NOVEMBER 2010

Gas System Operator Incentives Initial Proposals Consultation 2011/12

UK Gas Transmission

nationalgrid

THE POWER OF ACTION

Executive Summary

The current arrangements for recovery of costs associated with Operating Margins and the NTS Environmental Incentive expire in March 2011. This year, at Ofgem's request through their open letter published in July 2010, National Grid has led on the development of Initial Proposals for Gas System Operator (SO) Incentives commencing 1 April 2011, namely Operating Margins and the NTS Environmental Incentive. This is the fourth year that National Grid has led the development of Initial Proposals.

This document sets out the key issues considered in each of these areas and sets out incentive scheme proposals. It also seeks views from industry participants as to whether they believe that these proposed schemes are appropriate or if an alternative may better incentivise National Grid, in its role as System Operator, to discharge its obligations effectively and efficiently.

Operating Margins

The market for Operating Margins provision is currently subject to a number of uncertainties, including the further development of the contestable market and the outcome of the NG LNG Storage Regulated Price Review. Ofgem's open letter in July asked National Grid to propose incentive schemes to be applicable from April 2011 within this uncertain framework.

Within the document, three proposals are made for schemes with a two year duration:

a) No direct incentive - cost pass through arrangement as at present.
b) Bundled incentive scheme which includes all Operating Margins costs, both holdings and utilisation costs.
c) Unbundled incentive scheme with separate incentives for holdings and utilisation costs.

NTS Environmental Incentive

Venting natural gas is currently an unavoidable consequence of the normal operation of the National Transmission System. The NTS Environmental scheme incentivises National Grid to consider the environmental impact of its operation and make the optimal decision in its use and standby of the compressor fleet.

- The proposals consider short term marginal cost incentive options to cover a two year period and a proposal to fund research and/or pilot projects to enable longer term improvements in environmental performance. In the longer term, these projects would facilitate better understanding and measurement of emissions, as well as develop technologies and processes to reduce or eliminate the effects of venting natural gas from the NTS.

We welcome feedback and comments on this document and request that these are submitted by 9 December 2010 to **soincentives@uk.ngrid.com**.

Contents

Section 1
Introduction

1.1 Introduction to Gas System Operator Incentives

1. National Grid Gas operates the high pressure Gas Transmission System in Great Britain. This System Operator (SO) function is subject to Licence[1] obligations and a number of financial incentive arrangements. These incentive arrangements encourage National Grid to minimise the overall cost of system operation to consumers, to consider environmental impacts and to support the efficient operation of the wholesale gas market.

2. These incentives are designed to deliver benefits to the industry and consumers. These benefits include direct financial benefit from reductions in the costs associated with operating the gas transmission network and other benefits from meeting key performance measures (such as through improved information provision to the market).

3. The various incentive schemes provide a focus on key areas where National Grid is able to create value for the industry and consumers, allowing National Grid to retain a share of any value created (or to be penalised should targets not be met).

4. A summary of the existing incentive schemes, the historic levels of performance under these schemes and the impact of incentive payments on charges is available on our website at the following address:

   http://www.nationalgrid.com/uk/Gas/soincentives/SupportingInfo

1.2 System Operator Incentive Review

5. The SO incentives are periodically reviewed. The current arrangements for Operating Margins and the NTS Environmental Incentive are in place until March 2011, and therefore these areas are being reviewed through this process.

6. Ofgem published an open letter on the SO review process2 in July, which confirms that National Grid will lead on the development and consultation on the initial proposals for the SO incentives. Following responses from the Initial Proposals, Final Proposals will be developed by Ofgem for consultation early next year.

November 2010	National Grid publish Initial Proposals for gas SO incentives
February 2011	Ofgem publish Final Proposals consultation
March 2011	Changes directed to NTS licence
April 2011	New incentive schemes start

Table 1.1: Timetable for gas SO incentive review

[1] The National Grid Gas plc Gas Transporter Licence in Respect of the NTS
[2] Open letter published by Ofgem 22 July 2010 http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?docid=219&refer=Markets/WhlMkts/EffSystemOps/SystOpIncent

7. Many of the other SO incentives are due to expire in March 2012, including the shrinkage and residual balancing incentives. The process for the review of these incentives will be considered by Ofgem later this year.

8. The development of linepack and cashout proposals[3] may trigger a review of the Residual Balancing Incentive prior to 2012 to align the incentive with any new industry frameworks.

1.3 Background to this Document

9. This document has been produced to enable the review of incentive arrangements and cost recovery mechanisms for Operating Margins and the NTS Environmental Incentive. The remainder of this document is structured as follows:

- Section 2: Operating Margins;
- Section 3: NTS Environmental Incentive;
- Section 4: Summary of Questions;
- Section 5: Contact Details; and
- Appendices.

1.4 Feedback and Contact Details

10. We welcome any feedback on this document including suggestions for additional information to incorporate.

11. Further information on Gas SO Incentives can be found on the National Grid website via the below link:

http://www.nationalgrid.com/uk/Gas/soincentives/

Responses to the consultation should be sent to
soincentives@uk.ngrid.com

By 9 December 2010

[3] In accordance with obligations under Special Condition C27 of the National Grid Gas licence in respect of the NTS.

Section 2
Operating Margins

Operating Margins is a service required by the System Operator in order to reduce the likelihood of an emergency on the gas national transmission system or in the event of an emergency, to ensure the safety of all users on the system. This section details the uncertainties in the market for Operating Margins services and proposals for cost recovery and incentive arrangements in this area.

2.1 Operating Margins Background

12. Operating Margins (OM) gas is used to maintain NTS pressures in the immediate period following operational stresses and before market balancing measures become effective. Such stresses may result from supply failure, unanticipated demand changes or failure of an NTS pipeline or associated equipment. A quantity of OM is also procured to manage the orderly run-down of the System in the event of a Network Gas Supply Emergency (NGSE) whilst firm load shedding takes place.

13. Operating Margins is provided by storage facilities, Liquefied Natural Gas (LNG) importation facilities, offtake reduction and supply increase services. Procurement from the National Grid LNG Storage facilities is via pre-emption rights on an annual basis, in accordance with the provisions of the Uniform Network Code (UNC). The price of Operating Margins services from NG LNG Storage facilities is at regulated prices[4]. Procurement of the service from the other facilities is on commercial terms.

2.2 Operating Margins Requirement

14. The Operating Margins Requirement defines the volume of gas and deliverability (rate of flow) required in a number of different scenarios to either reduce the likelihood of a Network Gas Supply Emergency or to manage the system safely during an emergency. This forecast requirement detailed below is used within cost estimates later in this document. As this is a forecast requirement, it is subject to change, such as following the experience of the latest winter supply and demand patterns.

15. The Operating Margins Requirement is made up of a number of different parts. The three categories of OM requirement are:

- Group 1: Managing pressures and the safety of the system following a beach supply failure or forecast demand change;

- Group 2: Support network pressures in the 24 hours following compressor and/or pipeline failures (which can require OM to be held both within locational zones and nationally); and

[4] Provision of Operating Margins services from NG LNG Storage services is at regulated prices, where they have not been suspended, under Special Condition C3 of the NTS licence.

- Group 3: 'Orderly Rundown': Used to effect isolation of Very Large Daily Metered Customers (VLDMCs) and Local Distribution Zone Daily Metered (LDZ DM) loads such that the remaining predominantly domestic demand can be met with supply available at the time.[5]

16. Each of the Operating Margins Requirements will need a volume of gas delivered within a short time period. The rate at which the gas can be delivered is often referred to as the deliverability. Some of the Group 2 requirement is tied to a specific locational zone – as local network pressures cannot be maintained for sufficient time to allow for the transportation of OM services located further away. Figure 2.1 shows the locational zones for Operating Margins for the years 2011/12 and 2012/13.

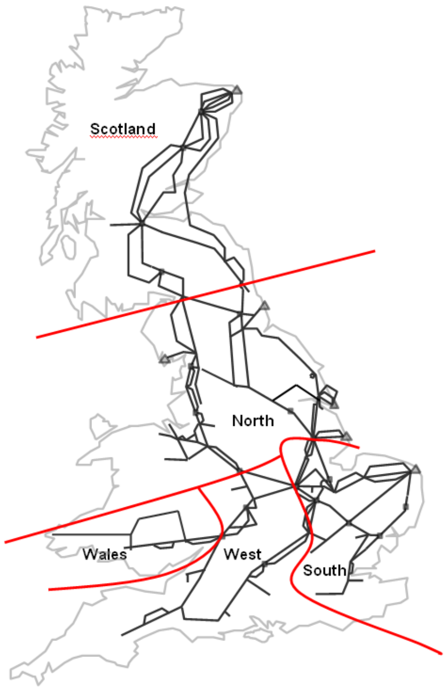

Figure 2.1: Operating Margins Locational Zones

17. As part of our annual supply and demand forecasting process and our licence requirement to produce the Annual (Gas) Ten Year Statement, National Grid consults with key participants in the UK gas industry on an annual basis. The main consultation process occurs in the Spring, with further industry feedback on the forecasts through the Transporting Britain's Energy (TBE) conference in July. Our forecasts are compared to other parties' forecasts and we constantly assess new data as it becomes available to us.

18. The consultation process includes informal meetings and discussions with the major UK gas shippers, gas producers, power generators, operators and developers of importation and storage facilities and other interested parties. In addition, historic information is compared to the current information being provided to us and any physical gas flow data. The outputs from this

[5] Assumptions made in the calculation of the Orderly Rundown requirement are published within the Operating Margins Statement which is published here: http://www.gasgovernance.co.uk/OpsMargins

forecasting consultation process are used within the OM requirement assumptions and analysis.

