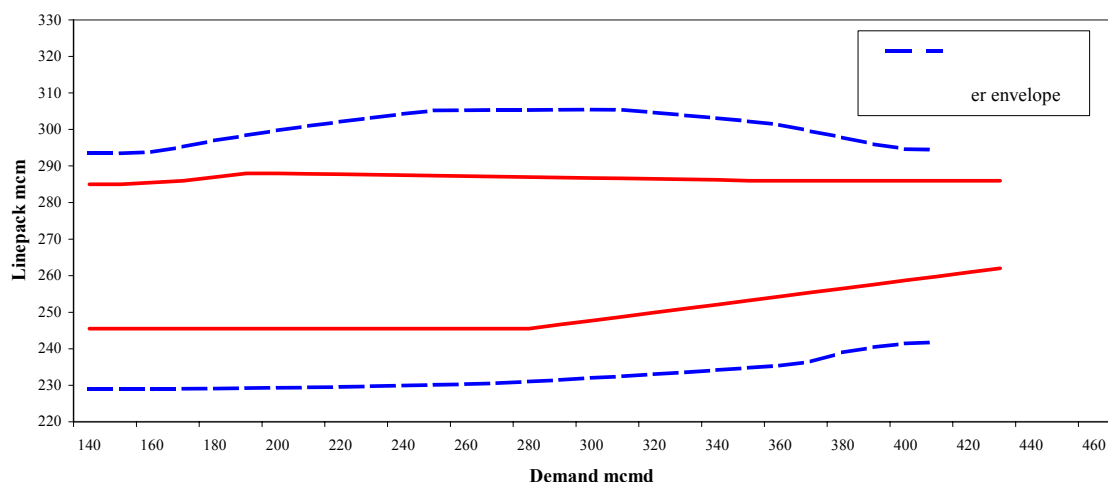
Range of Available LP

The range of available LP, *i.e.*, the minimum and maximum “safe” levels, will vary from day to day and hour to hour according to a large number of important criteria, including the location and temporal patterns of inputs and offtakes, availability of infrastructure, etc.²⁶ Available information can affect Transco management of the system and shipper behaviour with consequences for available LP. To help with this study, Transco has provided reasonable estimates of upper and lower bounds for safe system operation. Transco has indicated how the upper and lower bounds depend on daily demand, as shown by the “inner envelope” and “outer envelope” in Figure 1 below. In brief, operation within the inner envelope implies a negligible probability of failure, while operation outside the outer envelope presents a high probability of failure. The relationship shown between the envelope and demand is somewhat simplistic, but necessary for initial modelling.

Transco has a high degree of confidence that under most conditions, operation within the inner envelope is consistent with safe and secure system operation. However, it should be expected that some points within this envelope might not always be tolerated. Figure 1 also reflects on a particular configuration of the system. System expansion might change the envelopes. Annex I presents further caveats to the inner and outer envelopes.

²⁶ A separate section of the report discusses this point in greater detail.
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Figure 1: Upper and Lower Bounds for Available NTS LP²⁷



Correct interpretation of Figure 1 is important to the analysis in this report. LP outside the “inner envelope” implies not that supply failure is a certainty, but that there is a risk of supply interruption, which becomes increasingly significant the further LP falls. When LP is below the lower (inner) bound Transco cannot guarantee that the tools it has available to manage LP (OCM trades, compression, interruption of interruptible transportation contracts, use of LNG²⁸ etc) would be adequate to avoid the need for curtailment (supply failure).²⁹ However, the probability of curtailment may be relatively small if LP is only slightly below or above the lower bound, rising to near certainty as LP gets closer to the outer envelope.

The LP Buffer

To clarify exposition, it is useful to define the LP “buffer” as follows: at any point in time, the *available buffer* is the difference between LP at that time, and the minimum safe level of LP corresponding to that day’s demand (*i.e.*, the lower bound of the inner envelope). By definition, the *available buffer is the maximum amount that LP can fall within-day from its current level without introducing a positive probability of supply failure.*³⁰

²⁷ This figure is provided by Transco and is applicable to the NTS at October 2002.

²⁸ Note that the use of these tools is already implicit in the bounds shown in Figure 1.

²⁹ Conversely, if LP rises above the maximum level shown then there may be a risk of curtailing firm injections.

³⁰ In principle one could define an analogous concept for the upper bound, and denote these as respectively the lower and upper buffers. However, given that the focus of current concerns, and of this report, is on excessive depletion of LP, the terminology used here is unlikely to risk ambiguity.

The *opening buffer* is the difference between opening line pack (“OLP”), *i.e.*, the LP at the beginning of the gas day (0600), and the minimum “safe” level of LP corresponding to that day’s demand, *i.e.*, the lower bound of the inner envelope shown in Figure 1. By definition, the *opening buffer is the maximum amount that LP can fall below its opening level within the day, without introducing a positive probability of supply failure.*

Current Levels of Within-Day LP Usage

Table 1 shows the maximum “within-day depletion” (*i.e.*, the greatest dip caused during the gas day) for the NTS as a whole, and from each “sector”,³¹ in the gas year 10/01-9/02. It also shows the lowest opening buffer for that period, and the lowest buffer seen during any hour of that period.³² We note that the maximum LDZ depletions may have been unusually modest because of the mild winter of 2001/2.

Table 1: LP Usage (10/01-9/02)

<u>Maximum Depletions (MCM)</u>	
Beach	10.5
Rough	8.6
LDZ	8.0
CCGT	3.9
Total of Maximums	31.1
Aggregate Observed	16.2
<u>Buffer (MCM)</u>	
Lowest Opening	9.9
Lowest Observed	2.3

Notes:
Beach excludes Amoco input at Teeside.

A first observation is that the sum across all sectors of the individual maximum depletions of 31.1 MCM is very large, compared to either the range of available LP as indicated in Figure 1, let alone the minimum observed opening safety buffer of 9.9 MCM shown in Table 1. If the different sectors maximum depletions had coincided with the lowest opening buffer in a so-called “perfect storm”, supply failure would have been a near certainty. A less extreme coincidence of localised depletions could also create problems.

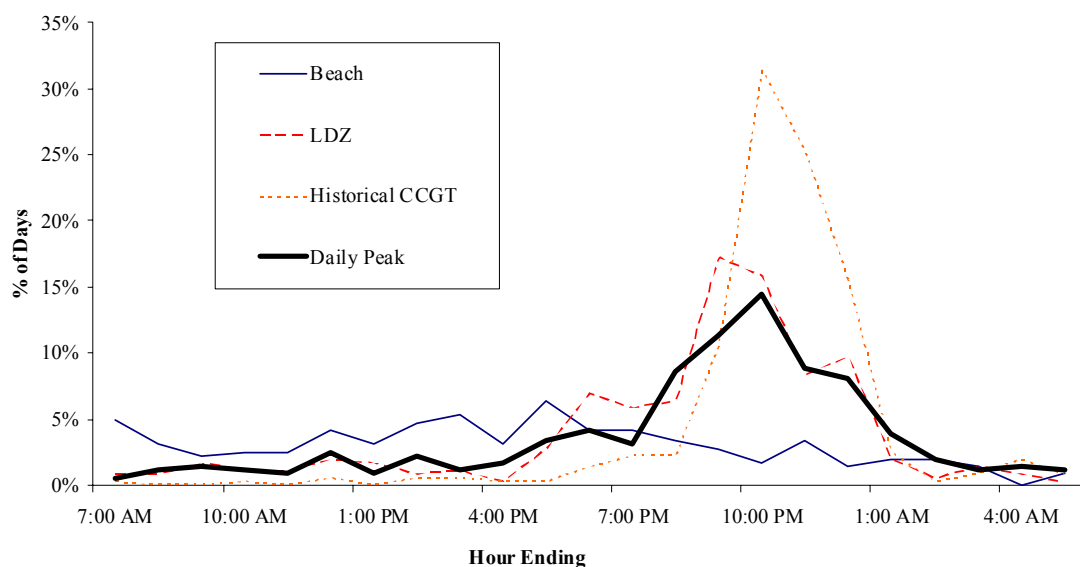
³¹ We divide NTS users into the following sectors: beach, storage (Rough), LDZs, CCGTs, industrial users and interconnectors. The latter two have relatively small impact, and our analysis focuses on the first four.

However, a second observation is that the maximum within-day dip experienced on the system as a whole was just 16.2MCM. Moreover, the minimum safety buffer observed during the period was 2.3, implying that LP never went below the lower safety bound. There was no “perfect storm”.

Further analysis of the data indicates that a “perfect storm” is extremely unlikely, for three reasons.

First, within a given day, different sectors tend to deplete (and build) at different times of day, as shown in Figure 2. LDZ and CCGT depletions tend to peak around 10pm, reflecting patterns of demand and the relation between LDZ and NTS diurnal storage designed into the system (and current Transco operations). The timing of beach depletion appears rather random, which would be consistent with an explanation that attributed a significant part of within-day beach profiling to random outages upstream of NTS entry points. This does not however imply that commercial incentives may not also play a significant role in beach profiling behaviour, as we discuss later in the report.

Figure 2: Timing of Peak Depletions (10/01-9/02)



Second, LP depletion by different sectors does not display significant positive correlation. On the contrary, on the days that are potentially “most dangerous”, there are significant negative correlations across sectors, as shown in Table 2³³

³² Annex 1 provides more detail on the exact definition of the “maximum daily depletion”, and the data underlying Table 1.

³³ Corresponding figures for all days of the year are shown in 0.

Table 2: Correlations of Within-Day Depletion Across Sectors (10/01-9/02)

					NTS Aggregate	
					Depletion	Demand
<u>Top 10% of Depletion Days</u>						
Beach	1.00	-0.34	-0.41	0.05	0.58	-0.20
Rough		1.00	-0.10	-0.11	0.30	0.10
LDZ			1.00	0.09	0.03	0.49
CCGT				1.00	0.16	-0.05
NTS Aggregate Depletion						-0.04

In particular, it appears that on days of high overall depletion, beach and/or storage tend to compensate for depletion caused by LDZs. This pattern is rather intuitive: on days where LDZ demand promises to exceed previous forecasts, one would expect shippers/storage operators to bring gas onto the system early in the day since:

- Shippers have strong incentives to avoid imbalance on such days, because cash-out prices are likely to be high. Bringing gas on early in the day provides some insurance against ending the day short (due for example to an off-shore supply interruption later in the day).
- Bringing extra gas on early in the day effectively gives the shipper a free option to sell additional spot gas later in the day. If spot prices rise during the day, the shipper may wish to sell extra gas into the market. However, if the shipper leaves it until later in the day to bring that gas on, it may not have sufficient capacity to bring on (by the end of the day) as much extra gas as it would like to sell. In contrast, if it brings on gas early in the day, it has the choice of selling the extra gas later in the day, or scaling back its flow rate later in the day if spot prices do not rise.

Third, the very low correlation between NTS aggregate depletion and demand shown in Table 2 may appear counter-intuitive, especially since on days of very high demand LDZ operations are expected to deplete the NTS LP.³⁴ However, this effect may be balanced by the way Transco chooses to set opening LP. The data suggest that opening LP tends to compensate for expected within-day depletion by LDZs, *i.e.*, Transco operates the system in such a way that on days when LDZ depletion is anticipated to be

³⁴ Table 2 relates to the days of highest depletion which are not necessarily the days of highest demand. This period may have included very few days when planned NTS diurnal provision will have been material because of the mild winter.

unusually high, Transco opens with a larger-than-usual buffer, as shown in Table 3.³⁵ Transco is able to pre-build LP against LDZ depletion in this way because such depletion is to a significant extent a programmed response to high demand, and therefore predictable from demand forecasts. Although it is not possible to predict demand perfectly, Transco's current operational practice attempts to anticipate high demand. Of course, LDZ depletion may be positively correlated with opening LP, simply because high opening LP allows Transco to permit larger depletion before undertaking corrective actions.

Table 3: Correlations between Opening Buffer and Within-Day Depletion (10/01-9/02)

	Opening Buffer
<u>Top 10% Depletion Days</u>	
Beach	-0.18
Rough	0.33
Beach and Rough	0.07
LDZ	0.38
CCGT	-0.17
NTS Aggregate Depletion	0.14
NTS Demand	0.36

Current Risk of Supply Interruption

The data presented above suggest that:

- Available LP is sufficient to deal with within-day depletion from any single sector.
- Available LP would not be sufficient to deal with very large simultaneous within-day depletions from multiple sectors.
- However, the pattern of behaviour across sectors makes large simultaneous within-day depletions from multiple sectors relatively unlikely: different sectors tend to have their associated large depletions on different days and at different times of day.
- Moreover, Transco tends to open the system with higher than average LP on days that are likely to see higher than average depletions.

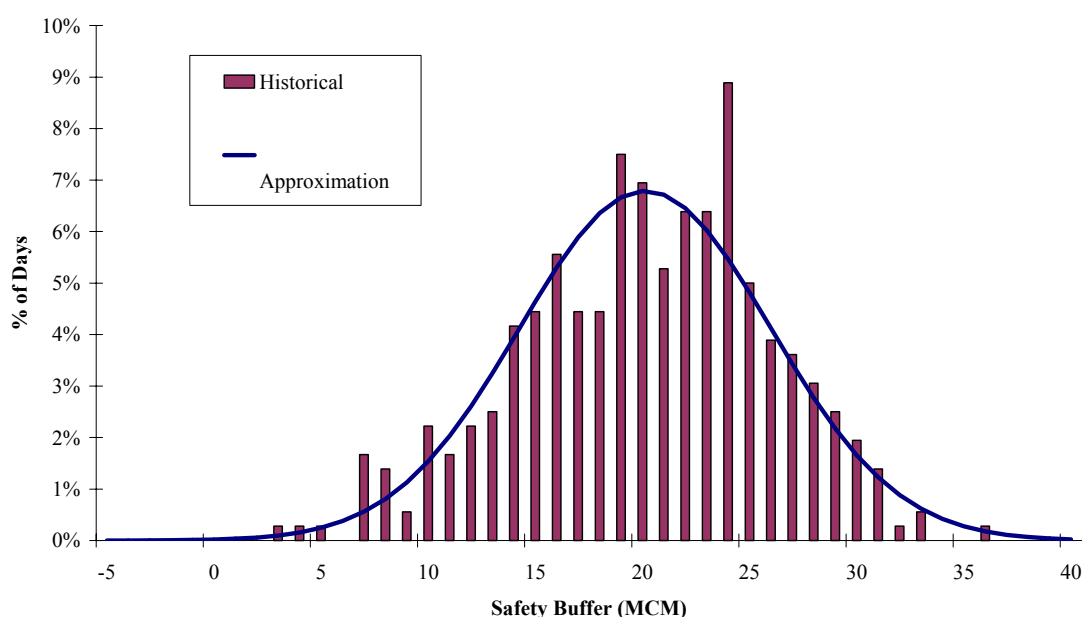
³⁵ The positive correlation between LDZ depletion and opening buffer indicates that the opening buffer tends to be larger on days when more LDZ depletion occurs (typically, days of high demand).

To go beyond these qualitative conclusions, we have performed a number of quantitative analyses. Each of these analyses involves extrapolation from historical data, and as such is subject to the weaknesses that affect any attempt at forecasting a potentially changing future based on limited and imperfect data concerning past behaviour. However, we believe that taken together, the various analyses give a reasonably robust assessment of the implications for system security of current patterns of within-day use of NTS LP.