19. The OM requirements are calculated using various assumptions including demand and supply levels, emergency isolation profile assumptions as well as information on network topology and local demand levels[6]. The current estimates requirements for 2011/12 and 2012/13 are as shown in the table 2.1 below:

	2010/11	2011/12			2012/13		
		Low	Central	High	Low	Central	High
Supply Loss / Demand Forecasting change	337	337	337	337	337	337	337
Locational: North	10	0	0	10	0	0	10
Locational: West	117	117	117	117	117	117	117
Locational: South	93	20	46	93	20	46	93
Locational: Wales	0	0	0	0	0	0	0
Locational: Scotland	73	17	60	73	27	60	73
Non-locational	98	98	98	98	98	98	98
Orderly Rundown	480	0	470	623	0	480	623
Total (GWh)	**1208**	**589**	**1128**	**1351**	**599**	**1138**	**1351**

Table 2.1: Operating Margins Requirement

20. The ranges are based on looking at potential ranges in supply and demand levels over the next two years. This includes both national UK and specific locational information. The central cases are based on an expectation that the basic supply and demand outlook will remain similar to that described in this year's winter outlook allowing for some limited changes expected in UKCS figures. The most significant sensitivity is that of orderly rundown to non-storage supply levels. At the time of writing, no winter 2010/11 data is available so final requirements may well vary; for example, there is a sensitivity to the global LNG market and whether gas continues to be shipped to the UK which is difficult to predict this far ahead. Changes in demand may also affect the final requirements both at the UK level and for the locational requirements.

2.3 Costs of Providing Operating Margins

21. Operating Margins can be provided from a range of different facility types. The availability and pricing of these services has a major impact on the cost of Operating Margins services.

[6] When assessing OM requirements, National Grid bases its analysis on an assumed order of supply utilisation as described in the Operating Margins statement. Please see the latest OM Statement at http://www.gasgovernance.co.uk/OpsMargins

22. The largest providers of Operating Margins are currently storage facilities, followed by LNG importation facilities, demand reduction and supply increase provision. Supply increase provision is where a provider has the ability to increase flows from a gas field above the level expected. Non-storage OM provision has increased its market share in recent years following the development and promotion of different forms of OM provision through the OM contestability project. The development of contestability has led to more competition and options in the market for OM provision; this may lead to a reduction in the reliance on storage provision in future years. If you would like more information on the type of Operating Margin provision by requirement type, please see our Tender Information Report[7].

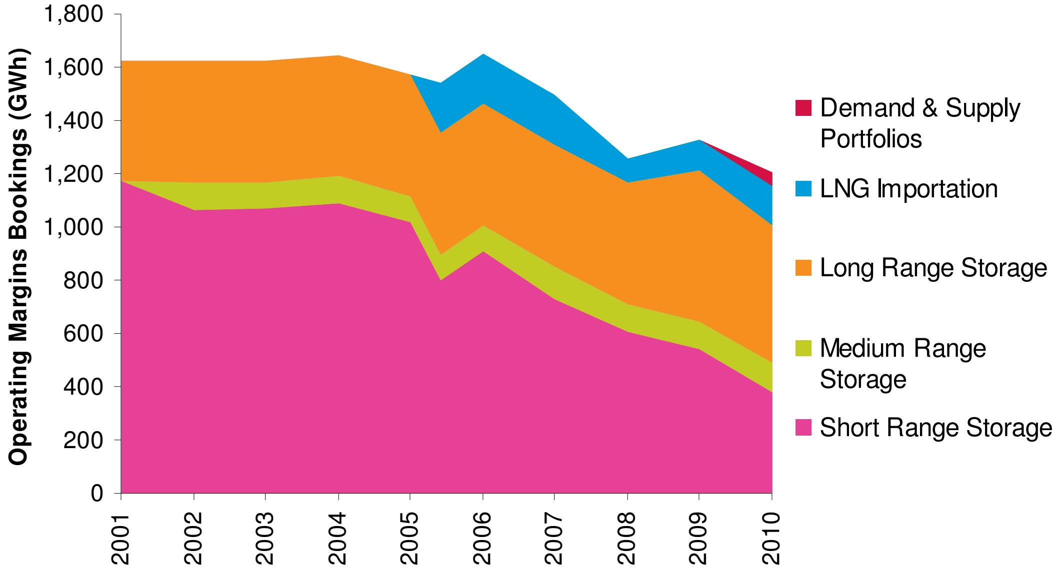

Figure 2.2: Operating Margins Bookings

23. The total costs for the provision of OM services comprise Holdings costs plus Utilisation costs.

24. Holdings costs comprise:

- The costs associated with Capacity contracts, detailed below;
- The cost of holding Delivery contracts, detailed below; and
- The charges associated with any required re-profiling of gas, where gas is withdrawn or sold where it is no longer needed in a facility and injected or bought in a facility where the holdings have increased from the previous year.

[7] The Operating Margins Tender Information Reports have information on the volume and types of tenders received and accepted. The reports are available at http://www.nationalgrid.com/uk/Gas/OperationalInfo/GasOperatingMargins

25. Capacity contracts enable National Grid to hold its own gas, such as within a storage facility, such that National Grid can nominate flows of its own gas onto the NTS, subject to the maximum rate that the site can deliver gas (deliverability). For more detail, including the types of costs associated with capacity arrangements, please see Appendix 2.

26. A Delivery contract is where a third party holds gas or the ability to turn up supply or turn down demand when required to by National Grid. There are additional costs associated with utilisation when gas is needed. If you would like to know more about the types of Operating Margins arrangements please see Appendix 2.

27. Utilisation of OM is a low probability but potentially high cost event, although costs would be expected to be small in any one year. When Operating Margins services are utilised, National Grid will pay either:

- A fee to exercise a delivery contract where a third party delivers gas onto the NTS or reduces offtake from the NTS; or
- Charges for the withdrawal of gas it holds in storage.

28. There may be further costs if the gas needs to be replenished after a utilisation event, for example following utilisation if the remaining stock in the facility does not meet the Operating Margins requirements for the remainder of the winter, it is necessary to replenish the gas held at that facility. Additional costs for reprofiling and procuring the gas will be incurred.

29. Most costs incurred by National Grid in connection with operating Margins are recovered from Users of the NTS. Relevant costs for both Holdings and Utilisation are recovered through either the NTS licence or neutrality[8].

30. If you would like more detail on the specific details of the costs involved in the Holdings or Utilisation of OM, these are shown in more detail in Appendix 2.

2.4 Current and Previous Incentive Arrangements

31. This section details current and previous incentive arrangements that have been in place for the provision of Operating Margins.

32. For 2010/11, costs associated with securing the availability of Operating Margins gas and the costs of utilisation of Operating Margins gas are not directly incentivised. All costs incurred are recovered from users ('cost pass-through') through the Gas Transporter licence and Neutrality arrangements subject to regulatory scrutiny by Ofgem in line with National Grid's licence obligation to be efficient and economic in its operation of the pipe-line system. If you would like more information on the elements of cost recovery please see Appendix 2.

[8] The costs that can be recovered through neutrality are set out in section K.4 of the UNC.

33. An incentive was not put in place for this year as, during the incentive setting process, a number of complexities were identified that would make a target setting process very difficult. These complexities included whether new provision types such as demand reduction and supply increase could provide Operating Margins services under the Safety Case[9] and the potential for suspension of some or all regulated prices for OM provision from NGLNG Storage.

34. In previous years, the cost of providing Operating Margins services had been incentivised. Prior to 2008/09 a bundled incentive scheme was in place which incentivised National Grid to manage both Holdings and Utilisation costs in a single incentive target. In 2008/9, the incentive was split into separate utilisation and holdings incentives and in 2009/10 the Holdings and contestable development costs were recovered on a cost pass through basis and the Utilisation element was subject to an incentive which included a cost target and cost collar.

35. The availability or holdings cost incentive in place in 2008/9 was an incentive whereby savings against the target cost would lead to an incentive profit and any costs above the target would lead to an incentive loss for National Grid.

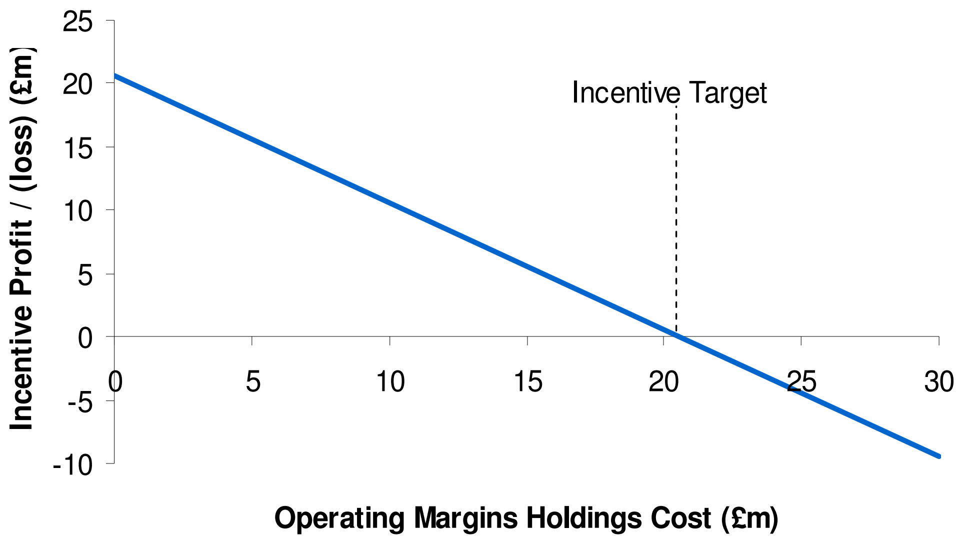

Figure 2.3: 2008/9 OM Holdings Cost Incentive

36. The utilisation incentive that was in place in 2008/9 and 2009/10 covered costs associated with using gas that National Grid had stored for OM. Other costs were covered through arrangements in the Uniform Network Code

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[9] The provision of Operating Margins by reducing demand from the NTS and/or increasing supply on to the NTS was subject to a successful revision of the National Grid Transmission Safety Case that was deemed satisfactory by the HSE in February 2010.

(UNC)[10]. The utilisation cost target was set to reflect the management of minor utilisations, if utilisation costs outturned below the incentive target, then National Grid would have made a profit. If costs were higher than the target then National Grid would have made a loss. The incentive scheme incorporated a collar to reflect the risk of a low probability high cost major OM utilisation.

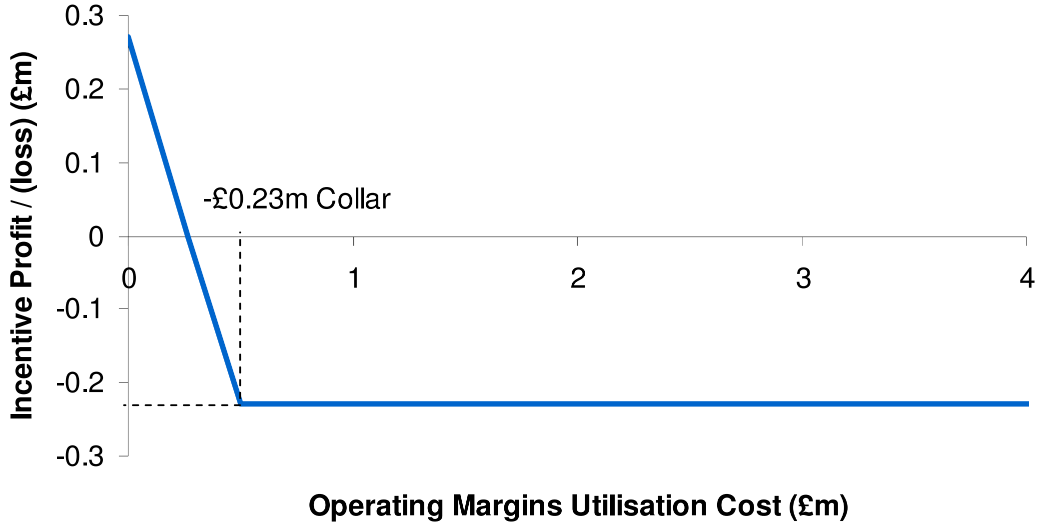

Figure 2.4: 2008/9 OM Utilisation Cost Incentive

2.5 Market for OM services

37. This section summarises the uncertainties in the market for the provision of OM.

38. National Grid, in its procurement of Operating Margins, is a customer within a larger market as each of the OM provision types has a range of uses and therefore price drivers. For example storage can be used as a trading tool, as part of a supply portfolio or in providing security of supply.

39. Operating Margins services purchased through market mechanisms such as the Operating Margins tender in Spring each year are contracted at a market price as tendered by each provider to National Grid. Each type of provider may consider the costs of providing the service, the market in that type of service provision and any other alternative services that they could provide from that facility in formulating its tender.

40. Each type of Operating Margins provider has its own underlying cost and price drivers. The price of services tendered may not always move in line with underlying cost drivers where the market in the purchase or sale of the

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[10] Operating Margins is covered in Section K of the UNC Transportation Principle Document that is available from the Joint Office of Gas Transporters website at http://www.gasgovernance.co.uk/

product changes. For example, if there is a constrained market such that demand is much greater than supply, prices may increase or vice-versa.

Commodity prices

41. A range of commodity prices are likely to have an influence over the pricing behaviour of OM market participants. For example, in the case of generation providers, changes in the dark or spark spreads[11] may impact both the likely availability of a gas fired power station and the pricing strategy dependant on the alternative sources of generation available to that provider.

Gas price differentials

42. Commercial storage participants may utilise pricing differentials between different time periods, which can be broadly labelled as “short-term” and “long-term”:

- Short-term differentials tend to be based around within-day or within-week timescales and tend to rely on pricing fluctuations caused by factors such as weekday versus weekend supply and demand patterns.

- Long-term differentials tend to be based around the differential between summer and winter forward prices.

- The margins in the market at the time of the OM Tender could potentially influence the price that will be offered for other services, such as OM.

Supply / demand balance

43. National Gas Transmission System balance is affected by physical factors, such as unexpected outages and the addition or removal of infrastructure on both the demand and supply side. It can also be affected by external factors such as political events and economic recessions, the likelihood of these factors may lead to a change in the pricing of OM tenders

44. Expected supply and demand balance for the coming year will tend to have an effect on the marginal gas price and market participants are likely to make an assessment of this when considering their tenders.

LNG supply & Global market differentials

45. LNG importation has become a significant source of UK gas supply and a number of factors have driven LNG price volatility in recent years:

[11] The dark and spark spreads are the theoretical margins of a power station from selling a unit of electricity, having bought the fuel (coal or gas respectively) required to produce electricity.

- The global nature of the LNG market results in a wider range of factors being able to influence prices. For example, following earthquakes in Asia LNG was used as a substitute power source replacing nuclear power. This significantly increased the global LNG price and resulted in a reduction of gas shipments to the UK.

- LNG suppliers are increasing production capability significantly around the globe and the associated supply increases may impact on forward gas prices, which in the short term may lead to downward pressure on prices in the gas market.

- The global economic slowdown has suppressed global LNG demand and this has also had an impact on LNG prices. With the UK currently receiving a significant number of LNG cargoes, this could create a downward pressure on prices in the gas market.

- We believe that recent LNG price volatility is likely to continue and the associated uncertainty may be reflected in OM tender prices.

Flexible Market Provision

46. Within the range of OM providers there are likely to be varying degrees of operational flexibility, as a result some market participants may take a risk-based approach to assess the likely costs of OM gas being utilised and factor these into any OM tender submitted.

Storage

47. The availability and pricing of storage services may be affected by changes in the number and size of facilities connected to the NTS.

48. There is a large amount of storage planned over the next ten years. However, there are a number of factors that may influence the development of proposed storage projects, which have led to our latest forecast[12] in yellow on Figure 2.5 below:

    - Many storage projects have been subject to time slippages and deferrals with relatively few new storage projects completed over the past decade. The recent economic conditions have not helped to reverse this trend.

    - The absence or limited nature of capacity signals from NTS entry capacity auctions for most of the proposed storage projects.

    - The difficulty in obtaining planning and other permits to enable the construction and operation of a facility.

[12] Storage Supply view from Transporting Britain's Energy (TBE) work.

- The potential development of single very large storage projects may change market dynamics and therefore deter other entrants at different locations from developing their facilities.

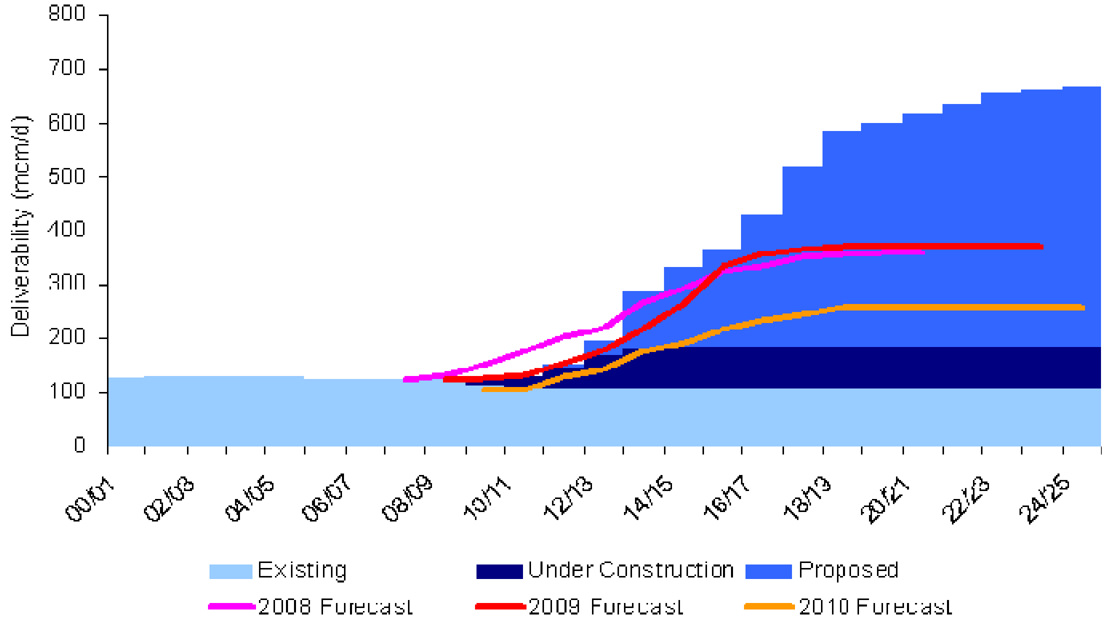

Figure 2.5: Storage Forecast

49. Operating Margins services are used either to reduce the likelihood of an emergency or in the event of an emergency. Therefore, National Grid and the new facility need to have confidence in the physical performance of that facility at a range of stock levels to be able to efficiently assess its potential for OM provision, such that a facility may not be able to provide Operating Margins in its first year of operation.

50. Currently, we do not have any information that would confirm that any new storage facilities will be interested in offering OM services.

51. NG LNG Storage has announced that Glenmavis and Partington LNG Storage facilities will not be offering commercial services from May 2011[13], though the facilities will be available for OM services. This will mean that if OM services are procured from these sites, National Grid as the Operating Margins Manager would not be able to take advantage of deliverability that has been purchased by other Users of the facilities. National Grid therefore would need to procure the required deliverability on a firm basis at either the revised Regulated Price or at the tendered price should the requirement type be deemed contestable. This would therefore increase the costs of using these facilities when compared to historic levels. Additionally, in the medium term, National Grid LNG Storage has indicated that the Partington facility may

[13] LNG Storage Strategic Review - Further Announcement on 26 May 2010 http://www.nationalgrid.com/NR/rdonlyres/7402D054_-2A01-469F-BF3C-DE5B56556F5D/41412/LNGStorageStrategicReviewFurtherAnnouncement.pdf

close[14], reducing the pool of current OM providers. Further detail on the effect of changes to regulated prices at NGLNG Storage facilities is provided in Section 2.7.

52. In addition, if sufficient deliverability is not booked by other users of Avonmouth LNG storage facility, National Grid may need to book deliverability to secure sufficient access to this facility.

LNG Importation with Storage

53. LNG Importation facilities with storage have provided Operating Margins for a number of years. In the South of England, the LNG Importation terminal, Grain LNG, began commissioning phase 3 of its expansion programme during late October and expect to be operational for winter 2010/11, increasing the potential to provide Operating Margins from this facility.

54. The LNG importation terminals at Milford Haven in South Wales, have now operated over 2008/9 and 2009/10 winters, demonstrating their operational capability, such that they may be able to provide Operating Margins services in the future.

55. The continued development of LNG importation facilities provides an area where further growth in the contestable market for some of the OM requirement types may be possible in the coming years.

Demand Reduction & Supply Increase Portfolios

56. NTS demands, such as industrial users and gas fired power stations, can provide Operating Margins by reducing their level of offtake from the NTS. Similarly, OM can be provided by increasing supply onto the NTS. This is a new form of provision for 2010/11, following the development of a UNC code modification and a safety case change. **Note:** If any further parties would like to consider providing this type of Operating Margins service please contact National Grid to discuss this further[15].