Each of our analyses involved estimating a probability distribution for the “daily minimum buffer”, *i.e.*, the lowest point that LP reaches during the day, relative to the inner envelope. Given such a distribution, we can estimate the frequency with which LP will fall below the “inner envelope”, and (with an additional heuristic approximation), the risk of supply failure.³⁶ We have performed the following analyses:

1. *Normal Approximation:* We assume that the daily minimum buffer follows a normal distribution, and use historical data to estimate that distribution, as illustrated in Figure 3.

Figure 3: Normal Approximation



2. *Random Simulation:* We perform a large number of simulations of “hypothetical days”.³⁷ Each simulation entails randomly choosing four dates (“D1” through “D4”) in the

³⁶ The additional heuristic approximation involves an assessment of the probability of supply failure as a function of how far LP falls below the inner envelope. It is described later.

³⁷ For a more detailed exposition see the annexes.

period covered by our historical data. We then calculate what the impact on NTS LP would have been on a day that combined the D1 behaviour of the beach,³⁸ the D2 behaviour of the LDZs, the D3 behaviour of the CCGTs, and the D4 opening buffer.³⁹ For each such day we then calculate the daily minimum buffer. By repeating this simulation process many times, we build up an estimated probability distribution for the daily minimum buffer.

3. *Random Simulation (Combined beach and LDZs)*: The methodology above will reflect the different within-day timings of depletion behaviour across sectors, but ignores the negative correlations between certain sectors, in particular the very significant negative correlation between beach and LDZs. A simple modification is therefore to apply the same methodology, but to treat beach and LDZs as a single combined entity (*i.e.*, to combine the behaviour of beach-plus-LDZs on one randomly selected day with that of CCGTs on a second randomly selected day, and opening buffer on a third).

Additional details concerning the methodology are provided in an Annex. The results are summarised in Table 4.

Table 4: Estimated Risk of Supply Failure

		Random Days		
		Normal	Beach and	Beach and
		Approx- imation	LDZ Separate	LDZ Together
<u>Safety Buffer (MCM)</u>				
Average		19.6	19.6	20.0
Standard Deviation		5.9	5.8	5.5
Expected Number of Days (in 20 Years)				
When Depletions Exceed Safety Buffer		3	6	3
Expected Supply Failure Every X Years		61	27	107

Notes:

Based on Oct '01 to Sept '02 data.

³⁸ To simplify our calculations and exposition, from this point on we include Rough in the beach sector. Given the high negative correlation between depletions by Rough and beach (see Table 2) it would be misleading to treat them as independent.

³⁹ This is a slight over-simplification: the actual methodology involves choosing the opening LP for that day, and comparing it to the lower bound of the inner envelope for the hypothetical day's demand (as measured by total beach injection for the day).

The results shown in Table 4 suggest that, based on recent historical data, within-day profiling does not pose an unacceptable risk to security of supply. For example, the analysis based on the normal approximation suggests that LP can be expected to fall below the “inner envelope” three days every twenty years, and that an actual supply failure can be expected once every sixty-one years.⁴⁰ The results of the second analysis show that even ignoring the significant support that the beach provides to compensate for LDZ depletion on more “difficult” days, the probability of supply failure appears to be acceptably low. Taking this factor into account via the third analysis gives results similar to those produced from the normal approximation.

Because it ignores the most important feature of the sectoral interactions, *i.e.*, the negative correlation between beach and LDZs (see Table 2 and also Table 11), the second of these methods might over-estimate the risk of supply failure. Conversely, by combining beach and LDZ sectors the third method may underestimate the probability that a day of high LDZ depletion will coincide with relatively little support from the beach (for example, because outages restrict the ability of the beach to build LP in response to LDZ demand). The third of these methods may therefore under-estimate the risk of supply failure.

We recognize that our analysis involves less detail and sophistication than the Transco analysis concerning the one-in-twenty year standard. Our analysis may tend to overstate security by failing to consider localised line-pack issues. However, we believe that a reasonable conservative estimate of the risk of supply interruption due to within-day swing is between one in 27 and one in 107 years. We would expect the risk of interruption to be closer to the lower number of years in our range.

Future Trends in Within-Day LP Usage

Transco claims that within-day profiling has increased significantly since the introduction of RGTA. For example, simple extrapolation based on historical data would imply that post-RGTA a within-day depletion of more than 20MCM could be expected once every 21 years, while pre-RGTA the probability was essentially zero.⁴¹

Specific concerns have been raised about two possible changes in the patterns of NTS LP usage that could significantly increase the risk of supply failure. First, it is alleged that within-day profiling at the beach has increased significantly over the last few years, possibly in part as a result of reduced

⁴⁰ Recall that, as discussed earlier in this report, failure is by no means certain when LP falls below the “inner envelope”. Outside of the envelope Transco cannot guarantee security of supply, and the probability of supply failure increases the further LP falls below the envelope.

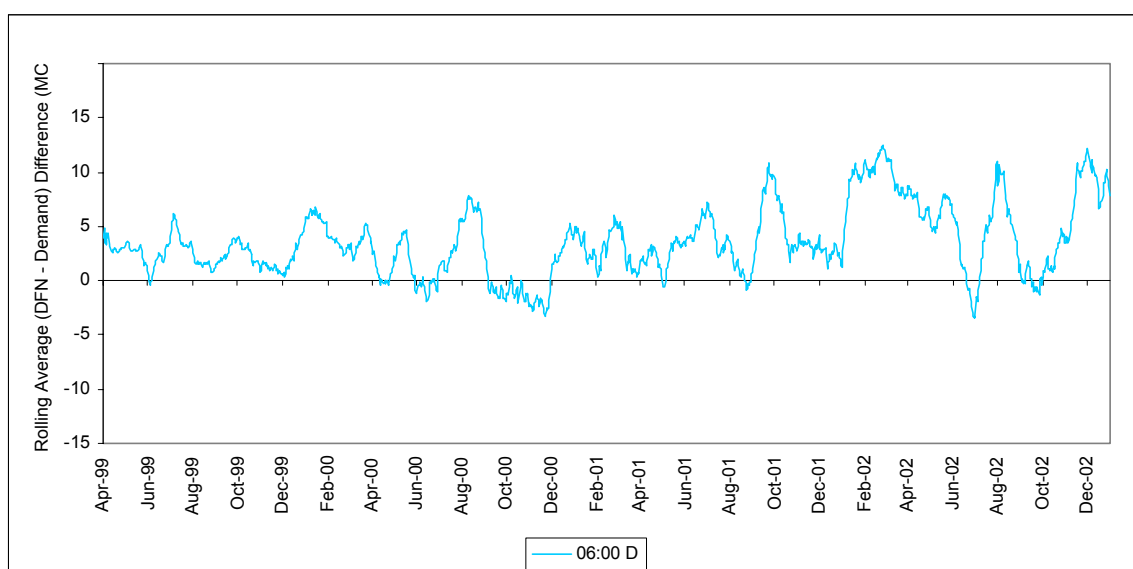
⁴¹ This is based on data on aggregate LP behaviour from 10/97-9/02. Our analysis uses a much shorter time series (10/01-9/02), partly because a breakdown by sector was only available for the shorter period, and partly because the changing behaviour over the last few years would make extrapolation from even a few years back potentially misleading.

investment in infrastructure upstream of the NTS. Second, a shift in the pattern of CCGT operation toward mid-merit would lead to increased within-day profiling by those generators. In addition, Transco has expressed concerns regarding a deterioration in the quality of information that it receives on intended gas flows.

Beach

Transco claims that beach profiling has increased over recent years. Unfortunately the data that Transco was able to provide us in relation to historical trends in beach profiling was relatively limited. However, the data shown in Figure 4 provides good evidence, albeit somewhat indirect.⁴²

Figure 4: DFN – Demand Difference⁴³

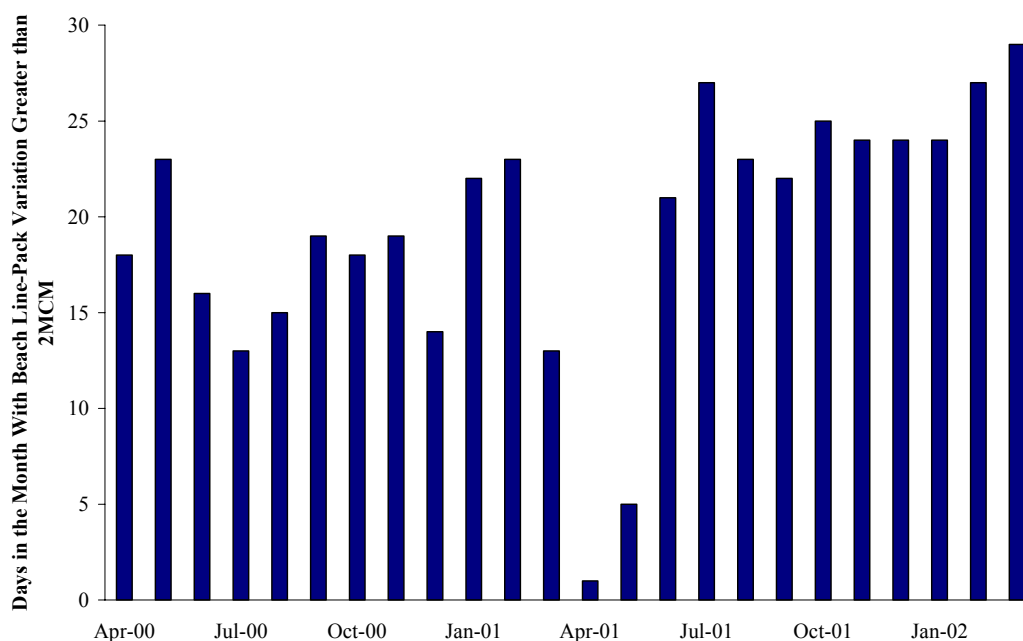


Further evidence can be seen in Figure 5, which shows a (moderately) noticeable rise in the number of days where beach profiling causes either line-pack depletion or build of more than 2MCM on the NTS from April 2000 to the present.

⁴² To interpret the data in this way, we rely on the following Transco explanation: (a) DFN 0600 notifications are a good proxy for early-day flow rates; (b) Demand is a good proxy for total daily beach throughput (so end-of-day imbalances can be ignored for this purpose). The DFN 0600 vs demand comparison is therefore in effect a comparison of early-day and average daily flow rates, and any discrepancy is a sign of profiling.

⁴³ This figure provided by Transco.

Figure 5: Days with Line-Pack Variation at the Beach Greater than 2MCM



Possible explanations for increasing profiling at the beach fall into two categories. First, physical factors such as increasing age of offshore equipment could reduce offshore reliability and increase variation in beach flows. Indeed the availability of free diurnal storage on the NTS itself reduces the incentive for operators to invest in and maintain offshore infrastructure. In the longer term one might expect an increase in offshore reliability as newer, longer offshore pipes come online (connecting the UK to Norwegian offshore fields).⁴⁴

Second, short-term commercial incentives could lead to deviation from constant flow rates. In a competitive market, there is a natural incentive to “front-load” gas early in the day, taking advantage of the free option to increase total daily input relative to forecast, in response to OCM prices.⁴⁵ However, when trading is relatively thin there may also be incentives to “back-load” in an attempt to push up prices and induce Transco actions.

However, in the absence of more complete information concerning offshore and beach behaviour, it is difficult to draw any strong conclusions as to likely future trends.

⁴⁴ However, more LP offshore also facilitates beach swing, so if shippers wish to backload gas they may have increased ability to do so.

⁴⁵ If a shipper brings more gas on early in the day, it can always reduce throughput later in the day. However, if it delays bringing gas on, it may not be able later in the day to increase flow as much as it would like (because of physical limitations on the maximum possible hourly flow rate). Front-loading gas therefore inherently provides more flexibility.

CCGTs

So long as CCGTs operate as baseload plant, running at/close to full capacity for a large part of the day, they have relatively little impact on within-day LP depletion. However, a shift away from baseload toward mid-merit would tend to increase the extent of within-day profiling by CCGTs, and thus contribute to further LP depletion. A CCGT at mid-merit would tend to operate only during peak periods of power demand, ranging approximately speaking from hour 3 to hour 14 of the gas day. Its gas offtake would therefore be very largely concentrated in the first half of the gas day, leading to increased LP depletion.

To estimate the impact on LP usage of a shift to mid-merit, we have used a detailed despatch model of the England & Wales system. The model combines:

- A database of installed capacity (including for each unit data on capacity and fuel type, and estimates of thermal efficiency).
- An hourly load series.
- Modelling of random outages.

The model predicts hourly despatch of each unit, allowing us to estimate total gas-fired generators gas offtake by the hour, and derive daily maximum LP depletion by CCGTs. Combining the model with historical data on hourly loads, we estimate the distribution of daily maximum LP depletion, and calculate the probability of extreme gas-fired generators linepack depletion episodes.

We perform this exercise under two different scenarios: CCGTs at baseload in the merit order, and CCGTs at mid-merit. We compare these scenarios with each other, and with historical data on CCGT LP usage. Our results are shown in Table 5.

Table 5: CCGT LP Depletion

	Average	Standard Deviation	Annual Maximum
Historical	1.3	0.8	3.9
Simulation: CCGTs Baseload	1.2	1.2	5.4
Simulation: CCGTs Mid-Merit	2.8	2.2	9.8

These results suggest that a shift to mid-merit would produce a very significant increase in CCGT within-day profiling, increasing the annual maximum swing caused by the CCGT sector by about 4.4MCM relative to baseload operation. We believe that this analysis is conservative and robust. The

estimated swing under the simulation of baseload operation is reasonably close to historical data, and the higher estimated variability is a sign of conservatism.⁴⁶ The results for mid-merit are consistent with (somewhat more extreme than) predictions from related approaches to estimating CCGT swing that we developed in conjunction with National Grid Transco.

Security of Supply Implications if CCGTs Move to Mid-Merit

We have repeated two of the security of supply analyses presented above, with the historical CCGT data replaced by the results from the simulations described above of the LP usage that could be expected from CCGT's if they were to shift to mid-merit.⁴⁷

Table 6: Estimated Risk of Supply Failure (1 in X years): Alternative CCGT Scenarios

	Normal Approx- imation	Random Days	
		Beach and LDZ Separate	Beach and LDZ Together
<u>Expected Supply Failure Every X Years</u>			
Historical	61	27	107
Baseload	n/a	19	39
Mid-Merit	n/a	5	7

Notes:

Based on Oct '01 to Sept '02 data.

These results indicate a relatively high estimated risk of supply failure when CCGTs operate at mid-merit. As discussed earlier, it is reasonable to use the two “random day” methods to provide a range of values, implying a risk of supply failure somewhere between one day in 5 years and one day in 7 years.

⁴⁶ It is also rather intuitive. Simple despatch modelling is likely to predict rather homogeneous behaviour across CCGTs. In practice there are many factors that make a given genset run at different times or levels of output from those predicted by simple despatch modelling. This greater heterogeneity of behaviour will tend to “smooth” the aggregate behaviour of the CCGT sector within the day, leading to less extreme variation than predicted by the model.

⁴⁷ We did not repeat the “normal approximation” analysis, because it requires a very heroic assumption that we can backcast on a day-by-day basis what CCGT swing would have been in the year 10/01-9/02, had CCGTs been at mid-merit.

It may seem counter-intuitive that our baseload simulation gives higher variance of depletion than seen in the historical data (as shown in Table 5), but lower overall risk of supply interruption. The explanation appears to lie in the detailed forecasts of hour-by-hour operation.⁴⁸ The natural conclusion however is that using our simulations in the “random days” analysis risks under-estimating the probability of supply failure.