57. Following the UNC and safety case change introducing contestability, demand reduction and supply increase contracts were accepted in the 2010/11 OM tender. This is an area which has the potential to developed further for some OM requirement types, with the exception of orderly run down requirements[16].

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[14] NG LNGS response to Ofgem's Open Letter consultation on National Grid LNG Storage facilities Price control: http://www.ofgem.gov.uk/Networks/Trans/GasTransPolicy/LNGPriceControl/Documents1/FINAL%20National%20Grid%20Liquefied%20Natural%20Gas%20facilities%20price%20control.pdf

[15] If you are interested in providing OM, please contact Chris Cortopassi on Chris.Cortopassi@uk.ngrid.com or 01926 656859. Further information is available at: http://www.nationalgrid.com/uk/Gas/OperationalInfo/GasOperatingMargins

[16] In an Orderly run down scenario, a Network Gas Supply Emergency Stage 3 will have been declared and as such, firm load shedding will be instigated and UKCS supplies could be

2.6 Procurement

58. Operating Margins services can be bought through tender, bi-lateral contracts or through UNC processes for those facilities where Operating Margins can be booked under pre-emption rights[17]. Where economic and efficient to do so, National Grid uses a tender to procure OM services and publishes a Tender Information Report[18] on the outcome of that tender.

59. National Grid intends to run an Operating Margins tender in early 2011 for OM services from 1 May 2011. The timescales of the tender are set out below[15]:

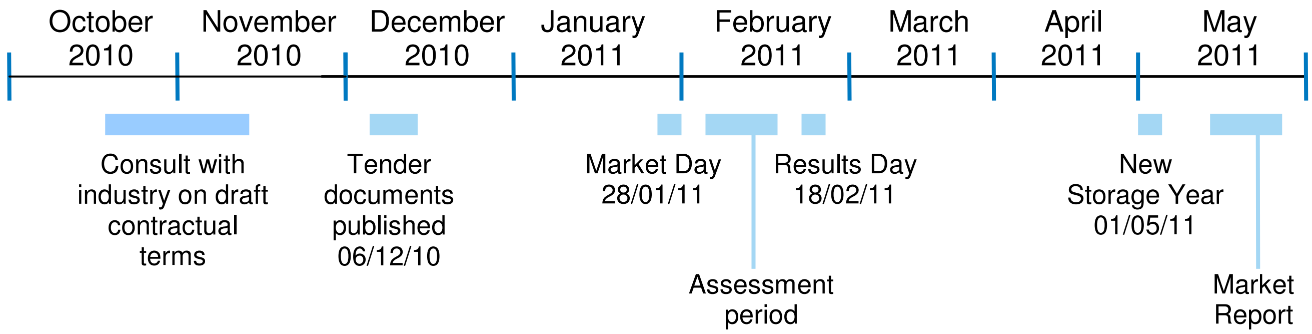

Figure 2.6: 2011/12 Operating Margins tender timescales

60. In order to allow providers time to review the tender documentation, the draft standard terms have been published to enable input from interested parties. Full tender documentation will be published in early December in advance of the tender period in late January as shown in the above timeline.

61. Following the OM tender, there may be a change in the volume of OM gas held at each facility. Following on from the Operating Margins service tender, it is expected that tenders relating to gas re-profiling will be held in April in advance of the new Storage Year on 1st May. The re-profiling tender is carried out to ensure that the required volume of gas is held in any given facility for the following storage year. The re-profiling may be either an increase or decrease in stock levels, ensuring that stocks are at the level to meet the OM requirement. The tender is held in April to prevent any additional charges being incurred once the new storage year commences on 1st May. For example, should stocks be above the capacity holding at the 1st May overrun charges would be incurred at some facilities.

2.7 Regulated Pricing at NG LNG Storage Facilities

62. NGLNG Storage currently provides approximately one third of Operating Margins provision under ‘pre-emption rights’, where Operating Margins

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asked to flow at maximum. Therefore demand reduction and supply increases will already be taking place such that these OM contracts will be unable to provide OM at this point.

[17] Currently pre-emption rights are in place for the Glenmavis, Partington and Avonmouth LNG Storage facilities.

[18] Tender Information Reports for previous tenders are available at http://www.nationalgrid.com/uk/Gas/OperationalInfo/GasOperatingMargins

services have priority over other bookings under the UNC. In August, Ofgem announced a review of regulated pricing ('C3 prices') of services from NG LNG Storage facilities[19].

63. The NGLNG Storage facilities are important in Operating Margins provision due to both their high deliverability and location on the NTS.

64. There is uncertainty in the overall costs for Operating Margins due to the uncertainty around the structure, level and potential suspension of regulated pricing for OM services from NG LNG Storage.

Potential Structure of Regulated Pricing

65. Following the review, the new form of regulated pricing at these facilities could be by price regulation (as now) where prices are defined in the licence, or by a revenue restriction where the a defined level of revenue can be recovered by the facility operator. Ofgem note in its Open Letter that it had previously considered price capping as more appropriate for pricing services from NG LNG Storage.

66. A price based mechanism would fit into the current regime for OM procurement enabling a pricing assessment between these facilities and any available alternatives to be completed.

67. Alternatively, if OM services from NG LNG Storage were to be under a revenue restriction, and the incentive arrangements introduced incentivised National Grid to minimise the cost of operating margins in one year, this may undermine the development of a competitive market. For example, it is conceivable that National Grid may be the only customer at some LNG Storage facilities. In a scenario where NG LNGS is subject to a revenue restriction, it is possible that the pricing structure would make it efficient and economic for National Grid NTS to book an entire site for OM provision as the cost would be the same irrespective of the volume booked at the facility, reducing the amount of Operating Margins booked on the open market.

68. The Initial Proposals for the NG LNG Storage pricing structure are due to be consulted on by Ofgem in November 2010 and Final Proposals are due to be consulted on in January 2011. The regulated pricing arrangements are being reviewed for the period up to RIIO-T1 in 2013, when funding may or may not fall under the remit of these negotiations

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[19] Ofgem published an Open Letter on National Grid LNG Storage facilities Price control on 17th August 2010: http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?file=FINAL%20National%20Grid%20Liquefied%20Natural%20Gas%20facilities%20price%20control.pdf&refer=Networks/Trans/GasTransPolicy/LNGPriceControl

Level of Regulated Pricing

69. From initial analysis of likely Operating Margins costs, with all other assumptions staying the same, the overall costs of Operating Margins are greatly impacted by the level of regulated prices at the NG LNG Storage facilities. As the level and structure of these prices has not yet been set, this is therefore a major uncertainty in the estimated costs of providing Operating Margins in the next two years.

70. The impact of a change in the form of regulated prices at LNG Storage facilities on the competitive market for OM provision is unknown and therefore difficult to forecast. A number of specific scenarios have been analysed to enable appropriate deadbands and sharing factors to be considered. Further details are available in Appendix 3.

Potential Suspension of Regulated Pricing

71. The regulated prices for OM services from NG LNG Storage can be suspended or partially suspended for any or all of the facilities and for any or all requirement types. The ability for regulated prices to be suspended introduces complexity as the outcome will not be known until during the tender assessment period as the decision to suspend or not cannot be made until after the tender market day.

72. The decision of whether regulated prices will be suspended can have a significant impact on both the Operating Margins bookings and costs as this could change the order of pricing in assessment and therefore the cost of service provision. During the 2010 Operating Margins tender, it was forecast that costs could be between £17m and £35m depending on which, if any, of the regulated prices for OM services from NG LNG Storage were suspended. It is likely that the impact of decisions on suspending prices could be similar in future.

73. Last year, the main criteria used to assess whether to suspend regulated prices of OM services was whether each requirement could be met by tender offers from providers other than NG LNG Storage.

74. Following the receipt of tenders, it became clear that the criteria had been met for the North locational, Orderly Rundown and Non-locational requirements, such that the regulated prices for these requirement types were suspended[20]. However, regulated prices were not suspended for the Supply Loss, West and Scotland requirements, as there were insufficient tenders to meet the requirement without NG LNG Storage[21].

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[20] Ofgem's decision letter on whether competition in the provision of OM services has been effective based on NGG's 2010 OM tender is available here: http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?file=OM_Contestability_18_February_2010%20(sig).pdf&refer=Networks/Trans/Archive/GasTrans/LNGPriceControl

[21] The South Locational requirement cannot be fulfilled by any of the NGLNG Storage facilities and therefore was not included in the 'C3' price suspension assessment.

75. The regulated price suspension criteria for 2011/12 and 2012/13 will be published by Ofgem before Christmas 2010. Depending on which criteria are used in the suspension decision, this could drive different prices to be suspended, which drives further uncertainty in the estimated cost of Operating Margins provision.

2.8 Potential incentive and cost recovery structures

76. When considering potential incentive and cost recovery structures for Operating Margins, it is important to understand the likely behaviours that may be driven by an incentive and the level of control that National Grid has to manage each aspect of OM provision in an efficient, economic and co-ordinated manner. The aspects that need to be considered include:

- Providing Operating Margins services at an efficient cost, both in the shorter and longer term.
- Enabling an efficient trade off between utilisation costs and holdings costs for all types of OM services.
- Enabling & encouraging participation from all potential OM providers and having arrangements in place that do not have any undue bias towards or against any particular provider type.
- Provision of clear information and market signals on the requirement, mechanisms for service provision and outcome of tenders.

77. National Grid considers that there are a number of uncertainties that need to be considered when designing any arrangements for Operating Margins for the years 2011/12 and 2012/13:

- The outcome of the review of the NGLNGS regulated price structure, in particular whether regulated prices are in the form of a revenue or price restriction and the level of prices for Operating Margins services from LNG Storage.
- The effect of the potential changes in regulated prices on other market participants' tender prices.
- Whether the regulated prices for OM services from LNG Storage are suspended, which is dependent on the available market in OM provision and the criteria are used in the decision.
- The volume and deliverability of Operating Margins required by requirement type, which is only estimated at this stage, and is affected by external factors such as changes in forecast demands and supplies.

- The level of OM utilisation in any given year. There is the potential for a large utilisation of OM in any year, though smaller utilisations have occurred more often.

- The drivers for OM service providers that could lead to movements in OM tender prices. The link between the cost of OM and other industry indicators, such as seasonal gas price differentials is highlighted by the indexed nature of some OM costs.