The chief conclusion from this analysis is therefore that *if all CCGTs move to mid-merit, the risk of supply failure is likely to be significantly higher than one day in twenty years.*

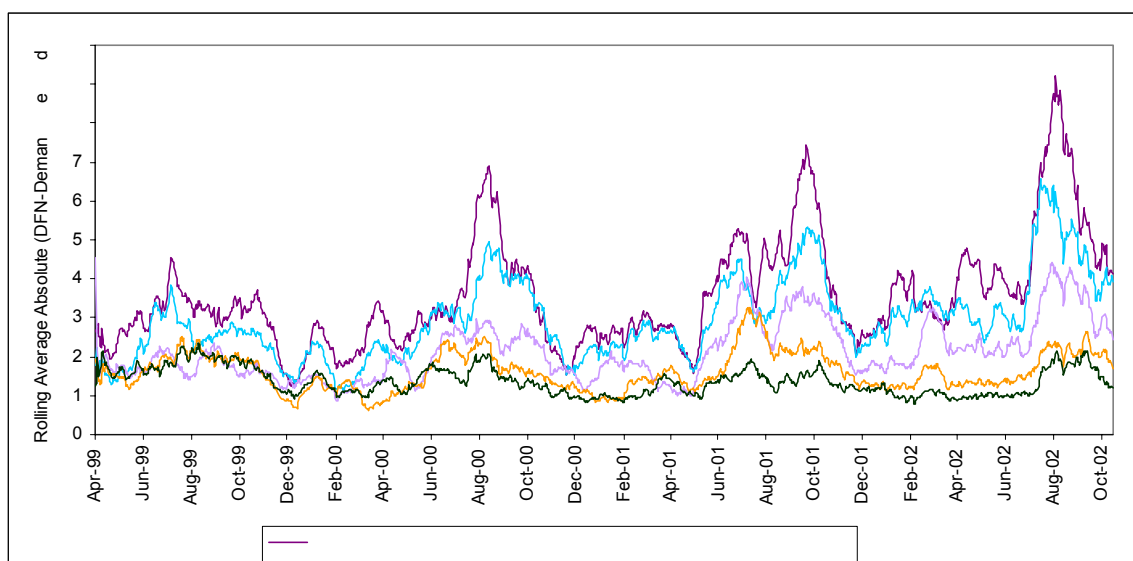
LP Usage and Information Provided to Transco

Additional related concerns have been expressed by Transco concerning deterioration in the quality of information that it receives on intended gas flows. For example, the discrepancies between demand and DFN nominations ahead of the day and early in the day appear to have increased over time, as illustrated in Figure 6. This trend is itself likely to follow from increased profiling. In the absence of any mechanism that would allow or incentivise most shippers to inform Transco of their intended within-day profile, their DFN nominations before and early in the gas day will not be reliable indicators of intended daily total throughput (for a shipper intending to profile within the day).

Transco claims that the informational problems aggravate the difficulties it faces in within-day balancing. On a qualitative level this claim is entirely plausible. However, it is beyond the scope of this report to quantify the impact of any informational problems facing Transco, or to analyse the likely effect of recent or proposed changes such as the “Incentivised Nomination Scheme”.

⁴⁸ In particular, our model tends to predict greater variability in LP depletion than seen historically, but with maximum daily depletion occurring earlier in the day than seen historically (and therefore tending to coincide less with maximum daily depletion by other sectors, in particular LDZs).

Figure 6: DFN/Demand Absolute Difference (Percentage of Output)⁴⁹



Conclusions and Recommendations

Security of Supply

Our analysis, based on recently observed performance, suggests that *current patterns of within-day swing do not pose an unacceptable threat to system security*. If recent events are indicative of the future, and current behaviours persist, then the probability of supply interruption resulting from within-day LP depletion is less than one day in twenty years.

While within-day swing has increased since the introduction of RGTA, there is limited evidence to suggest that this is an ongoing trend rather than a one-off “step” shift in behaviour. In particular, available evidence on beach behaviour and its underlying determinants is too weak to draw firm conclusions of any kind.

However, *future increases in within-day swing could increase the risk of supply failure to unacceptable levels*. In particular, our analysis indicates that a shift in the merit order that saw CCGTs move to mid-merit would be likely to increase linepack utilisation to such an extent that the probability of supply interruption from within-day LP depletion would significantly exceed one day in twenty years. This analysis assumes that other network sectors do not change materially.

⁴⁹ This figure provided by Transco.
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Indicators of Increasing Risk

Because our analysis implies a potential future increase in risk, it makes sense to try to identify a set of “leading indicators” that would give some advance warning of such an increase. We have identified the following candidate indicators:

- *Gas-coal forward spread.* Our analysis indicated that the position of CCGTs in the merit order is a key determinant of within-day swing. Forward prices for gas and coal provide the best single prediction of when gas is likely to move to mid-merit.
- *Expiration/renegotiation of CCGT’s “legacy contracts”.* Many CCGT’s still have legacy contracts that provide gas at below-market prices, and contain resale restrictions.⁵⁰ These contracts will tend to keep the CCGT’s higher in the merit order than would be implied by spot fuel prices. As they expire or are renegotiated (increasingly likely, given the changing “spark-spread”), the CCGT’s will therefore move down the merit order.
- *Changes in UK installed capacity.* Such changes will also affect the merit order and CCGT swing on the NTS.
- *Changes in patterns of gas use in Ireland.* Changes in the composition of demand in Ireland, such as the closure of a fertiliser factory or addition of a new CCGT, could lead to increased swing at the Moffat interconnector.
- *Spot and forward spreads across the Bacton-Zeebrugge interconnector.* Changes in the level and volatility of these spreads imply changes in interconnector use.
- *Available information on reliability of offshore infrastructure.* The lack of information and information-gathering powers makes it difficult to assess trends in beach behaviour. However, indicators that may be available publicly or via the DTI, such as the reliability and average age of infrastructure, and the extent of physical diversification of supply across multiple offshore sources, will shed some light on likely changes in behaviour.
- *Within-day swing on a sector-by-sector basis.* If within-day depletion by two or more individual sectors increases, the effect may be somewhat mitigated (and therefore masked) if new extremes of behaviour by each sector happen not to coincide. It may therefore take longer

⁵⁰ Without resale restrictions, the opportunity cost of burning gas would be the current spot price, not the contract price. With resale restrictions, the opportunity cost is the contract price (or its variable component, which may be even lower if take-or-pay conditions are binding).

for these increases to become visible in data at the aggregate NTS level than in data at a sector-by-sector level.

- *Correlation of depletions across sectors.* These have played a major role in our analysis, and should be monitored on an ongoing basis.

Finally, there may also be a case for requesting Transco to engage in much more detailed modelling of within-day flows and their security-of-supply implications, as a next step beyond the kind of analysis contained in this report. Transco should also be encouraged to consider proposing incremental reforms to the balancing regime and its own operations that can be implemented while imposing zero or minimal burdens on shippers. For example, using National Grid data to forecast CCGT operations could provide valuable advance warning on days when CCGTs produce unusually high swing. Combining this with Transco's existing ability to forecast "difficult days" (based at least in part on knowledge of programmed LDZ operations), it may be possible to follow the Dutch example by formulating more stringent rules that apply only on such days.

Annex I Range of Available LP

This section explains in more detail the derivation and significance of the inner and outer envelopes shown in Figure 1.

Interpretation

LP outside the “inner envelope” implies not that supply failure is a certainty, but that there is a risk of supply interruption, which becomes increasingly significant the further LP falls. When LP is below the lower bound Transco cannot guarantee that the tools it has available to manage LP (OCM trades, compression, interruption of interruptible transportation contracts, use of LNG etc) would be adequate to avoid the need for curtailment.⁵¹⁵² However, the probability of curtailment, although material, remains relatively small if LP is only slightly below the bound, rising to near certainty if LP is very far below the bound. The “outer envelope” shown in Figure 1 represents Transco’s estimate of the level of LP at which supply failure becomes almost certain. Transco states that:

The inner envelope represents a very high probability of secure and safe operation consistent with prudent operation but facilitating as far as is practical the workings of the *within-day* gas market and the commercial freedom of shippers. Allowing linepack to deplete outside of this range even by modest amounts should be expected to materially increase the risk of failure. Transco’s assessment is that national linepack depletion close to the outer envelope would almost certainly lead to a supply failure.

The region between the inner and outer bounds therefore represents the linepack band in which security of supply is at risk. To assist in our analysis, Transco has suggested a heuristic interpolation between the negligible probability of failure represented by the inner envelope and the almost certain probability of failure represented by the outer envelope. Transco has reasoned that the likelihood of failure will at first rise slowly, then accelerate as LP approaches the outer envelope. Once the likelihood of failure is already extremely high, further movement toward the outer envelope will have a more modest incremental impact.

⁵¹ Conversely, if LP rises above the maximum level shown then there may be a risk of curtailing firm injections.

⁵² Note that significant use of these tools is already implicit in the bounds shown in Figure 1.

In this report we use an alternative heuristic interpolation (which in our applications is more conservative than the one suggested by Transco) to estimate the probability of supply failure. As can be seen from Figure 1, the width of the linepack band between the lower inner envelope and the lower outer envelope varies (according to the level of demand) between 14.5MCM and 18.9MCM. We understand that the risk of failure cannot be 0% within the inner envelope and 100% on the outer. However, for the purpose of our analysis we use a straight line interpolation between 0% and 100%, implying that each 1MCM below the inner bound gives (no more than) a 7% probability of supply failure.⁵³ In comparison with the heuristic suggested by Transco, this gives a higher probability of failure for small dips below the inner envelope (and a lower probability of failure for large dips). Since the distributions we estimate imply mostly small dips, the effect is that our calculations are more conservative (estimate higher probability of supply failure) than they would have been if we used the heuristic suggested by Transco.

Because of the lack of data, this interpolation is necessarily heuristic. One might therefore argue for a more “precautionary” approach that (in effect) assumed supply failure every time LP drops outside of the inner envelope. This would simplify calculations, because one would simply need to estimate the probability of the LP buffer falling below zero. However, it would be fundamentally misleading. First, Transco have indicated that, under favourable circumstances, it could manage the system outside of the inner envelope. Although it is logically possible that the probability of failure would jump very quickly from close to zero to close to one, we understand that Transco considers it implausible. Second, recall that the inner envelope is derived from looking at the extremes experienced over one year. The extremes experienced in one year will necessarily be less than over the course of twenty years.⁵⁴ As the system already meets a one-in-twenty-year standard, it must have the ability to tolerate some performance outside the inner envelope.

Derivation of Inner and Outer Envelopes

The lower line of the inner envelope is derived by Transco from historical data for the gas year 10/01-9/02, by fitting a line below a scatterplot of minimum daily NTS LP vs daily demand for the year (with some scaling adjustments to take into account system changes during/after the year). The upper line is derived by the same methodology applied to maximum daily NTS LP. The methodology therefore implicitly assumes that the extremes of within-day NTS LP experienced during the year 10/01-9/02 were at or very close to the outer limit of 100% security.

⁵³ Since $14.5 \times 0.07 \approx 1$.

⁵⁴ Since the statistical variability in LP is necessarily much greater over twenty years than over one year, the distribution of LP over twenty years will necessarily show more extreme variation than over one year, so if one year defines the maximum safe variation, over twenty years LP is guaranteed to exceed it.

The lower line of the outer envelope is obtained by applying the same methodology to a different scatterplot. In this case, the “y-values” of each point on the scatterplot represents the sum of the minimum observed linepacks across each NTS zones, which will have been non-coincident. Transco’s assessment is that national linepack depletion close to the outer envelope would almost certainly lead to a supply failure.

Caveats

In association with the “inner envelope” shown in Figure 1, Transco attaches a series of caveats. Detailed evaluation of these caveats lies beyond the competence of The Brattle Group. However, based on our understanding of the system they appear reasonable and plausible, and we have no reason to doubt them. Transco’s caveats are as follows (text in italics, provided directly by Transco):

The Actual NTS Linepack range will represent the available Linepack subject to the following caveats.

The available Linepack;

- *will be limited by compressor outages (and pipe outages) particularly
 - *Summer effects (demands up to 300 Mscm/d) due to planned maintenance*
 - *Winter effects (generally higher demands) due to unplanned outages.**
- *is dependent on supply patterns, for example higher northern entry flows or interconnector imports will reduce Linepack availability*
- *is dependent of demand patterns*
- *is location dependent and hence full utilization can only occur with appropriate combinations of [profiling] Offtakes and Entry Points flows.*
- *is not fully available at all times in a gas day: the maximum depletion could only occur at approximately 22:00 hours coincident with minimum LDZ pressures.*
- *is dependent on the opening level of National linepack and its zonal distribution.*

By definition the construction of the envelope Transco use for the balancing action decision-making process will take account of the most favourable circumstances, particularly with regard to supply and demand patterns, opening positions and distribution of linepack. Thus less favourable circumstances should be expected to reduce available linepack flexibility.

The balancing action decision making process needs to take account of all the uncertainties associated with projected linepack levels e.g. supply side and offtake flow rate uncertainties. Additionally uncertainty in respect of the prevailing linepack levels within our Gas Transportation Management System (GTMS) arising from uncertainty associated with the calculation input variables, primarily system pressures would mean that Transco would need to take a balancing action earlier than might be considered absolutely necessary. This would be consistent with prudent system operation given the implications of system failure. Thus operational processes would be developed so that Transco would not plan to precisely hit the extremes of the operational envelope

Annex II: Current Use of LP

Methodology: Maximum Within-Day depletion

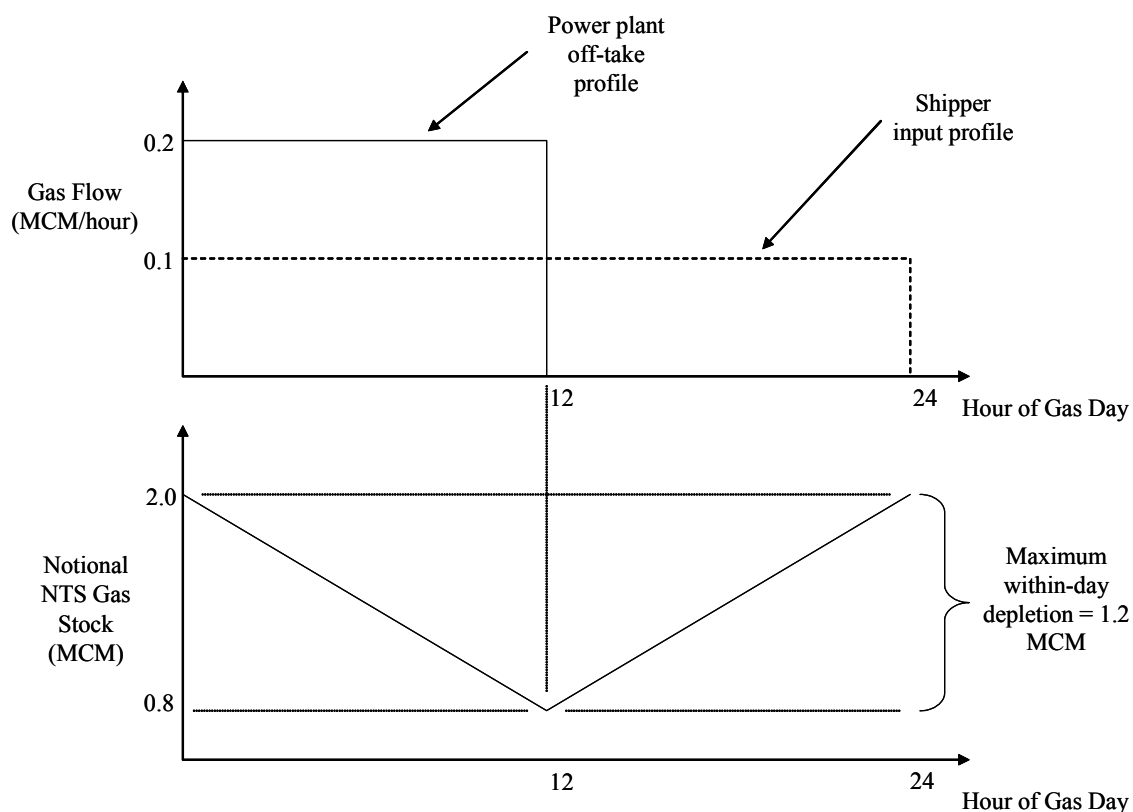
We measure the maximum “within-day depletion” for the NTS as a whole, and from each “sector”,⁵⁵ in the gas year 10/01-9/02. Within-day depletions arise from profiling at the beach or by consumers. For example, suppose a gas-fired power plant contracts with a shipper for gas supplies of 2.4MCM/day. Also, suppose that the power plant operates at full capacity for the first 12 hours of the day consuming all of its contracted supply, before shutting down for the second 12 hours of the day. Figure 7 illustrates the power plant’s gas off-take profile, together with a hypothetical flat shipper input profile.