- The desire of current or new market participants to offer OM services, as a growing volume of the OM is booked at facilities where there is no requirement for third party access.

78. In our work this summer to develop the arrangements for Operating Margins going forward, we have identified some options that could be further developed into either a cost–pass through arrangement (with no direct incentive) or be subject to an incentive:

a) No Direct Incentive - Pass through of both holdings and utilisation costs, as currently in place.

b) Bundled OM cost incentive

c) Unbundled OM cost incentive

Option A: No Direct Incentive - Cost Pass Through of Holdings and Utilisation Costs

Key Features:

- **Efficient & economic costs recovered from industry, following regulatory scrutiny**
- **No direct incentive for National Grid Gas**

79. As described above, there are a number of uncertainties that have a major impact on the estimated level of costs to fulfil the Operating Margins requirement. The impact of each of these uncertainties is unknown at this stage, and National Grid has been unable to find target adjustment mechanisms for all of the uncertainties outside of our control.

80. If the costs of Operating Margins were subject to cost pass-through and regulatory scrutiny, this would mean that the impact of uncertainties outside National Grid's control would not need to be factored into any incentive target. With cost pass-through arrangements, National Grid would still work to reduce Operating Margins costs to an efficient level, in accordance with its licence obligations to be economic, efficient and co-ordinated. However National Grid would not have a direct financial incentive.

Option B: Bundled incentive scheme for Holdings and Utilisation costs

Key Features:
- **Target for Holdings & Utilisation costs adjusted for regulated price changes (£19.5m if C3 prices remain as now)**
- **2012/13 target based on 2011/12 outturn costs**
- **Utilisation volume capped in utilisation cost measure**
- **£5.5m deadband**
- **25% upside sharing factor to £2m cap**
- **10% downside sharing factor to -£1m collar**

81. A bundled scheme would incentivise the minimisation of Operating Margins holdings and utilisation costs against a single target. As previously discussed, there are a number of uncertainties outside National Grid's control. To ensure that National Grid are not unduly rewarded or penalised by the outcomes of these uncertainties, we propose that where a relationship can be found, the target should be adjusted for these outcomes.

82. A number of discrete forecast scenarios have been studied for Operating Margins costs in 2011/12. A relationship has been identified between the level of regulated prices of NG LNG Storage and the forecast cost as shown in the figure 2.7 below. Therefore, it may be appropriate to link any cost target to these regulated prices, as they are not within National Grid's control.

83. The scenario analysis has been completed for a range of outcomes from regulated prices as currently in place to three times the current level. Outside of this range of pricing outcomes, there may be more fundamental changes to the market for Operating Margins services. Therefore, we consider that in this circumstance any incentive would need to be reviewed as the assumptions made in the scenario analysis may no longer be valid.

84. The proposed deadband shown in the chart below (figure 2.7) has been developed based on the analysis of a range of outcomes to the regulated prices review to reflect the some uncertainty in the reaction of market participants' to the outcome of the review of regulated prices for OM services from LNG Storage.

85. The lower value of the deadband at a range of regulated price levels has been calculated to try to ensure that National Grid is only rewarded for actions that we take to reduce overall OM costs, rather than price or volume movements outside our control. This deadband only reflects the change in Regulated pricing and a minimal reaction to this outcome by other market participants.

86. The higher value of the deadband at a range of regulated price levels has been calculated to ensure that National Grid are not unduly exposed to cost increases that are not within our control and reflects a greater impact of the Regulated Price outcome on other market participants pricing behaviour. However, the impact factored into calculating this level is significantly less than the change in regulated prices.

87. This scenario analysis results in the incentive proposal including a £5.5m deadband to reflect general uncertainties in the market for OM provision. If you would like to know more about the proposed deadband and target adjustment for the level of regulated prices in setting the incentive, please see Appendix 3.

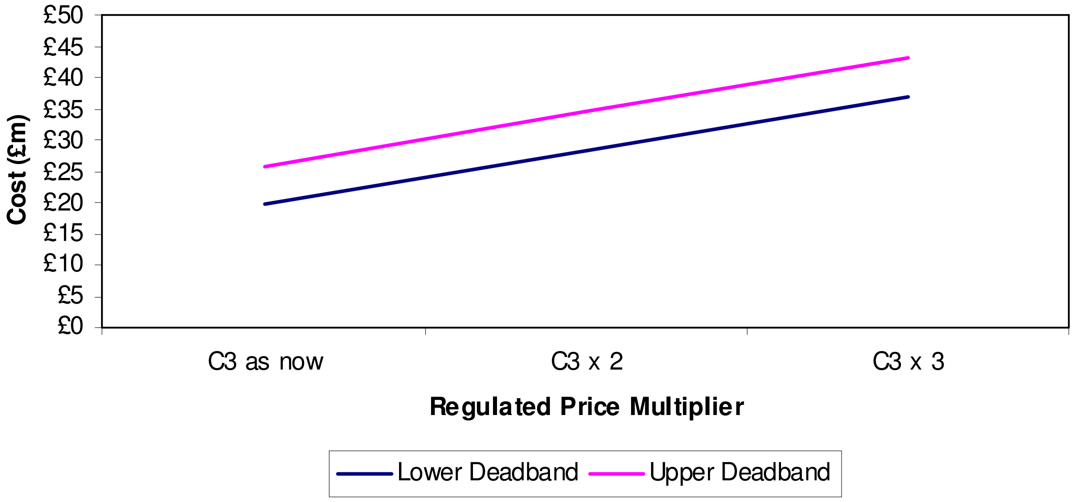

Figure 2.7: Estimated movement of Operating Margins costs with C3 prices and proposed deadband

88. The regulated prices for Operating Margins services from NG LNG Storage are currently set by facility. The scenario analysis assumes that the same change in prices would apply to all the facilities. If the Initial Proposals for the NG LNG Storage Price Review have a different pricing structure, such as a revenue restriction or the prices of the individual facilities are not uniformly adjusted, then we believe that the proposed incentive structures would need to be reviewed.

89. Though the scenarios have shown a relationship between regulated pricing and forecast Operating Margins costs, the proposed adjustment may not accurately account for the reaction of the market to the change in level of regulated pricing.

90. To reflect that the deadband does not account for all of the uncertainty relating to the impact that the NG LNGS price review and the continued development of the contestable market could have on market participants' pricing, the incentive proposal also includes sharing factors and a cap and collar to prevent National Grid from being unduly rewarded or penalised as a result of these factors which are outside of its control.

91. Sharing factors enable any increase or reduction in costs from the target level to be shared between National Grid and the industry.

92. Shallow sharing factors, caps and collars are proposed to reflect the high level of additional uncertainties including the level of tender participation and pricing behaviour, the fundamentals of the gas market and the review of regulated prices.

93. There is a risk that total OM costs will be greater than the higher deadband value. In this event, it is our view that the higher OM costs would most likely have been driven by external factors outside National Grid's control. To offer some protection against this outcome, a shallow 10% sharing factor and a collar to any possible incentive scheme losses is appropriate. We propose to collar any incentive losses at £1m.

94. There is a more limited opportunity for National Grid to reduce total OM costs below the lower deadband value. Reasonable changes to the behaviour of market participants have already been included in the scenario analysis which sets the lower deadband National Grid considers it is unlikely that any external factors outside National Grid's control would lead to significantly lower tendered prices for significant levels of volume from market participants.

95. National Grid believes that any reduction in OM costs below the lower deadband value would be as a result of action taken by National Grid, for example through encouraging more service providers to enter the market and therefore increasing competition, this would require National Grid to make a significant investment in resources to achieve this. To provide the necessary incentive to make this investment, we consider that a higher sharing factor is appropriate and we propose that this value should be 25%. A 25% sharing factor with a reduction in costs of £1m below the deadband would lead to a reduction in costs to industry of £750k with profit of £250k for National Grid.

96. We propose to cap any potential profits at £2m, this is at a higher level than the collar to ensure National Grid is incentivised to identify and implement OM cost saving initiatives over a wide range of possible OM cost outcomes.

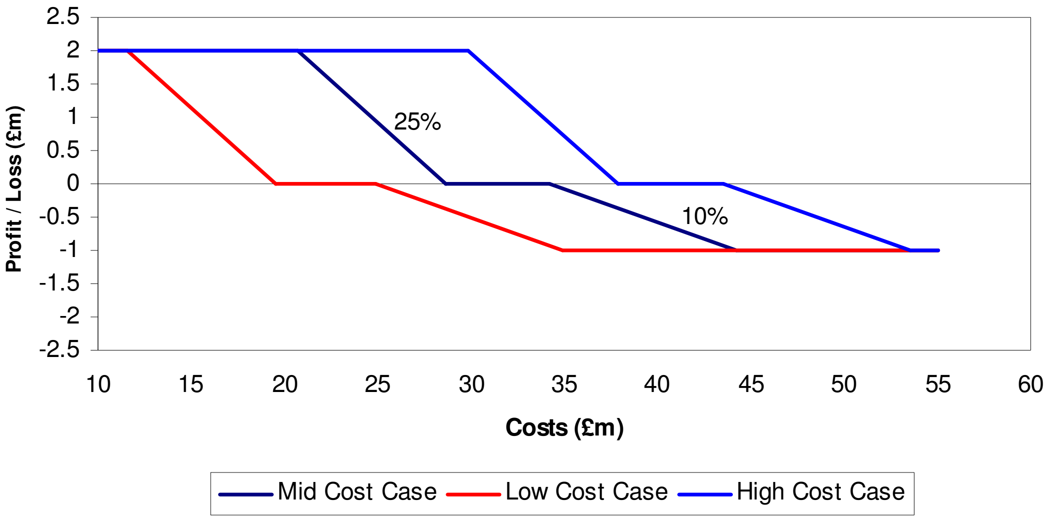

Figure 2.8: Potential structure of Bundled OM incentive – Holdings and Utilisation

97. The target for costs in the proposed bundled incentive scheme includes elements for both holdings and utilisation costs. The utilisation element of the incentive cost target proposed is calculated as an average historical utilisation volume multiplied by a weighted average OM utilisation price from the current

tender year. An example of this calculation is set out in more detail in Appendix 4.