Although the power plant consumes all its contracted supply in only 12 hours, the hypothetical shipper brings gas onto the NTS at a constant hourly rate, making good by the end of the day its 2.4MCM contractual commitment.⁵⁶ Throughout the period when the power plant takes off gas at a higher rate than the shipper brings gas onto the system, the NTS gas stocks deplete. The “maximum within-day depletion” caused by the power plant’s profiling is simply the maximum cumulative depletion of NTS gas-stocks in the day.

⁵⁵ We divide NTS users into the following sectors: beach, storage (Rough), LDZs, CCGTs, industrial users and interconnectors. The latter two have relatively small impact, and our analysis focuses on the first four.

⁵⁶ The hypothetical flat shipper profile, is not an assumption about shipper behaviour, but a device that allows us to separate out profiling by different types of user. For example, it allows us to look separately at the impact of CCGT and beach profiling, if both occur. Without this method, we would only be able to see the change in LP caused by hourly differences between beach input and CCGT offtake.

Figure 7: Maximum Within-day Depletion



Current Use of LP: Descriptive Statistics

Below we present a series of descriptive statistics summarising current use of LP.

Figure 8 shows the distribution of the maximum daily depletion by each sector, and for the NTS overall. For example, the figure indicates that the beach sector's maximum daily depletion was above 5MCM on approximately 10% of days in the year 10/01-9/02.

Figure 8: Distribution of Maximum Daily Depletion (Sectoral and Overall, 10/01-9/02)

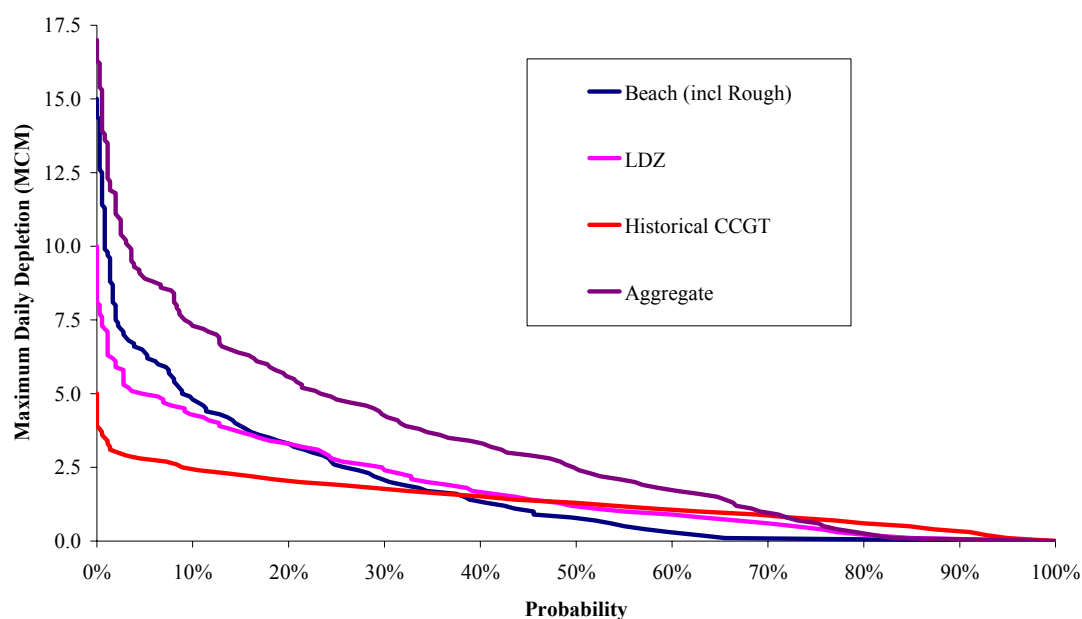


Table 7 summarises key features of each of these distributions. Tables 8, 9 and 10 provide additional descriptive statistics

Table 7: Maximum Daily Depletion (MCM)

	Max	Average	St Dev
Opening Buffer	9.90	22.81	4.99
Beach (incl Rough)	14.35	1.69	2.27
LDZ	8.02	1.76	1.68
CCGT	3.90	1.35	0.80
Aggregate Depletion	18.63	2.39	5.67

Notes:

Based on Oct' 01 to Sept '02 data.

2nd and 3rd November 2001, 18th May 2002, and 30th and 31st

August 2002 not considered because of data problems.

Beach excludes Amoco stream at Teeside.

Table 8: Descriptive Maximum Daily Depletion Statistics (MCM)

			Opening Buffer			Beach (incl Rough)		
			Max	Average	St Dev	Max	Average	St Dev
<u>Winter</u>								
	Weekdays	[1]	14.78	25.77	3.97	12.57	2.10	2.71
	Weekdays with High NTS Demand	[2]	14.78	25.80	4.99	8.07	2.65	2.94
	Weekends and Bank Holidays	[3]	13.04	25.60	4.37	14.35	1.44	2.46
	All Days	[4]	13.04	25.71	4.10	14.35	1.89	2.65
<u>Summer</u>								
	Weekdays	[5]	9.90	19.55	4.94	9.87	1.91	2.19
	Weekdays with High NTS Demand	[6]	n/a	n/a	n/a	n/a	n/a	n/a
	Weekends and Bank Holidays	[7]	9.95	20.44	4.31	4.31	0.97	1.31
	All Days	[8]	9.90	19.83	4.77	9.87	1.61	2.00
<u>Shoulder</u>								
	Weekdays	[9]	14.31	22.16	4.02	11.36	1.67	1.98
	Weekdays with High NTS Demand	[10]	n/a	n/a	n/a	n/a	n/a	n/a
	Weekends and Bank Holidays	[11]	15.64	21.49	3.38	5.32	0.99	1.48
	All Days	[12]	14.31	21.98	3.86	11.36	1.48	1.88
<u>All Seasons</u>								
	Weekdays	[13]	9.90	22.77	5.08	12.57	1.92	2.37
	Weekdays with High NTS Demand	[14]	14.78	25.80	4.99	8.07	2.65	2.94
	Weekends and Bank Holidays	[15]	9.95	22.88	4.78	14.35	1.17	1.93
	All Days	[16]	9.90	22.81	4.99	14.35	1.69	2.27

Notes and Sources:

Winter comprises November, December, January, February and March. Summer comprises June, July, August and September. Shoulder comprises April, May and October.

High NTS demand refers to 10% of days with highest demand.

2nd and 3rd November 2001, 18th May 2002, and 30th and 31st August 2002 not considered because of data problems.

Table 9: Descriptive Maximum Daily Depletion Statistics Cont'd (MCM)

			LDZ			CCGT		
			Max	Average	St Dev	Max	Average	St Dev
<u>Winter</u>								
	Weekdays	[1]	7.66	3.06	1.72	3.90	1.71	0.80
	Weekdays with High NTS Demand	[2]	7.22	3.70	2.20	2.94	2.13	0.58
	Weekends and Bank Holidays	[3]	8.02	2.66	1.88	2.28	0.77	0.55
	All Days	[4]	8.02	2.93	1.78	3.90	1.41	0.85
<u>Summer</u>								
	Weekdays	[5]	4.03	0.78	0.72	3.02	1.65	0.73
	Weekdays with High NTS Demand	[6]	n/a	n/a	n/a	n/a	n/a	n/a
	Weekends and Bank Holidays	[7]	1.75	0.42	0.42	3.21	1.40	0.84
	All Days	[8]	4.03	0.66	0.66	3.21	1.57	0.77
<u>Shoulder</u>								
	Weekdays	[9]	4.55	1.38	1.21	2.55	1.08	0.58
	Weekdays with High NTS Demand	[10]	n/a	n/a	n/a	n/a	n/a	n/a
	Weekends and Bank Holidays	[11]	3.35	1.04	0.90	1.54	0.60	0.45
	All Days	[12]	4.55	1.28	1.14	2.55	0.95	0.59
<u>All Seasons</u>								
	Weekdays	[13]	7.66	1.87	1.67	3.90	1.52	0.77
	Weekdays with High NTS Demand	[14]	7.22	3.70	2.20	2.94	2.13	0.58
	Weekends and Bank Holidays	[15]	8.02	1.52	1.66	3.21	0.95	0.73
	All Days	[16]	8.02	1.76	1.68	3.90	1.35	0.80

Notes and Sources:

Winter comprises November, December, January, February and March. Summer comprises June, July, August and September. Shoulder comprises April, May and October.

High NTS demand refers to 10% of days with highest demand.

2nd and 3rd November 2001, 18th May 2002, and 30th and 31st August 2002 not considered because of data problems.

Table 10: Descriptive Maximum Daily Depletion Statistics Cont'd (MCM)

			Aggregate Depletion		
			Max	Average	St Dev
<u>Winter</u>					
	Weekdays	[1]	17.95	3.44	5.57
	Weekdays with High NTS Demand	[2]	17.66	6.07	5.40
	Weekends and Bank Holidays	[3]	17.49	1.83	5.07
	All Days	[4]	17.95	2.93	5.47
<u>Summer</u>					
	Weekdays	[5]	18.63	3.05	6.42
	Weekdays with High NTS Demand	[6]	n/a	n/a	n/a
	Weekends and Bank Holidays	[7]	10.66	0.04	4.75
	All Days	[8]	18.63	2.10	6.11
<u>Shoulder</u>					
	Weekdays	[9]	17.70	2.24	5.27
	Weekdays with High NTS Demand	[10]	n/a	n/a	n/a
	Weekends and Bank Holidays	[11]	11.04	0.96	5.30
	All Days	[12]	17.70	1.89	5.31
<u>All Seasons</u>					
	Weekdays	[13]	18.63	3.00	5.81
	Weekdays with High NTS Demand	[14]	17.66	6.07	5.40
	Weekends and Bank Holidays	[15]	17.49	1.01	5.08
	All Days	[16]	18.63	2.39	5.67

Notes and Sources:

Winter comprises November, December, January, February and March. Summer comprises June, July, August and September. Shoulder comprises April, May and October. High NTS demand refers to 10% of days with highest demand.

2nd and 3rd November 2001, 18th May 2002, and 30th and 31st August 2002 not considered because of data problems.

Table 2 (in the main body of this report) shows correlations of depletions across sectors and with aggregate demand, for the 10% of days with highest depletion. The corresponding correlations for all days are shown in Table 11.

Table 11: Correlations of Within-Day Depletion Across Sectors (10/01-9/02)

	Beach	Rough	LDZ	CCGT	NTS Aggregate	
					Depletion	Demand
Beach	1.00	0.14	-0.10	0.21	0.71	0.06
Rough		1.00	0.11	0.09	0.50	0.34
LDZ			1.00	0.11	0.34	0.58
CCGT				1.00	0.39	0.06
NTS Aggregate Depletion						0.32

Table 3 (in the main body of this report) shows correlations between different sectors and the opening buffer for the 10% of days with highest depletion. The corresponding correlations for all days are shown in Table 12.

Table 12: Correlations between Opening Buffer and Within-Day Depletion (10/01-9/02)

	Opening Buffer
Beach	-0.17
Rough	0.12
Beach and Rough	-0.07
LDZ	0.33
CCGT	-0.09
NTS Aggregate Depletion	0.00
NTS Demand	0.47

Annex III: Methodology for Probabilistic Analysis

Random Simulation

Table 13: Sample Hypothetical Day

Beach (incl Rough) Day	29-Jul-02						
LDZ Day	9-Feb-02						
CCGT Day	20-Dec-01						
Opening Safety Buffer Day	13-Sep-02						
Opening Safety Buffer (MCM) [1]	24.18						
						Cummulative NTS Line- Pack	
		Hourly Depletion (MCM)					
	Beach (incl					Depletion	Safety Buffer
Hour of Gas Day	Rough)	LDZ	CCGT	Total	(MCM)	(MCM)	
	[A]	[B]	[C]	[D]	[E]	[F]	
				[A]+[B]+[C]	[E]t-1 +[D]t	[1]+[E]	
1	0.10	-0.13	0.29	0.25	0.25	24.43	
2	0.30	-0.37	-0.11	-0.18	0.07	24.25	
3	0.19	-0.27	-0.43	-0.51	-0.44	23.74	
4	0.30	-0.28	-0.64	-0.62	-1.06	23.12	
5	0.37	-0.14	-0.76	-0.53	-1.59	22.59	
6	0.21	-0.17	-0.58	-0.54	-2.13	22.05	
7	-0.02	-0.16	-0.40	-0.58	-2.71	21.47	
8	-0.01	-0.08	-0.33	-0.42	-3.13	21.05	
9	0.70	-0.05	-0.18	0.47	-2.67	21.51	
10	0.30	-0.07	-0.35	-0.12	-2.79	21.39	
11	-0.07	-0.18	-0.76	-1.02	-3.80	20.38	
12	-0.02	-0.22	-0.82	-1.06	-4.86	19.32	
13	0.03	-0.18	-0.63	-0.78	-5.64	18.54	
14	0.00	-0.07	-0.28	-0.35	-5.99	18.19	
15	-0.24	-0.01	-0.06	-0.31	-6.30	17.88	
16	-0.17	0.09	0.20	0.12	-6.17	18.01	
17	-0.38	0.14	0.27	0.03	-6.14	18.04	
18	-0.31	0.20	0.51	0.40	-5.74	18.44	
19	-0.13	0.16	0.65	0.68	-5.06	19.12	
20	-0.26	0.25	0.70	0.69	-4.38	19.80	
21	-0.14	0.36	0.79	1.01	-3.36	20.82	
22	-0.22	0.42	0.89	1.09	-2.28	21.90	
23	-0.25	0.37	0.97	1.09	-1.18	23.00	
24	-0.25	0.38	1.06	1.18	0.00	24.18	

Notes:

Beach excludes Amoco input at Teeside.

Each simulation entails randomly choosing four dates (“D1” through “D4”) in the period covered by our historical data. We then calculate what the impact on NTS LP would have been on a day that combined the D1 behaviour of the beach,⁵⁷ the D2 behaviour of the LDZs, the D3 behaviour of the CCGTs, and the D4 opening buffer.⁵⁸ For each such day we then calculate the daily minimum buffer.

⁵⁷ We include Rough in the beach sector.

⁵⁸ This is a slight over-simplification: the actual methodology involves choosing the opening LP for that day, and comparing it to the lower bound of the inner envelope for the hypothetical day’s demand (as measured by total beach injection for the day).

By repeating this simulation process many times, we build up an estimated probability distribution for the daily minimum buffer.

Random Simulation (Combined beach and LDZs)

The methodology above will reflect the different within-day timings of depletion behaviour across sectors, but ignores the negative correlations between certain sectors, in particular the very significant negative correlation between beach and LDZs. A simple modification is therefore to apply the same methodology, but to treat beach and LDZs as a single combined entity, as illustrated in Table 14.

Table 14: Sample Hypothetical Day (Combined beach and LDZs)

Beach and LDZ Day	29-Jul-02				
CCGT Day	20-Dec-01				
Opening Safety Buffer Day	13-Sep-02				
Opening Safety Buffer (MCM) [1]	24.18				
				Cummulative	
				NTS Line-	
				Pack	
		Hourly Depletion (MCM)			
	Beach and			Depletion	Safety Buffer
Hour of Gas Day	LDZ	CCGT	Total	(MCM)	(MCM)
	[A]	[B]	[C]	[D]	[E]
			[A]+[B]	[D]t-1	+ [C]t
					[1]+[D]
	1	-0.03	0.29	0.26	24.44
	2	0.13	-0.11	0.02	24.46
	3	0.07	-0.43	-0.36	24.10
	4	0.18	-0.64	-0.46	23.65
	5	0.27	-0.76	-0.49	23.15
	6	0.09	-0.58	-0.48	22.67
	7	-0.06	-0.40	-0.45	22.21
	8	0.00	-0.33	-0.33	21.89
	9	0.76	-0.18	0.58	22.47
	10	0.43	-0.35	0.08	22.54
	11	0.01	-0.76	-0.75	21.79
	12	0.10	-0.82	-0.72	21.07
	13	0.13	-0.63	-0.50	20.57
	14	0.04	-0.28	-0.24	20.32
	15	-0.20	-0.06	-0.27	20.06
	16	-0.16	0.20	0.04	20.10
	17	-0.39	0.27	-0.12	19.98
	18	-0.32	0.51	0.19	20.17
	19	-0.14	0.65	0.50	20.67
	20	-0.28	0.70	0.42	21.09
	21	-0.10	0.79	0.69	21.78
	22	-0.15	0.89	0.74	22.53
	23	-0.17	0.97	0.80	23.33
	24	-0.20	1.06	0.85	24.18

Notes:

Beach includes Rough but excludes Amoco input at Teeside.

Annex IV: Limitations of Analysis

As with any empirical modelling, the analysis in this report is restricted by the extent and quality of available data, and the necessary methodological reliance on a number of approximations and simplifications. While we believe that the results are adequately robust and reliable, we note for the sake of completeness and transparency the following limitations:

- The analysis is based on only a single year's data. While this is in part due to limited data availability, it is questionable whether a longer time series would have been of much value, because of the rapidly changing environment.
- The use of 1 year's data to estimate Long-run statistical distributions may understate risk by under-estimating the variance in the distributions. This is likely to be the case for the analysis based on "random days", which implicitly assumes that the one year observed distribution is the true distribution.
- However, the analysis also contains an implicit assumption that Transco has no additional ability to control opening LP. A fuller assessment of risk and the potential for increased risk should take into account the fact that Transco could, at some cost, exert increased control over opening LP. Ignoring this fact introduces a conservative bias that is likely to compensate for any potential un-conservative bias arising from reliance on one year's data.
- The data series includes a (relatively small) number of missing data points.
- The data is subject to measurement error (for NTS LP, typically less than 2%).
- The CCGT analysis is based on the England & Wales genset only. It therefore does not take into account the 1140MW CCGT at Peterhead in Scotland (which is Scotland's only CCGT). However, this bias is significantly mitigated by the fact that Peterhead has a dedicated connection to an offshore field that produces "off-spec" gas, which cannot enter the NTS. Peterhead therefore does not always take gas from the NTS. On days when gas was particularly scarce it would have a natural incentive to use its dedicated source.⁵⁹

⁵⁹ Similarly, our analysis assumes that "dual-fuel" plants use coal rather than gas. This is reasonable since high CCGT depletion occurs at times of high gas prices relative to coal (making CCGTs mid-merit).

- The methodology does not explicitly address any of the “local issues” concerning the distribution of LP across the different NTS zones. However, Transco’s derivation of the inner and outer LP envelopes shown in Figure 1 does, to an extent, take such interactions into account.

Appendix 3 Transco response

Conclusion

Transco welcomes and supports Ofgem's conclusions.

Transco regards the analysis undertaken by Ofgem and its consultants as a significant contribution to the debate regarding development of the gas balancing regime. The analysis endorses the concerns Transco has raised about regime operation, particularly the increased utilisation of NTS linepack that has been observed since NGTA and which might be expected to continue. In light of this, Transco welcomes, and agrees with Ofgem's conclusions that:

- a move towards shorter allocation periods is not appropriate in the foreseeable future;
- it is appropriate to develop a set of leading indicators that might be used to help indicate whether further regime reform is likely to be justified; and
- that "incremental reforms" should be developed that may subsequently, if necessary, be introduced to address either operational or commercial issues should regime performance deteriorate.

Background to Transco Position

Transco's concerns about regime operation have focussed on the extent of NTS linepack variations experienced on the system and the difficulties Transco faces in defining efficient balancing actions in the light of informational uncertainties and the complex behavioural interactions inherent within the current regime.

Transco applaud Ofgem for employing independent consultants, the Brattle Group, to consider a key aspect of the issue: whether both currently and prospectively the observed problem might pose a threat to system security on the NTS. Transco has worked closely with the Brattle Group and generally supports the conclusions in the Brattle report.

The report endorses the concerns which Transco raised about regime operation, and the potential impact of the significantly increased flow rate variations seen on the system since the introduction of NGTA. These variations are causing much higher levels of utilisation of the within-day linepack flexibility than are envisaged in our planning assumptions. Given the nature of Transco's balancing tools, further increases in within day linepack variation might generate commercial inefficiencies and ultimately could have serious consequences for secure gas deliveries were a number of factors to coincide.

However Transco believe that, given experience to date, Brattle is right to conclude that under most circumstances Transco can expect to be able to manage the system with the current patterns of flow rate variation and with existing tools, thereby supporting assurances given by Transco that the integrity of the system can be maintained at this point in time. Transco does not believe that moving to within day allocations is justified at this stage since the benefits through any reduction in the risk to security would not be expected to outweigh the likely costs of implementation.

Transco notes the Brattle view that "future increases in within-day swing could increase the risk of supply failure to unacceptable levels". The Brattle analysis specifically considers the possibility that within-day flow rate variations might increase in the power station sector. Transco believes that this is a helpful example, but that there are similar risks from other factors. For example, beach flow rate variations might increase. Equally, the effects of diurnal provision from the NTS to LDZs could increase NTS linepack depletions, for example in a winter of greater severity than that covered by the Brattle analysis.

Transco is currently undertaking more analysis to assess both national and local implications of potential within-day linepack variation and of the potential impact of sectoral behavioural change. This work is expected to help inform any decision as to whether further incremental regime reform might be promoted for implementation ahead of the forthcoming winter.

Our ability to maintain the integrity of the system depends in large part on gas being delivered into the system at appropriate flow rates, and in a timely manner, in response to expected demands and forecast demand changes. The NTS has been designed on this assumption and it is essential that gas flows onto the system are sufficiently close to the design assumptions to maintain the integrity of the system.

Transco observes, however, that the current trading arrangements may not offer sufficiently strong incentives to encourage flow rate variations that will ensure within-day linepack levels will remain within an acceptable operational envelope. Hence it remains appropriate to consider both changes in operational balancing policy and further regime reform to mitigate the potential risk to system integrity.

Transco recognises the benefits to the competitive market place of the current regime. Of particular value are the NBP concept, daily balancing and allocation.

Transco concludes that, subject to the outcome of further modelling, incremental reform of the energy balancing regime may be required to address the prospective increased risks associated with regime operation. These risks relate to both the integrity of the system and potential commercial inefficiencies arising from the operation of the trading arrangements. However it is important that such changes do not impose inappropriate burdens that might unduly frustrate the operation of the market.

Furthermore Transco support the approach of developing leading indicators that might indicate, or confirm, deteriorating regime performance. This could then inform the decision whether to implement further incremental or fundamental reform of the gas trading arrangements.

Should such reform be considered necessary Transco would anticipate, in the first instance, that such reforms should generally be “incremental” so as to enable the retention of as many of the benefits that currently accrue to the commercial operation of the regime, provided that such arrangements are consistent with maintenance of the integrity of the system. Furthermore Transco believes that such potential reforms need to be developed and, where appropriate, industry systems amended to have the necessary capability. This would ensure that if regime performance should deteriorate significantly, reform could be quickly implemented to ensure the continued integrity of the network and the efficient commercial operation of the regime.

Transco comments on the Brattle Analysis

Brattle has worked to build on the Transco approach of assessing linepack usage on a sectoral basis. Transco endorses the underlying inputs and methodology adopted and described in the Brattle report. The modeling approach provides a reasonable representation of the key features of regime performance. Clearly no modeling can be perfect and capture the full intricacies of such a complex regime, but notwithstanding this Transco believes the conclusions drawn in the Brattle report are broadly appropriate.

The Brattle analysis has been conducted taking account of data derived from one year of operational experience. The conclusions must therefore, as Brattle acknowledge, be taken as indicative rather than definitive. Based on this one year of data, and assuming similar patterns of flow-rate variation, statistical analysis might conclude that the probability of events conspiring to cause linepack variations to jeopardize the integrity of the system might be low, but certainly not zero. However, it is important to acknowledge that the modelling features a number of simplifying assumptions. Specifically it does not feature any locational representation or any peculiar, so far non-coincident, interactions which might not generate the “perfect storm”, referred to by Brattle, but which might constitute a “heavily localized squall” sufficient to jeopardize the integrity of the system.

Thus the modelling which features in the report cannot be expected to be as robust as in other areas where Transco has developed sophisticated processes to ensure “1 in 20” requirements are satisfied. For example, the LDZ diurnal planning process utilises models taking account of a 71 year temperature history input to derive robust “1 in 20” requirements that are subsequently validated using transient modelling of the LDZ Networks.

However, at this stage in the development of the modelling of linepack utilisation Transco considers that the Brattle work, in conjunction with the above considerations, provides an appropriate basis to inform opinion about current and potential future operation of the regime.

Transco notes the Brattle view that “future increases in within-day swing could increase the risk of supply failure to unacceptable levels”. Whilst Brattle specifically focus their prospective analysis on the power generation section Transco believes that the utilisation of linepack associated with beach inputs could increase and that if different temperature conditions were to occur the pattern of LDZ utilisation of NTS linepack might also change.

Transco therefore agrees with Brattle that there is a high risk that without changes in either or both of Transco balancing action policy and regime reform that NTS linepack utilisation may increase. Transco therefore endorses the Brattle view that it might be appropriate to consider incremental reform provided that such reforms do not place inappropriate burdens on market players.

Appendix 4 Brattle's survey of international gas balancing regimes

Introduction

This report presents a general overview of international gas balancing regimes, and aims to inform the debate on gas balancing in the United Kingdom. We first highlight emerging balancing themes and trends with particular attention on the Netherlands and Southern California. Both the Netherlands and Southern California share similar network characteristics with the United Kingdom and have witnessed active balancing debates and significant changes to their balancing regimes. Additionally, we summarise broad differences between balancing approaches in Europe, North America and Australia.

Emerging themes and trends

We identify several emerging themes associated with balancing regimes around the world:

- ◆ *Rather than focusing on pure daily or sub-daily regimes, Transmission System Operators (TSOs) appear to favour daily balancing regimes with “hourly tolerances”, i.e., regimes that require balancing on both hourly and daily levels, but typically with significantly larger tolerances at the hourly level. This tendency reflects the need to reconcile the following considerations:*
 - *on the one hand*, the absence of a sub-daily balancing requirement can lead to shippers varying inputs and outputs quite widely over the gas day. Shippers typically vary daily flows to take advantage of short-term arbitrage opportunities and available linepack storage. For example, shippers might ‘front-load’ deliveries early in the day in anticipation of higher demand later in the day. Such profiling would be possible in the absence of hourly tolerances but might lead to an unacceptable drop in system pressure and possibly threaten stability;
 - *on the other hand*, for many systems the application of strict sub-daily balancing rules is unnecessary on all but (at most) a few days during the year. The quantity of available linepack is very large relative to demand for within-balancing-period swing, so that allowing such swing imposes only minimal system costs.
- ◆ *TSOs typically combine shorter (i.e. hourly) balancing periods with “flexibility services” and charge-free tolerances, while systems with longer balancing periods do not. For instance, Fluxys in Belgium requires hourly balancing and offers both rate and volume flexibility. Alternatively, New South Wales’ Moomba to Sydney pipeline requires only monthly balancing but does not provide any flexibility services.*

- ◆ *TSOs use balancing rules to control the aggregate level of linepack in the system, but continue to rely on their own resources to manage the “local” distribution of linepack within the system.*

Even while a system remains in balance in aggregate, the distribution of linepack within the system may require TSO actions (for example, linepack may be too high in the east and too low in the west, requiring the TSO to run compressors to shift gas westward). Balancing rules refer to the overall stock of gas in the system, without reference to its spatial distribution in the system. Since gas often takes more than a day to travel from an entry point to the receipt point, an hourly requirement that gas entering the system exactly match the gas leaving the system may, depending on the circumstances, be unnecessary. Conversely, it is possible that requirements for daily or monthly balancing provide sufficient stability at the aggregate level, but create “local problems” within the system.

We have not seen any system that has different balancing rules by location. However, Ruhrgas and some other German networks allow greater flexibility (higher imbalance tolerances) for transportation over longer distances.

- ◆ *Cash-out regimes are increasingly charging shippers based on a mark-up or a discount from an “indicative” market price rather than charging shippers a fixed imbalance charge.*

Austria, the UK, Belgium, Germany, and Southern California use market-based prices. However, the trend towards market-based prices is less applicable in countries where the balancing period is longer and a market price is not clearly available. For instance, Australia Pipeline Trust charges imbalances based on a percentage of its throughput rate rather than as a percentage of a market price. This is appropriate given the absence of an obvious market price in New South Wales.

- ◆ *At least one TSO has introduced asymmetric balancing tolerances, whereby different tolerances apply depending on whether the shipper is ‘long’ or ‘short.’*

In Southern California, during the winter a shipper has a 30% tolerance for under delivery of gas, but an unlimited tolerance for over delivery of gas. The reason for these arrangements is that during the winter the TSO finds it harder to make up shortfalls in gas supply because gas storage withdrawal capacity is under heavy demand.

Case studies

We describe the Netherlands and Southern Californian balancing regimes in detail below. The purpose of these case studies is to highlight how balancing issues relevant to the UK have been treated elsewhere.

The Netherlands

The Netherlands' recent history shows how onerous balancing requirements can deter entry and stifle competition in a liberalising gas market. From a UK perspective the Netherlands' regime is interesting because the Dutch are now moving away from hourly balancing to daily balancing with hourly tolerances. We discuss the balancing debate in the Netherlands below and summarise the recent reforms that have taken place.