98. The utilisation part of the cost performance measure would include a volume collar. This should incentivise National Grid to include utilisation costs within its assessment of Operating Margins tenders, such that should there be an OM utilisation, it could be resolved in the most efficient manner. The volume cap would reduce the exposure to the risk of a major event such as a major supply loss, leading to a large volume of OM being utilised, which would not be within National Grid's direct control.

99. There is a high level of uncertainty in the market for Operating Margins provision and related changes in costs that could lead to creating either a windfall profit or loss. Therefore, National Grid believes that any incentive structures outlined in this document should be reviewed if:

- Regulated price suspension is extended to further OM requirement types; or
- If, following review, NGLNG Storage facilities' regulated prices are outside of the analysed range (one to three times current regulated prices) in creating the regulated price target adjustment (as described in paragraph 83) or prices are not uniformly changed from the current prices; or
- The outcome of the NGLNG Storage price review results in a revenue rather than a price restriction (as described in paragraph 67).

100. Providing the regulated prices are unchanged between 2011/12 and 2012/13 as currently understood, we propose that the holdings part of the cost target for 2012/13 would be based on the outturn costs in 2011/12 with an RPI uplift. Given that regulated pricing is a major driver in the uncertainty of costs in 2011/12, which should be resolved in 2011/12, the outturn level for 2011/12 will then reflect the resolution of this uncertainty and provide a suitable target for 2012/13. The utilisation element of the target in the second year of the incentive, 2012/13, would be calculated as in 2011/12 with an RPI uplift as set out in Appendix 3.

101. The proposed 2012/13 incentive scheme would also continue to include the same £5.5m deadband as in 2011/12 centered around the 2011/12 outturn cost. This is to reflect the continued uncertainty around the impact of the NGLNGS price review on other market participants. The timeline for the 2011/12 tender is close to the publication of final proposals for the NG LNG Storage price review leaving little time for tenderers to fully assess its impact in the 2011/12 tender. Therefore National Grid considers that some participants' tenders for 2012/13 may include further reaction to the outcome of the price control as well as any further market developments.

102. Should the volume requirement change by in excess of +/- 10% between the two incentive years then National Grid believes that the cost target should be

reassessed as this level of volume change could lead to a significant move in costs between the two years which would not be factored into the cost target.

103. A change in the volume requirement, in either direction, could lead to a change in costs which may not have been allowed for in the incentive structure. Should the volume requirement significantly increase then additional volume would have to be contracted for in 2012/13 leading to additional cost. An element of re-profiling costs should gas need to be injected into a facility would also be incurred. Equally, should the volume requirement reduce significantly, then the volume of operating margins purchased would reduce, though re-profiling of stocks at the affected facilities would have to be carried out, which could lead to additional costs being incurred.

Option C: Separate incentive schemes for Holdings and Utilisation costs:

Key Features:

- **Separate Incentives for Holdings & Utilisation Costs.**
- **Holdings:**
  - **Cost target adjusted for regulated price changes (£19m if C3 prices remain as now)**
  - **£5.5m deadband**
  - **2012/13 target based on 2011/12 outturn costs**
  - **25% upside sharing factor to £2m cap**
  - **10% downside sharing factor to -£1m collar**
- **Utilisation:**
  - **Utilisation cost target: £0.5m**
  - **Utilisation Volume capped**
  - **25% upside sharing factor to £0.125m cap**
  - **10% downside sharing factor to -£0.1m collar**

104. In any average year, the holdings costs would be expected to be much higher than the utilisation costs due to the low probability of a major utilisation. Therefore, this relative size is reflected in the profit and loss potential of each incentive within the unbundled scheme proposal. In any one year, there is a risk of utilisation costs being greater than holdings costs.

105. The unbundled scheme would incentivise the reduction of Operating Margins holdings and utilisation costs against individual targets. As previously discussed, there are a number of uncertainties that could affect the Operating Margins costs that are outside National Grid's control. To ensure that National Grid are not unduly rewarded or penalised from the outcomes of these uncertainties, we propose, as in the bundled incentive proposal, that where a relationship can be found, the targets should be adjusted for these outcomes.

106. An unbundled scheme incentivises National Grid to minimise costs in both the holdings and utilisation of Operating Margins gas while removing all the

impact a high cost utilisation would have in a bundled scheme on efficient holdings procurement.

107. As in the bundled scheme, the holdings cost target would be adjusted for the relationship which has been identified between the level of regulated prices of NG LNG Storage and the forecast Operating Margins cost as shown in figure 2.9.

108. The proposed structure in terms of target, deadband, caps, collars and sharing factors in the unbundled holdings cost scheme is the same as in the bundled incentive scheme outlined above. As highlighted previously in the bundled scheme, these reflect the general uncertainty around the market for OM provision in particular following the outcome of the NG LNG Storage regulated prices review. The proposed incentive structure can be seen in the figure below:

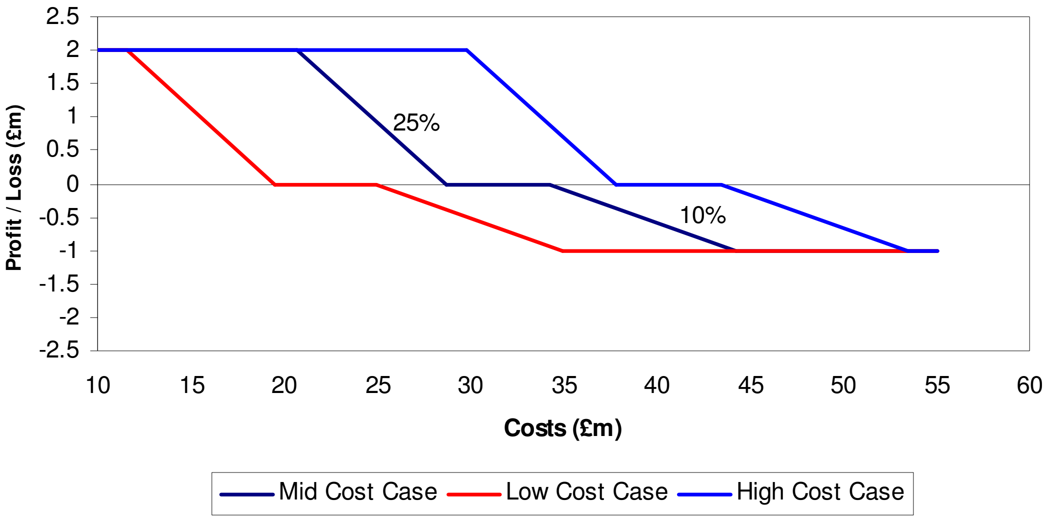

Figure 2.9: Proposed Unbundled OM Holdings Incentive

109. The Utilisation cost target within the unbundled incentive proposal is calculated as an average historical utilisation volume multiplied by a weighted average OM utilisation price from the current tender year. An example of this calculation is set out in more detail in Appendix 4.

110. As in the bundled scheme, the utilisation incentive proposal includes a volume collar to enable an average level of utilisation to be incentivised when tenders are assessed, whilst reducing National Grid's exposure to the risk of a major event, for example a Supply Loss which would be outside of our control.

111. In the event of a utilisation requirement, dependant on the type or location of that requirement, National Grid may have a limited number of providers available to satisfy the requirement. For example, a locational utilisation requirement is likely to have less providers available than those who can be called upon for an orderly run down utilisation. Although the utilisation costs will be included in the assessment of the tender offers, only an average price

is factored into the target, such that in the case of a utilisation, National Grid may need to use a more expensive contract.

112. In order to not create perversities in the unbundled incentive proposal, National Grid proposes that the utilisation target would be subject to the same sharing factors as in the holdings scheme (25% upside, 10% downside). If the utilisation incentive sharing factors were significantly different to that in the holdings incentive scheme, then this could introduce perversities in the assessment of tenders if the holdings and utilisation costs of the tenders are not assessed on an equal basis.

113. The utilisation incentive would have a cap of £0.125m and collar of -£0.1m creating an incentivised range on utilisation of £1.5m for a volume of 35.5GWh The potential structure of this incentive is shown below in Figure 2.10.

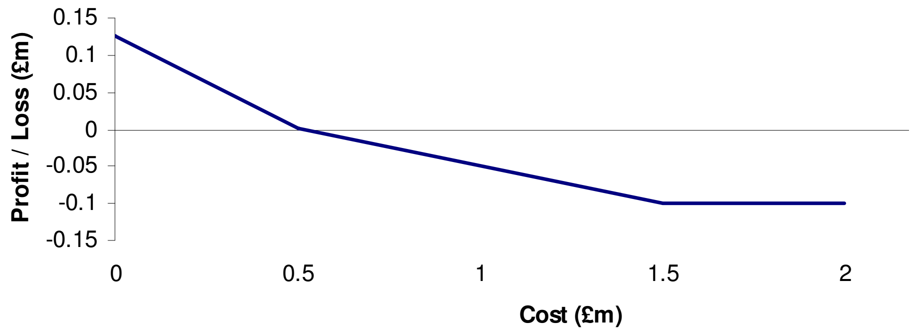

Figure 2.10: Unbundled Utilisation Cost Incentive structure

Operating Margins Consultation Questions

Question 2.1	Do you believe Operating Margins should be subject to an incentive scheme or should the current cost pass through arrangements continue?
Question 2.2	What type of incentives do you believe are appropriate for Operating Margins?
Question 2.3	Should any incentive or pass-through arrangement cover the 2 year period?
Question 2.4	If you believe an Operating Margins incentive should be put in place, should it be a single incentive covering both utilisation and holdings costs or should these be considered as separate incentive schemes?
Question 2.5	Do you agree with using a target cost adjustment to enable changes in the regulated prices for OM services from NGLNGS to be reflected? If not, how would you suggest the uncertainty is handled within the incentive scheme?
Question 2.6	Do you agree that it would be appropriate to reassess the incentive target cost if there is: - Further suspension of regulated prices for OM services from National Grid LNG Storage than in the current year? - If regulated prices are outside the analysed range? - A change in the volume of Operating Margins requirement between 2011/12 and 2012/13 of greater than 10%?
Question 2.7	Given the levels of uncertainty in the cost of providing Operating Margins, do the sharing factors, deadband, cap and collar proposed reflect the level of risk and control? If not, what values of these would you think appropriate? Sharing factors: 25% upside & 10% downside, Deadband: £5.5m, Cap: £2m, Collar: £-1m
Question 2.8	Large utilisations are less common than smaller utilisations, and can be triggered by events outside National Grid's control, such as following a supply loss. Do you support the approach of having a volume cap to manage the level of control and risk in utilisation? Do you agree with the approach of using average historical volume of utilisations (35.5GWh) as the utilisation cap? If not, how do you think this would be best calculated?
Question 2.9	Do you agree with the approach of using average historical volume of utilisations (35.5GWh) within the utilisation cost target? If not, how do you think this would be best calculated?
Question 2.10	Should the utilisation cost target be based on the average prices accepted through tender this year? If not, what do you feel would be most appropriate methodology?
Question 2.11	Should all utilisation costs be included in an utilisation performance measure (i.e. including costs from capacity and delivery contracts) or just those costs that are not recovered through neutrality?
Question 2.12	Should the 2012/13 incentive target be based on the outturn in 2011/12? If not what would be an appropriate target?
Question 2.13	Do you agree with the proposal of incorporating the same deadband around the 2011/12 outturn for the 2012/13 scheme? If not, what would you consider to be appropriate?