In 1999, the Dutch incumbent Gasunie was an integrated gas transport and supply company. It transported almost all gas within the Netherlands and supplied over 70% of the Dutch market. In response to gas market liberalisation in the Netherlands and the consequent need to allow third-party access to its gas transmission system, Gasunie developed the Commodity Service System (CSS). The CSS was a system of tariffs for both gas supply and gas transport and included imbalance penalties for third-party shippers.

Gasunie's Commodity Service System

Gasunie's CSS balancing regime was extremely onerous. Third-party shippers were required to match their off-takes on an hourly basis to within a tolerance of 2%. Whenever shippers were short and unable to meet the strict tolerance level, Gasunie required them to redress the imbalance by purchasing gas at the price calculated under the CSS rules. As well as charging shippers for the balancing gas purchased, Gasunie also charged shippers for the pipeline capacity required to transport the balancing gas at rates which significantly exceeded the underlying transport costs.

When shippers were long, Gasunie purchased the 'excess' gas from shippers at 50% of the CSS commodity price. The absence of a market in which shippers could trade away imbalance positions meant that shippers had no choice but to sell excess gas to Gasunie at the heavily discounted price.

Balancing reform

Gasunie's CSS balancing rules, which were developed without guidance from the Dutch energy regulator (DTe), prompted numerous complaints from third-party shippers. In response, the DTe

developed a consultative set of preliminary guidelines in August 2000⁶⁰ to address the problems raised above. During the consultation period, the DTe commissioned both economic and technical studies of Gasunie's balancing rules.

The economic study⁶¹ highlighted the punitive nature of the balancing regime and the discriminatory effect for new entrants. The technical study⁶² made two important points. First, *the amount of linepack available varied with gas demand*. When gas demand was high, there was relatively little linepack available and therefore imbalances could potentially threaten system security. Conversely, when demand was low, linepack was more plentiful, so that imbalances could be accommodated in the system relatively easily. The second finding was that *a daily – as opposed to an hourly – balancing regime could be accommodated by the Gasunie system without compromising system integrity, as long as it included provisions to handle extreme levels of demand*.

At the end of the consultation period, the DTe concluded that the Gasunie system should apply both daily and hourly tolerances.⁶³ However, the level of the hourly tolerances would depend on gas demand and would be far more relaxed than the 2% hourly tolerances applied previously. DTe recommended an hourly balancing tolerance of 25%, based on the technical study. In addition, the DTe mandated that shippers should be able to trade out-of-balance positions and that imbalance charges should be cost-reflective rather than punitive.

During the consultation period, Gasunie was split into a trading arm (Gasunie Supply and Trading) and a transportation arm called Gastransport services (GTS). GTS's current system of imbalance charges⁶⁴ is based on a system of 'daily balance, hourly tolerances.' Over the gas day (06:00 AM to 05:59 AM), the difference between gas entered into the system and off-taken from the system by a shipper must not differ by more than 2%, measured over the shipper's entire portfolio of customers and suppliers. Shippers who are short and breach the 2% tolerance level must purchase the daily make-up gas at 180% of the GTS gas price. Similarly, GTS purchases daily 'excess' gas from shippers who are long at 55% of the gas price.

As well as keeping a balanced position over the gas day, shippers must also match *metered* gas inputs and off-takes on an hourly basis to within an *hourly tolerance*. As more linepack is available at periods of low demand, the hourly tolerances are more relaxed when demand is low. However, when

⁶⁰ Guidelines for the year 2001 issued by the Director of DTe, as referred to in article 13 and article 18 of the Gas Act (Rules in Respect of the Transmission and Supply of Gas, Staatscourant 2000 [Netherlands Government Gazette], No. 305)

⁶¹ "DTe Implementation of the Gas Act", December 2000, The Brattle Group.

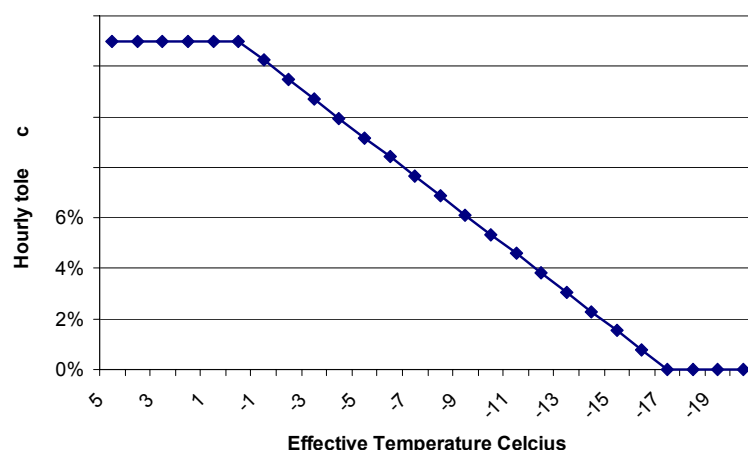
⁶² DTe, "Evaluation of Gasunie Balancing Regime Part 2" Issue date: 28 September 2001 Submitted by The Jacobs Consultancy Nederland.

⁶³ Guidelines Gas Act 2003, DTe.

⁶⁴ Gastransport Services, Transmission Service Agreement 2003-2, Model 11 November 2002.

gas demand is high, hourly tolerances become more stringent. In practice, gas demand in the Netherlands is strongly negatively correlated to ambient temperature, which is used as a proxy for gas demand when calculating the hourly tolerances. Therefore, at temperatures above 0°C shippers are allowed an hourly tolerance of 13%, and this tolerance declines linearly to 0% tolerance at -17°C (Figure 1).

Figure 1: GTS Hourly tolerances as a function of temperature



If a shipper inputs excess (or insufficient) gas into the transport system and exceeds the hourly tolerance, a charge is levied. If a shipper's off-take from the system plus the hourly tolerance is *less* than the shipper's input to the system, the shipper has an hourly excess.

As an example, imagine in a certain hour the applicable tolerance is 1,000 m³/hour and the applicable gas price is 12 €cents/m³. In that hour a shipper flows 10,000 m³ into the system, but withdraws only 8,000 m³. The shipper's hourly excess would be 1,000 m³, calculated as 10,000 m³ minus 8,000 m³ minus the hourly tolerance of 1,000 m³. Consequently, for the hour in question the shipper is charged €54, calculated as the hourly excess of 1,000 m³ multiplied by 45% of the gas price of 12 €cents/m³. Note that GTS can apply a rate of 100% of the gas price or refuse to accept the excess off-take if it has "reasonable grounds" to do so.

If a shipper's off-take from the system plus the hourly tolerance is *more* than the shipper's input to the system, the shipper has an hourly shortage. However, in contrast to the hourly excess charge, the hourly shortage charge is levied only on the maximum hourly shortage within the gas day.

In addition to the balancing arrangements described above, GTS also offers a *tolerance service capacity* and a *tolerance service volume*. The tolerance service capacity enables a shipper to buy extra tolerance, which can be added to the standard hourly tolerance. The tolerance service capacity is purchased for the entire year.

The tolerance service volume is applied to the daily volume balancing requirement. For example, if a shipper were short over the gas day, the tolerance service volume would be added to the gas volumes that the shipper entered into the system. If a shipper were long, the tolerance service volume would be added to the volume that the shipper removed from the system.

The tolerance service volume and capacity are related, in that a shipper may only purchase tolerance service volumes up to a maximum of 24 times the contracted tolerance service capacity. Both the tolerance service capacity and volume can be traded. Capacity can be traded on a daily basis and volume can be traded on a monthly basis. However, little trading has taken place to date as the system has only been in place since 1st January, 2003.

Critique of the new Dutch balancing rules

The revised balancing rules for the Dutch gas transport system have addressed some of the concerns with the old regime. While an hourly tolerance is hourly balancing by any other name, the requirement to remain in balance on an hourly basis is far less stringent than under the old CSS regime. This will be of particular benefit to shippers with a limited portfolio of customers. Over the next few years, the hourly tolerances that GTS has applied will be evaluated by DTe to determine whether there is scope for further relaxation.

Third-party access to gas storage has improved and GTS now facilitates trading out-of-balance positions. However, the imbalance charges for shortage and excess gas are still not based on market prices nor are the balancing charges clearly linked to the underlying cost of undertaking balancing actions. Buying excess gas at 55% of the oil-linked gas price and selling it at 180% of the same price appears to be somewhat arbitrary. It remains to be seen whether the anticipated legal separation of GTS from Gasunie Supply – and the possible transfer of GTS ownership to the Dutch state – will facilitate further reforms.

Lessons for the UK

The main lesson that the Netherlands can offer to the UK is that strict hourly balancing is not required to maintain system stability under most conditions. A system of daily balancing with hourly tolerances strikes a good compromise between maintaining system stability and avoiding unnecessarily stringent balancing rules. GTS has recognised that the stringency of the hourly tolerances required depends on system conditions such as total gas demand. Transco might similarly consider implementing special rules whenever it detects that demand or other conditions might complicate balancing or threaten security of supply.

We note that a key difference between the UK and the Netherlands is that the Dutch gas system already has the necessary hardware in place to implement hourly tolerances. Moreover, in the Netherlands,

ambient temperature is the variable used to determine the allowable hourly tolerance, due its strong relationship to gas demand. If a similarly strong relationship were to be found in the UK then temperature could also be used as a proxy for gas demand. However, using the actual level of gas demand to apply ‘special rules’ for days in which certain demand and supply conditions arise would be equally appropriate.

Southern California

In contrast to GTS, which has relaxed its balancing regime, Southern California Gas Company (SoCalGas) has recently applied stricter balancing rules. However, the starting point for SoCalGas was markedly different than GTS, as SoCalGas previously required balancing on a monthly basis. Southern California’s system is similar to Transco’s in some key regards: it is a networked system with multiple entry points, and gas-fired generators comprise about 30% of gas demand in California.⁶⁵

Initially, SoCalGas relied on a monthly balancing regime. However, under this regime, SoCalGas observed consistent under-delivery of gas within the month. SoCalGas claimed that gas under-delivery threatened the operation of its pipeline system, particularly when storage levels were low.

SoCalGas believed that the underlying cause of the under-delivery was daily gas price volatility. When prices at California’s state border were high, some shippers would short the system by continuing to deliver gas to their customers whilst not purchasing and delivering gas into the pipeline network. When prices had fallen, shippers would purchase extra gas to make up the short fall and ensure that they were in balance over the month. In essence, SoCalGas’s relaxed balancing rules gave shippers access to short-term (within-month) storage at no cost, just as Transco’s rules provide short-term (within-day) storage at no cost.

In response to the perceived abuse of its liberal balancing regime, SoCalGas revised its balancing rules in 1997.⁶⁶ Its revised regime consisted of monthly balancing with daily balancing requirements during the winter months when storage capacity was low.

As well as an under delivery problem in the winter months, SoCalGas also experienced over delivery problems in summer and especially at weekends. In order to deal with this problem, SoCalGas implemented so-called “over-nomination events” on gas days when total scheduled volumes exceeded the expected system demand. After calling such an event, SoCalGas could implement daily balancing rules to try and prevent excess delivery from occurring. The over-nomination event affects the entire

⁶⁵ California Energy Commission, Natural Gas Supply and Infrastructure Assessment, 700-02-006F, December 2002, Table 1.

⁶⁶ The details of SoCalGas’ balancing requirements are specified in SoCalGas’ tariff. See Rule No. 30 Transportation of Customer-Owned Gas and Schedule No. G-IMB Transportation Imbalance Service. Reform of the gas balancing regime: next steps 107
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system and remains effective throughout the gas day regardless of whether scheduled volumes drop below actual demand during the day.

SoCalGas' revised regime preserved part of the relaxed nature of its initial regime but allowed SoCalGas to implement daily measures during difficult summer and winter periods. This approach mirrors the one used by GTS, in the sense that SoCalGas adjusted the allowed balancing tolerance according to the physical conditions (i.e. storage levels) prevailing at the time.

Monthly cash-out prices

Throughout the year, SoCalGas requires each shipper's cumulative imbalance at the end of each month to remain within a tolerance of 10%.⁶⁷ Any short imbalance in excess of the tolerance is charged at 150% of the highest daily Southern California Border prices reported by major industry trade publications for that day. Similarly, long imbalances in excess of the tolerance are charged at a "buy-back rate" of no more than 50% of SoCalGas' actual purchasing costs.⁶⁸

Daily winter balancing

SoCalGas' daily winter (November-March) balancing requirement, which augments monthly balancing, varies between three tolerance levels depending on the amount of gas in SoCalGas's storage facilities.⁶⁹ Starting November 1 of each winter, shippers must deliver at least 50% of their demand directly or through storage withdrawals for each five-day period (Table 1).⁷⁰ Deficiency volumes are subject to a daily balancing standby charge of 150% of the highest spot Southern California Border price reported by a major trade publication during the five-day period. Interruptible storage withdrawals and imbalance trading are ineligible to satisfy the minimum delivery quantities.

⁶⁷ Trading imbalances at the end of each month allows for the exchange of offsetting obligations.

⁶⁸ The buy-back rate is equal to either the lowest incremental cost of gas purchased by SoCalGas during the month in which the excess balance was incurred, or 50% of the applicable core subscription procurement charge during the month in which such excess balance was incurred, whichever is the lowest.

⁶⁹ In addition to operating the gas transmission and distribution system in Southern California, SoCalGas is the owner and operator of four storage fields in southern California with total working gas capability of approximately 119 Bcf (3.37 bcm).

⁷⁰ SoCalGas does not consider five-day periods on a rolling basis. Therefore, it is possible for a shipper to be in balance on day one through four and trigger penalties on the last day of a period without any further opportunity to rectify the imbalance.

Table 1: Winter balancing rules and charges

Winter Storage Level (November 1 - March 31)	Rule	Charge
	Over each 5-day period , must balance 50% of demand directly or through storage.	150% times the highest published Southern CA Border price over 5-day period.
<i>Peak Day Minimum</i> plus 0.56 BCM	Over each day , must balance 70% of demand.	150% times the highest published Southern CA Border price for the day .
<i>Peak Day Minimum</i> plus 0.14 BCM	Over each day , must balance 90% of demand.	150% times the highest published Southern CA Border price for the day .

Upon a decline in total storage inventory to a level less than the “peak day minimum” plus 20 Bcf (0.56 bcm), shippers must balance at a minimum of 70% of demand on a daily basis. The peak day minimum is the volume of gas in storage that provides deliverability for a 1-in-35 year peak day demand. To facilitate planning, information on the annual peak day minimum and total storage inventory is distributed to shippers on a daily basis. Undelivered volumes in violation of the 70% requirement are subject to a balancing standby charge of 150% of the highest spot Southern California border price reported on that day.

In the event of a decline in total storage inventory to a level less than the peak day minimum plus 5 Bcf (0.14 bcm), shippers must balance at a minimum of 90% of demand on a daily basis. The same penalty of 150% of the maximum spot Southern California Border price assessed under the 70% daily regime is applied to any deficiency volumes.

Excess Nominations Days

While daily winter balancing minima were implemented primarily to address under deliveries, SoCalGas retains the additional year-round right to charge over deliveries during “over-nomination” days. On such days, SoCalGas typically attempts to solve the over-delivery problem itself by reducing any short-term interruptible “hub” storage services that might contribute to the problem. If these steps are not adequate, SoCalGas then notifies shippers via electronic bulletin board of the excess nomination period, with the hope that shippers will voluntarily reduce their nominations. If shippers reduce their nominations in a manner sufficient to resolve the over-delivery problem, the over nomination event is cancelled. If they do not, SoCalGas imposes reductions on the shippers it believes are causing the over nomination problem and, during the period of excess nominations, the penalty “buy-back rate” described above is applied on a daily basis. Thus, all deliveries and firm storage withdrawals in excess of 110% of the customer’s actual usage are assessed at approximately 50% of SoCalGas’ actual procurement costs.

Critique of SoCalGas' Revised Balancing Rules

SoCalGas' daily balancing rules have been criticised by shippers using its system. Shippers have alleged that SoCalGas implementation of the daily rules are prejudiced by the fact that SoCalGas holds a monopoly in storage services. Shippers argued that SoCalGas' proposed rules served to increase demand for firm storage and "hub" services. Some parties have also suggested the possibility of affiliate abuse, noting that SoCalGas may be able to offer short-term firm storage agreements to its affiliates, allowing them to avoid the penalties associated with the balancing rules. SoCalGas' discretion to institute daily balancing in the summer has also been criticised. In addition, parties have objected to having daily balancing rules, without allowing daily imbalance trading.

Lessons for the UK

Southern California's experience offers two main lessons for the UK. First, as in the Netherlands, balancing rules can be tailored to the operational requirements of the gas system in question. Thus, longer balancing periods may be feasible for most of the year, with shorter balancing required when it is operationally necessary.

Second, balancing rules need to be evaluated in the larger context of the market structure and market rules in place to ensure that the rules do not provide opportunities for anti-competitive behaviour. Rules that allow the TSO too much discretion should be avoided if possible to prevent opportunities or suspicions of abuse. However, as mentioned above, Transco might consider implementing specific rules that grant it the ability to impose stricter balancing tolerances just as SoCalGas is allowed to identify and treat "excess nominations days."

By giving the example of SoCalGas, Brattle does not imply that a monthly balancing period is something that should be considered for the UK. Monthly balancing is possible in Southern California because of the long length of the pipelines feeding the system, the associated large amount of linepack which these lines can provide, and the relatively large amount of storage available to SoCalGas. In contrast, the gas lines feeding the UK system are shorter and less numerous and the UK has a relatively small amount of storage. Consequently the introduction of monthly balancing in the UK would lead to overuse of scarce storage facilities, resulting in supply interruptions.

Survey of International Balancing Regimes

Table 2 summarises the key components of balancing regimes in Europe, North America and Australia. The third column in Table 2 shows the type of pipeline system in each country. This feature is relevant to the choice of balancing regime in a country, as, for instance, pipeline networks which consist of long, point-to-point pipes – such as Australia – will have more linepack available and can therefore afford to have longer balancing periods. Pipeline systems, which are more of a network – i.e. show a

higher concentration of input and off-take points – have less linepack available and therefore require shorter balancing periods. As the UK pipeline system approximates a network, countries with a network system offer the best comparison.

Table 15: International Balancing Regimes

Country	TSO	System Configuration	Balancing Period	Available Flexibility Services	Charge-Free Tolerance	Cash-Out Price	
						Shipper is Short	Shipper is Long
[1] Austria	OMV	Network	Hourly	- <i>Imbalance management</i> : flexibility option negotiated individually.	2 hours multiplied by 2% of the committed transport capacity	Based on weighted average of ranked sell offers.	Based on weighted average of ranked buy offers.
[2] Belgium	Fluxys	Network, 17 entry points	Hourly	- <i>Rate flexibility</i> : allows users to increase capacity delivered to a redelivery point, and - <i>Volume flexibility</i> : allows users to accumulate imbalances between the quantity of delivered and redelivered energy.	- <i>Basic rate flexibility</i> : 10% of hourly capacity on a route. - <i>Volume flexibility</i> : 10 hours worth of basic rate flexibility.	<i>Commodity charge</i> : 130% of the relevant daily Zeebrugge price, and <i>Capacity charge</i> : complementary volume flexibility tariff (times 2 when the temperature ≤ -5 Celsius)	<i>Commodity charge</i> : 70% of the relevant daily Zeebrugge price, and <i>Capacity charge</i> : complementary volume flexibility tariff divided by 6 (times 2 in July and August)
[3] Germany	Ruhrgas	Interconnected network plus isolated pipelines	Hourly, Daily, Monthly	- <i>Extended balancing</i> : Users can extend their charge-free tolerance by up to 25% of booked capacity. Cost is €85 per m3/h per year. - <i>Imbalance management</i> : Users can offset current month's imbalance with next month's imbalance, and pool imbalances with other shippers.	- <i>Daily flexibility</i> : 15% of hourly capacity x 24. - <i>Hourly flexibility</i> : 15% of hourly capacity.	Gas import price multiplied by factor stated in transportation contract. Factor of 170% used in past.	Gas import price multiplied by factor stated in transportation contract. Factor of 50% used in past.
[4] Australia	Australia Pipeline Trust (APT)	Long Parallel	Monthly (or four hours if notified by APT)	None	N/A	User pays price paid by APT to rectify the shortfall	User pays 250% of the <i>Throughput Rate</i>
[5] The Netherlands	Gastransport Services	Network, over 50 entry points and hundreds of exit points.	Daily, Hourly	- <i>Tolerance Capacity Service</i> : users can extend their free tolerance by purchasing tolerance service capacity. Cost is €61 per m3/h per year. The purchased tolerance service, as well as the free tolerance, can be traded.	- <i>Daily flexibility</i> : 2% of the daily volume. - <i>Hourly flexibility</i> : between 0% and 13% of the hourly capacity, depending on the temperature.	- Daily Shortage, shipper buys short gas at 180% of the GTS gas price. - Hourly shortage, charge for the maximum hourly shortage over the day. Varies between €0.45/Nm3/d and €31.5/Nm3/d depending on season.	- Daily Excess, shipper sells long gas at 55% of the GTS gas price. - Hourly excess, Shipper charged at 45% of the GTS gas price.
[6] Southern California	SoCalGas	Interconnected network plus isolated pipelines	Monthly, Daily	None	- <i>Monthly flexibility</i> : 10% of the monthly volume. - <i>Daily flexibility</i> : varies, depending on gas storage levels.	- Monthly and daily shortage (winter only) Shortage, shipper buys short gas at 150% of the highest border price on the cash-out day.	Shipper sells long gas at 50% of the TSOs average purchasing price.

Sources and Notes:

- [1] OMV website, http://www.omv.com/smgr/portal/jsp/index.jsp?p_site=AT and conversations with E-control.
[2] Fluxys natural gas transport services in Belgium, Conditions & Tariffs as from 1 January 2003, http://www.fluxys.net/pdf/Tarieven_Tran_030102_UK.pdf
[3] Ruhrgas website, <http://www.ruhrgas.de/englisch>.
[4] APT Pipelines (NSW) Pty Limited, ACN 080 842 360 (formerly known as AGL Pipelines (NSW) Pty Limited) Access Arrangement for Central West Pipeline, Part 2 - Gas Balancing.
[5] Transmission Service Agreement 2003-2, available from www.gastransportservices.nl
[6] SoCALGas tariffs, Rule No. 30 "Transportation of Customer-Owned Gas" and Schedule No. G-IMB "Transportation Imbalance Service".

Table 3 shows how much storage is available and how much natural gas is consumed by gas-fired generation in a selection of European countries. The purpose of this table is to illustrate the level of balancing resources available to each European system and to give one indication (i.e. the proportion of gas-fired generation) of the likely extent of demand for within-day swing. Interestingly, Table 3 shows that the UK has less storage available and proportionally more power plant gas consumption than the other European countries covered in this report. In this respect, the figures for Belgium are closer to the UK experience.

Table 3: Storage Volumes and Gas Consumption by the Power Plant Sector

Country	Annual Demand (BCM) [A]	No. of Storage Facilities [B]	Storage Volume		% Natural Gas Sales to Power Plants [D]
			BCM [C]	Equivalent No. of Demand Days [C]/[A]x365	
Austria	7.2	5	2.3	116	18%
Belgium	15.9	3	0.7	15	22%
Germany	83.2	42	18.6	81	7%
Netherlands	40.8	3	2.5	22	14%
UK	97.0	8	3.6	13	29%

Notes & Sources:

[A]: Taken from Eurogas' Annual Report 2000. Calculated as sum of indigenous production, net imports, and net withdrawal from stocks.

[B],[C]: Situation on 1 January 2001. Data taken from Eurogas' Annual Report 2000, p.22.

[D]: Eurogas Annual Report 2001, *2001 Inland Sales of Natural Gas by Sector in EUROGAS Member Countries and EU15*.

Austria (OMV)

The current Austrian regime, which has only been in place since October 1st 2002, has the most stringent balancing requirements among the countries considered in this survey. In Austria, shippers are required to balance energy on an hourly basis within an extremely small tolerance. However, the TSO (OMV) offers flexibility services, which are negotiated separately with each customer. In addition, cash-out prices are set by a market-mechanism. According to the Austrian regulator (E-control), these prices have typically been around 17 cents/Nm³ for purchasing additional balancing gas and 11 cents/Nm³ for selling excess gas.

Under the Austrian mechanism, balancing gas is offered to the system operator, who constructs a merit order of balancing gas despatch, analogous to despatch merit orders in the electricity generating industry. This system is similar to the pre-RGTA system in the UK. Although the storage facilities, which provide much of the balancing gas are owned by just two companies (OMV and TIGAS), E-

control claims that sufficient shippers have purchased storage capacity to ensure a competitive market for balancing gas.

According to E-control, the decision to implement hourly rather than daily balancing was taken by ‘industry consensus’, with shippers apparently expressing a preference for hourly balancing. The Austrian incumbent, OMV, transports, stores and supplies gas, and one might argue that an hourly balancing regime would therefore give OMV an advantage relative to new entrants in the Austrian gas market. The balancing system has been implemented for a six-month trial period, and will be evaluated by the regulator in March 2003.

Belgium (Fluxys)

Fluxys’ balancing regime includes incentives that encourage shippers to subscribe for sufficient flexibility and capacity services. Fluxys’ flexibility incentives are highlighted in Table 2 and are similar in structure to the UK’s current system.

The main difference between the Belgium and UK systems is that the Belgium system is stricter. Fluxys not only requires hourly balancing, but it also increases its imbalance charges that occur during particularly cold or hot periods. We note that Fluxys’ rate flexibility is intended to address capacity overruns and is not intended to facilitate imbalances. However, because the rate flexibility affects the basic level of volume flexibility, we include it in Table 2 to provide a full description.

Fluxys also uses incentives to motivate shippers to contract for and schedule capacity accurately. Specifically, Fluxys determines the amount of hourly gas that each shipper has exceeded or failed to supply compared to its contracted amount for each day of the month. Fluxys then sets the daily amount equal to the largest absolute hourly difference and compares the daily amounts across the month.

Shippers are charged a “peak” charge for the largest daily deviation over the month and a “non-peak” charge for the remaining days. Both charges are based on the shippers’ annual capacity contract charge. If the temperature drops below 5°C on the day the peak occurred, the “peak” and “non-peak” charges are multiplied by two. These charges are in addition to the balancing charges described in Table 2.

Finally, Fluxys charges shippers an entry point and exit point scheduling fee. Shippers are not charged as long as the difference between their nominated and actual entry quantities is less than 3% and the difference between their nominated and actual redelivery quantities is less than 6%. Any entry or redelivery excess above these amounts is multiplied by 0.2% and charged a daily price.

Germany (Ruhrgas)

Ruhrgas appears to have a generous charge-free imbalance tolerance. Users of Ruhrgas' network are allowed to incur imbalances up to 15% of booked capacity without facing additional charges. This tolerance applies to both hourly and daily flows. Within any one hour, the input and output quantities of a shipper can deviate by as much as 15% of hourly-booked capacity. Similarly, at the end of any one day, a user's total input volume can differ from its output volume by up to 15% of daily-booked capacity. Daily capacity is calculated as the hourly-booked capacity multiplied by 24.

Ruhrgas' daily imbalance allowance is more lenient than those offered by other European network operators. However, the 15% tolerance is not always available to all customers. Ruhrgas states that a customer is granted the free imbalance to accommodate times when "it may not be possible to ensure simultaneity of input and output owing to unavoidable load fluctuations that cannot be planned for structural reasons". It is unclear whether a customer would be able to use the 15% tolerance if Ruhrgas were to consider that the imbalance occurred for other reasons.

Ruhrgas' published free balancing service applies only to transactions that transport gas 100 km or more. For customers wanting to transport gas across shorter distances, Ruhrgas says it will consider whether it can offer a reduced balancing service. However, Ruhrgas publishes no information on this reduced service. Other German networks also offer reduced flexibility for shorter transaction distances. One German network applies an imbalance allowance that decreases linearly with transportation distance. At 100 km the allowance is set at 15% of booked capacity, and at 50 km the allowance is 0%.

Imbalance charges are incurred when a shipper exceeds the free tolerance and has not purchased sufficient "extended balancing" from Ruhrgas to cover its imbalance position. The extended balancing increases shippers' charge-free tolerance. Shippers can book extended balancing up to an additional 25% of booked capacity. The charge for this service is 85 € per m³ per hour per year. Shippers can also pool any outstanding imbalance at the end of each month with other customers providing that the imbalance occurs along the same transportation route. Finally, shippers can offset any imbalance at the end of a month with their imbalance position at the end of the subsequent month.

The imbalance fee equals the German gas import price multiplied by the factors set out in the shipper's transportation contract. Two different factors apply, for short and long imbalances respectively. Ruhrgas does not publish the size of these factors, but a factor of 50% for a long position and of 170% for a short position have quoted previously.⁷¹ Ruhrgas tracks imbalances and charges shippers at the end of each month.

Australia (Australia Pipeline Trust's Moomba to Sydney Pipeline)

Australia's balancing regime is much more relaxed than the UK's regime. Although Australia Pipeline Trust's (APT) balancing rules are specific to its Moomba to Sydney pipeline in New South Wales, its rules are representative of balancing regimes throughout Australia. Typically, local distribution networks in Australia are linked to gas production fields through one extremely long pipe. For instance, the Moomba to Sydney pipeline sources gas from the Cooper Basin and is 2,026 km long.⁷² As a result, APT can rely on an abundant amount of linepack to meet any short-term imbalances.

The flexibility in APT's system is reflected in its extended settlement period. Users can reverse any end-of-month imbalance (M1) in the subsequent month (M2) through actual flow rate changes or gas trades with other users. If the user fails to redress its M1 imbalance in M2, APT may correct the user's position itself in the third month (M3). The user only pays an imbalance charge if all previous actions fail to eliminate its imbalance at the end of M3. The user pays APT for any imbalance regardless of whether it is long or short at the end of M3.

North America

The majority of pipeline companies in North America operate long, parallel pipes that connect gas sources to local distribution networks. Above, we described APT's balancing regime, which is similar to regimes typically used in North America. SoCalGas' regime and network outlined above is atypical and is interesting for its similarity to the gas network in the UK. We do not provide further details on other regimes used in North America as these regimes would not help inform the balancing debate in the UK.

⁷¹ Guidelines for good practice – Gas TPA – Compliance overview, prepared by the Directorate General for Energy and Transport of the European Commission for discussion at the 6th meeting of the Madrid Forum of 30-31 October 2002, Draft of 21st October 2002.