Venting natural gas is currently an unavoidable consequence of the normal operation of the NTS from various activities described below. This section considers the drivers of gas venting, its calculation and considers some potential techniques to reduce venting. The environmental cost of venting and incentive proposals are discussed in addition to how this area could progress over the next few years.

3.1 Background

114. There are activities associated with the commissioning, operation, maintenance and de-commissioning of assets on the NTS which result in the release of natural gas into the atmosphere.

115. Efficient operation of the NTS to deliver secure supplies at a reasonable cost has always been a key driver in the development of the system. Over time, environmental performance has become a higher priority and the current commercial arrangements and operational systems are being reviewed in the light of this drive to reduce the environmental impact of our activities.

116. In general, measurements from around the system are used to enable the monitoring of safe operation of the system and to inform commercial processes such as billing. In addition, there are some areas where National Grid's environmental performance is specifically measured, such as to measure the emissions from the use of compressors, but this measurement is not yet in place for all potential emissions from the NTS.

117. To be able to measure the environmental performance of the NTS, further work and investment is required to understand the drivers of venting, collect relevant data and calculate the emissions.

118. An estimate of the level of venting is shown in the chart below, broken down by asset type. Where venting is not currently formally measured or calculated, estimates have been used in these areas (shown in non-solid colour in the figure). Further information on the drivers of venting from the NTS is available in Section 3.3.

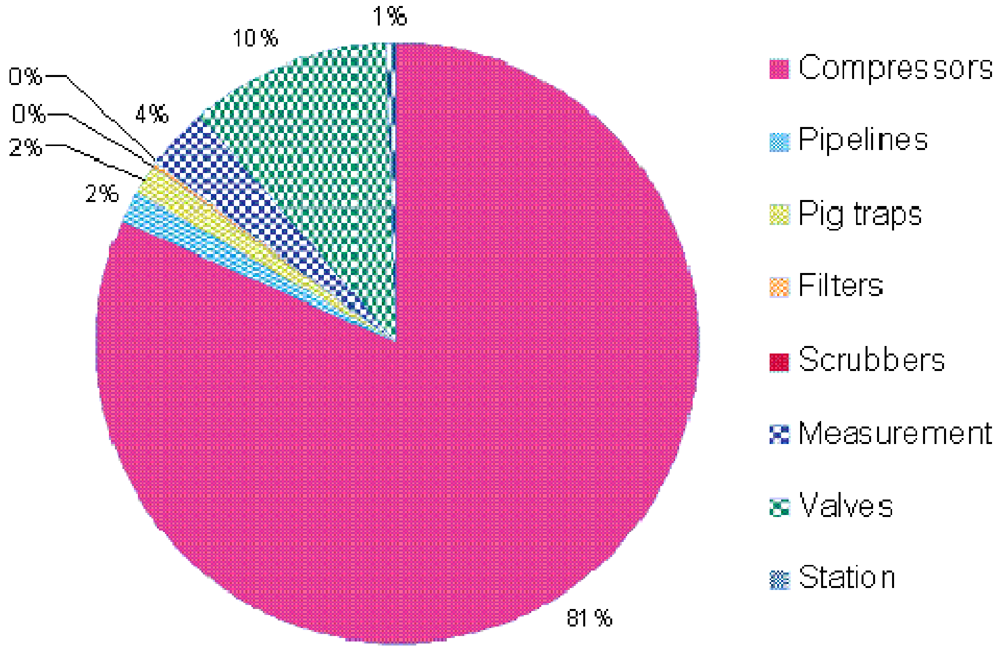

Figure 3.1: Estimated natural gas venting from the NTS by mass

119. The majority (81%) of natural gas venting from the NTS is from compressors that are used to move gas around the UK to where it is required. The current NTS environmental incentive covers the venting from compressors and this is discussed in more detail below in Section 3.2.

120. To put the venting of natural gas into context, we have calculated the carbon equivalent of NTS compressor venting and then compared this to an estimate of equivalent number of cars on the road, number of homes and number of cows including the percentage of each total that this equates to.

		% of total emissions of each type
Estimated Mass of Natural Gas Vented from the NTS compressors in 2009	3007[22] tonnes	n/a
Equivalent estimated Mass of Carbon Dioxide	~62,398 tonnes	0.01%[23]
Equivalent number of cars	15,571 cars	0.03%
Equivalent number of homes	6,522 homes	0.02%
Equivalent number of cows	24,056 cows	0.27%

Table 3.1: Table of venting from the NTS and other activities with equivalent emissions

121. Similarly, the assets and processes currently in place may not be the lowest emissions systems. National Grid has been working to identify where options

[22] This figure is as recalculated using the latest compressor venting methodology.
[23] Venting in CO_2 equivalent as a proportion of the Kyoto greenhouse gases as provisionally reported by DECC for 2009 in March 2010.

are available, or could be in the future, to eliminate or reduce this venting. As many of the options that may enable emissions reductions are not mature technologies within this industry, there is the need to further develop our knowledge and understanding in this area to ensure that efficient sustainable solutions can be implemented and any impacts and benefits can be quantified.

122. Another area for discussion is how environmental performance can be incentivised. This is discussed further, in terms of the environmental cost of emissions, how performance could be compared to a target or benchmark and potential incentive mechanisms, in later sections. Any incentive should be considered in parallel with sustainable investment where it can deliver reductions at an efficient cost.

3.2 Current and Previous Incentive Arrangements

123. The NTS Environmental Incentive scheme incentivises National Grid to make the trade-off between choosing to depressurise compressor units (venting the gas within them) or to keep units on standby - which incurs costs (financial and environmental) associated with ancillary electrical equipment (vent fans, oil pumps etc) and leakage through the shaft seal.

124. Reductions in the natural gas vented to atmosphere from the target, leads to an incentive profit based on the value of the environmental cost of the natural gas emissions saved. Similarly, if more natural gas is vented than the target, National Grid faces a loss equivalent to the environmental cost of the natural gas emissions above this level. The incentive applies to both gas and electrically driven compressors and currently expires in March 2011.

125. The current NTS Environmental Incentive compares the level of natural gas vented from compressors against a target set based on historic vented values. The incentive is summarised in the figure below.

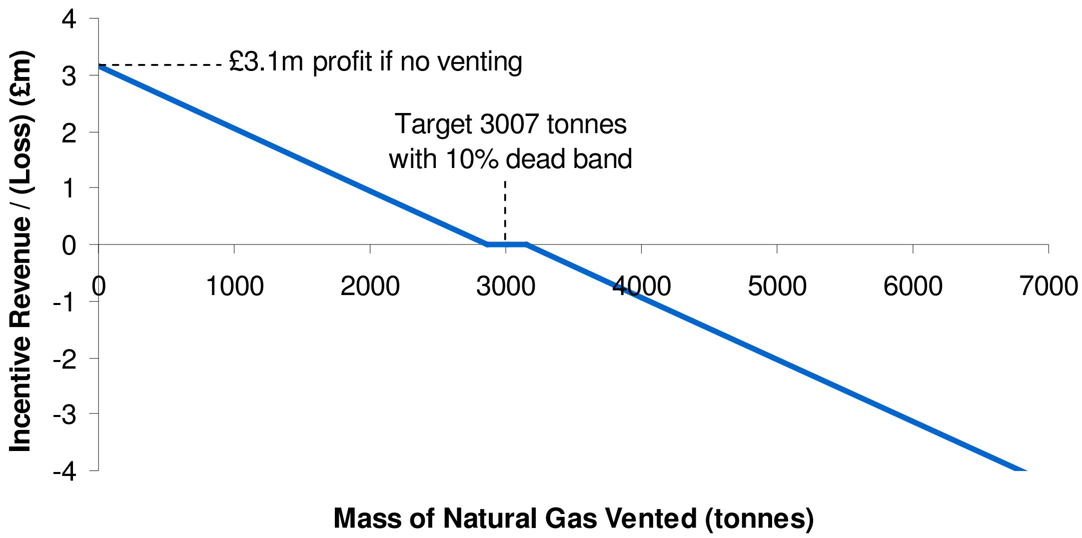

Figure 3.2: 2010/11 NTS Environmental Incentive

126. In 2009, National Grid undertook work to review all aspects of the methodology, measurements and constants used in calculating the mass of natural gas vented from compressors. The improvements to the calculation methodology and from site surveys identified[24] were implemented from 1 April 2010 and were reflected in the 2010/11 target. Information on National Grid's performance under the NTS Environmental Incentive is available in Appendix 5.

127. The price of venting a marginal tonne of natural gas in the incentive is based on the non-traded carbon price calculated by the Department of Energy and Climate Change (DECC)[25] and the environmental CO_2 equivalence of the components of natural gas[26].

3.3 Natural Gas Venting on the National Transmission System

128. This section details the processes that lead to venting on the NTS by asset type, with an estimate of the level of venting where possible. As illustrated in figure 3.1, compressors give rise to the majority of venting on the NTS and, as such, are discussed in detail here. Details of other causes of venting are described briefly in the section and in more detail in Appendix 6.

NTS Compressor Stations

NTS Compressors

129. NTS compressors across Great Britain are used to increase pressures in parts of the NTS and to move gas from the sources of supply to areas of demand.