⁷² <http://www.pipelinetrust.com.au/4/4-2set.html>.

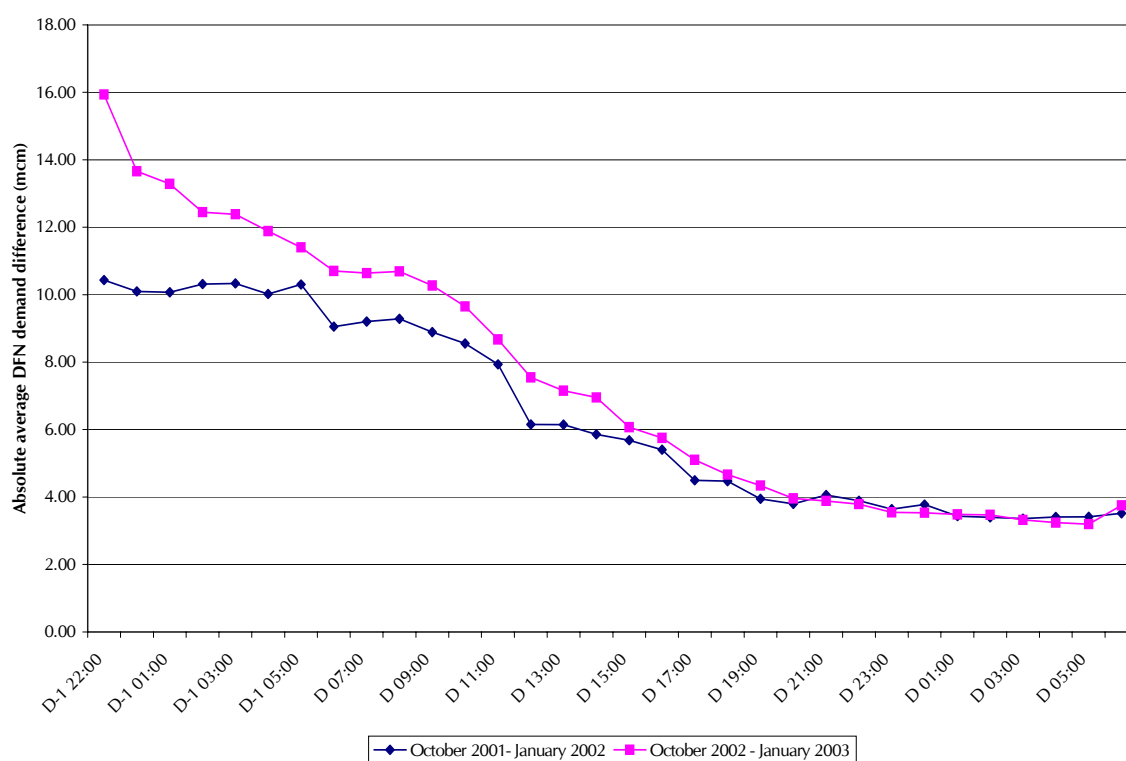
Appendix 5 Initial analysis of INS

- 5.1 In this appendix, we present some evidence of the developments in the NTS balancing performance and in the information available to Transco about intended gas flows since the introduction of INS on 1 October 2002.

At-link and DFN information

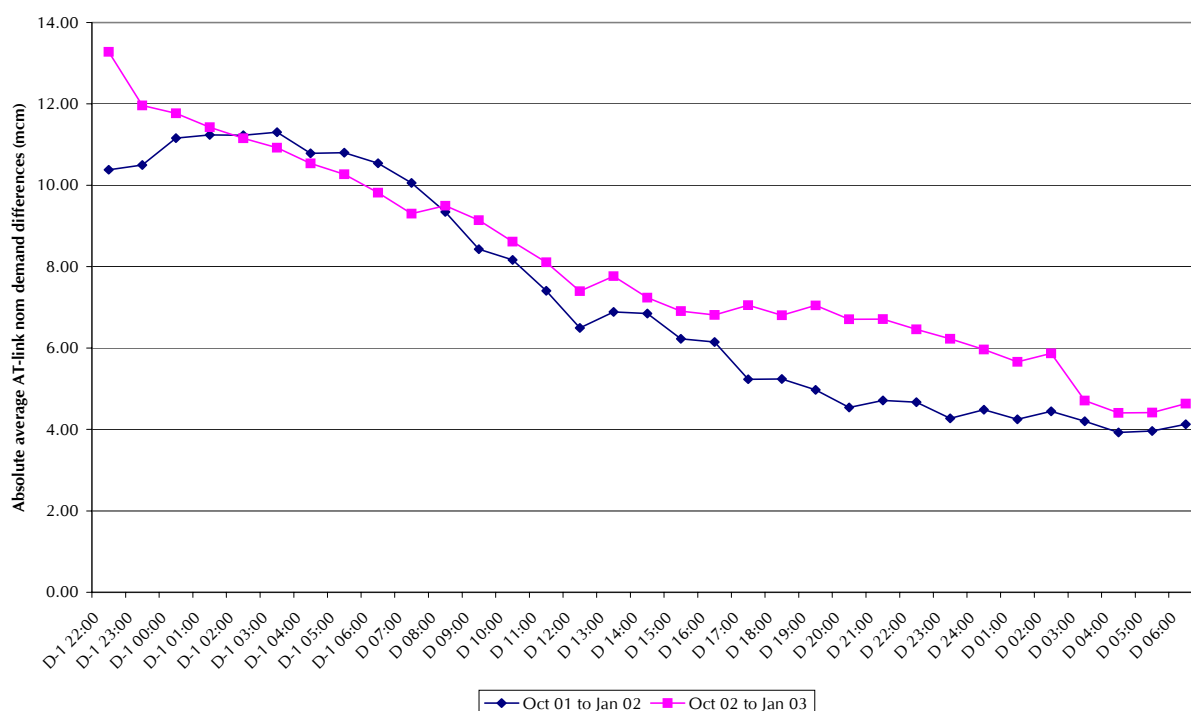
- 5.2 Figure 1 shows the difference, in absolute values, between DFNs and forecast demand between October 2002 and January 2003 and between October 2001 and January 2002. The graph indicates that the information provided to Transco through DFNs between the preceding gas day (D-1) and the first half of the day has deteriorated year on year. DFN information tends to become closer to demand towards the end of the gas day when gas positions are more certain.
- 5.3 During workstream meetings, Transco has indicated that in making its balancing decisions it relies mainly on the information provided by DFNs, especially earlier in the gas day. It then uses AT-link and INS nominations as support information. Later in the day, Transco tends to rely more on the flows that it actually observes on the system.

Figure 1 Absolute average DFN/demand differences



5.4 Figure 2 shows the difference, in absolute values, between AT-link nominations and forecast demand between October 2002 and January 2003, and between October 2001 and January 2002. The graph indicates that the information provided to Transco through AT-link later in the day has slightly deteriorated year on year.

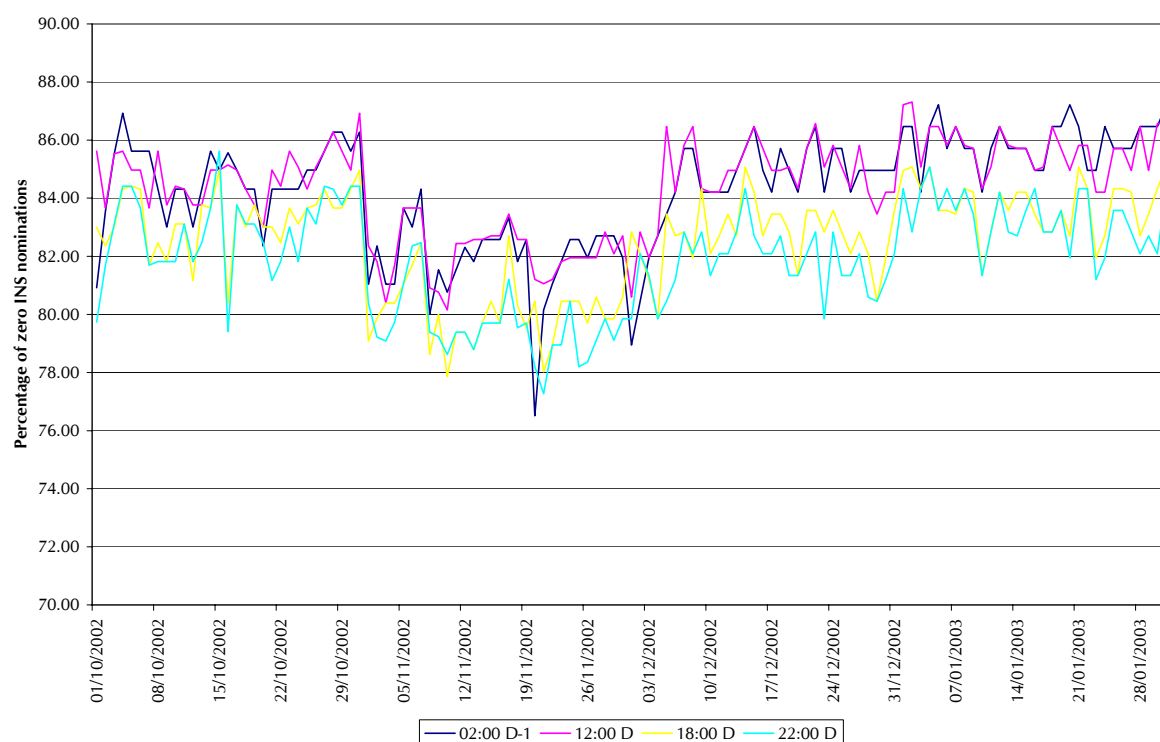
Figure 2 Absolute average AT-link nominations / demand differences



INS nominations and charges

- 5.5 Figure 3 indicates that the percentage of zero INS nominations with respect to total INS nominations between October 2002 and January 2003 is quite high with an average just above 83 per cent. This figure suggests that shippers tend to inform Transco that they will be in balance at the end of the gas day.
- 5.6 To the extent that a shipper is out of balance at the end of the day it is therefore exposed to both cash-out charges and INS charges. This figure therefore suggests that shippers are treating the INS charges as an extension of the present cash-out charging regime and raises issues as to whether INS is providing Transco with any additional information over and above what it received prior to 1 October.

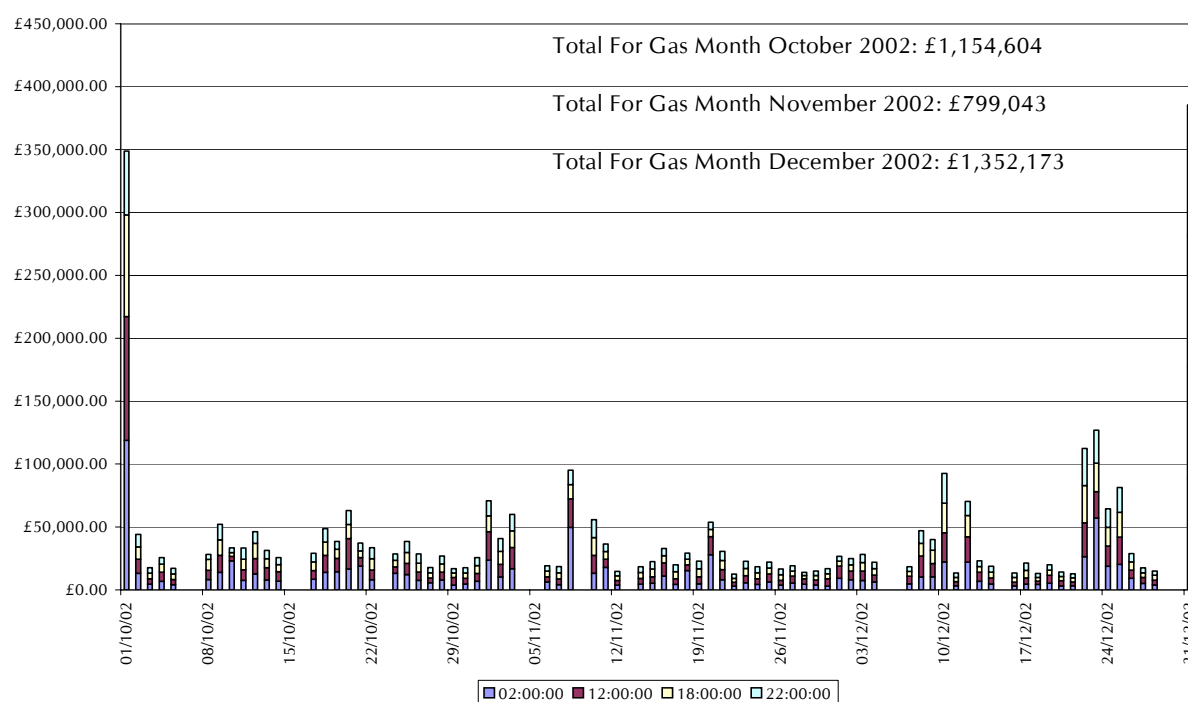
Figure 3 Percentage of zero INS nominations by recording point/day



5.7 Figure 4 shows the level of INS charges in October, November and December 2002. With the exception of 1 October 2002 and 31 December 2002⁷³ when INS charges incurred by the shippers' community were very high, the pattern of INS charges has been similar in the three months. The absence of any sign of reduction in the overall INS charges in the first three months may suggest that the quality information provided to Transco through INS is not improving.

⁷³ On 1 October 2002 the system was significantly long and the gas price dropped to a SAP of 8.2 pence/therm. On 31 December 2002, a fire at sub-terminal at Bacton caused supply losses and forced Transco to take local buy trades.

Figure 4 Aggregate INS charge by day from October 2002 to December 2002



Transco and shipper balancing behaviour

5.8 Table 1 indicates that the average volumes of Transco's balancing actions, both buy and sell, have decreased year on year. It also shows a significant increase in the number of days in which Transco took just a small balancing action.

Table 1 Transco energy balancing actions (mcm)

	Average buy volume	Sum of Buy volumes	Average Sell volumes	Sum of Sell volumes	Number of days with no actions	Number of days with actions on both sides of the market	Number of days with actions below 1 mcm
Oct 2001 to Jan 2002	3.89	97.35	4.24	335.35	21	3	13
Oct 2002 to Jan 2003	2.86	114.27	3.31	234.93	18	7	30

5.9 Table 1 also indicates that the number of days in which Transco has taken actions on both sides of the market has increased year on year. It could be argued that if the INS incentives on shippers were effective in helping Transco to better inform its balancing actions, the number of instances where Transco had to undo a buy (sell) action earlier in the day by selling (buying) hours later on the same day would decrease. Although the number of days in which Transco has taken an action on both sides of the market is still quite small, the data presented in table 2 does not suggest any sign of a decrease in such instances to date.

Table 2 Overall shipper imbalance

	Daily average (mcm)			% of throughput		
	Long	Short	Net	Long	Short	Net
Oct to Dec 2001	6.9	-4.7	2.3	2.13%	-1.46%	0.67%
Oct to Dec 2002	5.1	-4.1	1.0	1.51%	-1.22%	0.28%

5.10 Finally, table 2 indicates that shippers' overall imbalance seems to have been significantly reduced year on year. This may suggest that shippers are trading out a greater proportion of their imbalance quantity prior to the end of the day so as to avoid paying or receiving SMP cash out prices following the removal of the NDM forecast tolerance on 1 October 2002. It may also suggest that the INS, by increasing *de facto* the cash-out exposure, is encouraging shippers to better balance their inputs and offtakes to match their INS nominations.