130. The need to operate an individual compressor on any given day will depend on a number of circumstances including the sources of supply and demand, the prevailing network conditions, such as the current linepack distribution and the need to accommodate maintenance and construction plans. For example, a compressor may need to be used to support an area of the network to create the correct grid conditions to enable a pipeline inspection to be successfully carried out.

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[24] Further information is available on the National Grid website here: http://www.nationalgrid.com/NR/rdonlyres/8A990F49-FF4E-40DE-BEE6-77DF1152E048/39981/GasVentingMethodologyUpdate240210.pdf

[25] The government policy on carbon prices including values are available on DECC's web pages: http://www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/valuation/valuation.aspx. Previously, the Shadow Price of Carbon was used in the venting price, such that all carbon (and equivalent) emissions were valued at the same price.

[26] Natural gas contains a number of different components including Methane, Ethane and Carbon Dioxide. The largest component of natural gas is Methane (about 80% by mass). Initially, the incentive covered the methane component of venting only, though this was broadened to include all of the components in 2009/10.

131. These compressors release natural gas from a number of activities which are summarised below:

- Purging the compressor (and fuel lines on gas powered compressors) of air, prior to starting a compressor. This is necessary to remove the risk of air entering the pipeline system;
- On some compressors, where a gas starter motor is installed, natural gas is used to start the compressor;
- On some of the gas powered compressors, there is a small amount of leakage around a seal on the compressor shaft when the compressor is pressurised. This seal is used to separate combustion products from the areas where pipeline gas is actually being compressed; and
- Depressurising a compressor and associated pipework when the compressor is no longer required for active duty, for safety reasons when maintenance needs to carried out or for safety reasons should the compressor trip. Depressurising a compressor is the largest source of venting from NTS compressors, however this depressurisation does allow auxiliary electrical equipment such as ventilation fans and oil heating/circulation pumps to be switched off saving on the electrical costs and reducing the environmental impact of consuming electricity and the seal leakage resulting from the compressor being in a pressurised state.

132. It should be noted that the requirement to purge and depressurise the compressor apply equally to electrically driven compressors as they do to gas driven units.

133. Hence, the mass of gas vented from compressors is heavily influenced by the number of compressor operations and the expected interval between operations which, in turn, are driven by the supply and demand pattern.

134. The mass of gas vented from compressors was about 3007 tonnes in 2009[27], with an environmental cost of approximately £3.3m per annum. This is approximately 0.004% of total gas demand from the NTS in 2009/10.

NTS Station vent

135. Some maintenance activities on a compressor station or the decommissioning of a compressor station require a ‘station vent’. The annual mass vented from station vents is of the order of 22 tonnes per year from typically two or three events per year with an annual environmental cost of approximately £25k per annum.

[27] This figure is based on the recalculated mass of gas vented following improvements to the calculation methodology and from site surveys. Further information is available here: http://www.nationalgrid.com/NR/rdonlyres/8A990F49-FF4E-40DE-BEE6-77DF1152E048/39981/GasVentingMethodologyUpdate240210.pdf

Other Sources of Natural Gas Venting on the NTS

136. As stated previously, compressors are the primary source of vented gas on the NTS. This section briefly describes the other sources, full details of which are given in Appendix 6.

NTS Pipeline System

137. The NTS pipeline system is a welded steel system which operates at pressures of up to 94 bar. In normal operation, the pipelines do not release natural gas; however maintenance and connection activities can result in a requirement for a controlled release of natural gas, including

- Pipeline Inspections are undertaken to monitor the condition of the NTS pipelines pipeline inspections using in line vehicles (known as Pipeline Inspection Gauges or PIGs). Prior to launching the pig into the pipeline system the pig trap is de-pressurised to enable the pig to be put into the trap before purging the pig trap in advance of the pig entering the NTS. Once the pig has been launched into the pipeline system, the pig trap will then be vented again if necessary to allow the pig trap to be depressurised for subsequent pigs to be loaded into it.

- Pipeline depressurisation. Under certain circumstances (e.g. to cut into the NTS and carry out the necessary welding to facilitate the connection of a new pipeline or offtake), it is necessary to isolate a section of the NTS and purge it to air

- Pipeline purging. In order to re-commission a depressurised pipeline or commission a new pipeline, it is necessary to purge the air from the pipeline for safety reasons. In purging the pipeline, a small amount of natural gas will be released into the atmosphere as it is necessary to ensure all of the air is removed from the pipe before it can be reconnected to the NTS.

NTS Valves

138. NTS Valves. There are of the order of 10,000 valves on the NTS, comprising a number of different valve types. Maintenance of some valve types result in venting as described in Appendix 6. Each valve has an actuator that enables the valve to be moved from an open to a closed position and vice-versa. Some valve actuator types vent natural gas as part of their normal operation. Hence, the total amount of gas vented from valves is a function of their design and the number of operations that they experience.

Other NTS Emissions

139. Other assets which as part of their normal operation or maintenance can result in the release of natural gas include:

- Instrumentation such as gas chromatographs which take small samples of pipeline gas in order to provide information on gas quality

- Flow control valves. There are 20 flow control valves located at sites where a number of pipelines converge and are used to direct flows around the NTS enabling linepack to be transferred between zones. Some of the control / positioning devices vent small amounts of natural gas continuously.

- Filters are used at offtakes to remove any particulates from the gas, prior to the gas being metered. Scrubbers and Strainers are used on the NTS at compressor sites to remove any particulates and condensates from the gas prior to it entering the compressor. To allow the filters, scrubbers and strainers to be cleaned and then returned to service requires them to be depressurised and then subsequently purged of air, resulting in an amount of natural gas being released to atmosphere.

3.4 Potential to reduce environmental impact

140. For each vent type, consideration has been given to the types of processes, systems and technologies that could be used to reduce or eliminate venting of that type. Full site surveys have not been completed, but where possible how the technique might be applied, its limitations, and initial costings have been sought. Where information is available, we have also considered other environmental considerations such as energy use.

141. Where possible, a comparison of the emissions reduction potential against the investment cost estimate has been made for each option to enable further work to be focussed on areas where the most economic changes can be made. This is based on cost and venting estimates, and therefore may be updated when better information becomes available.

142. In some areas, it may be possible to reduce the level of venting where this investment would be uneconomic due to the environmental impact of the reduction in venting being less than the cost of the investment. For example, if the potential vented emissions reduction over the remaining lifespan of an asset multiplied by the environmental price of those emissions is less than the cost to put in place that reduction, there is no cost-benefit in doing that investment.

143. The optimisation decision can also be affected by other emission types, such as energy use. For example, there is a tension between venting to de-pressurise compressors to reduce energy use or keeping a compressor pressurised. Overall environmental performance would not improve if in order to reduce venting, a large amount of energy was used with a greater environmental impact than the venting reduction.

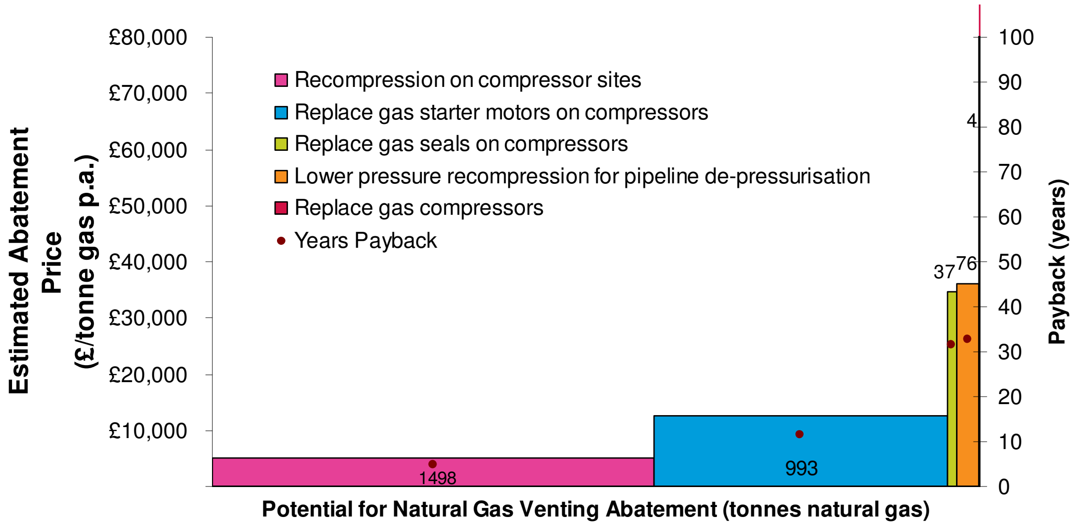

Figure 3.3: Estimated price of various venting abatement techniques

144. The above figure shows a summary of the estimated mass of natural gas that could be reduced against a rough price estimate. The data used in this figure[28] is the best available at the moment, but will be subject to updates as further information becomes available, as site surveys have not been completed and some of these techniques are not in common use.

145. The chart shows a wide range of prices and payback periods for investments to reduce the environmental impact of venting on the NTS. Some techniques may be efficient to install over the medium term, whereas others, such as replacing gas compressors would not be economic against the current environmental cost even in the long term.

146. The shortest identified payback period is approximately 5 years as shown in the figure above for recompression at compressor sites. Both the length of the estimated payback period and the maturity of the technology (it has not yet been trialled at any sites on the NTS) mean that no technologies have been identified that would be economic within a short term incentive in the next 2 years.

147. Many of the potential emissions reduction techniques described are not in common use for the applications described, and therefore further research and development may be required to enable more complete assessments to be made of the technology including its suitability for use on the NTS and the cost of deployment.

148. Venting on the NTS is made up from thousands of events on numerous pieces of equipment, and therefore any strategy to reduce the level of venting needs to consider the level of environmental benefit against any potential investment. Also, depending on the reason for the vent, the vent may

[28] The chart is based on a simple estimate of the price of abating venting where a techniques has been identified. The estimated cost of putting in place the reduction technologies as discussed in Appendix 6 has been divided by the estimated reduction in the mass of gas vented. The estimate does not include time value of money or consider restrictions from site specific factors as the information to quantify this is not currently available.

comprise of natural gas only or a mixture with air which limits any reduction options as an air and natural gas mix could prove difficult to safely store, recompress or flare.

149. For some vent types, there may be limitations in the feasible level of emissions reductions as a result of the use of venting in safety led processes as described below.

Safety Considerations

150. Venting is used in a number of safety critical processes, and therefore the impact of any changes due to the desire to reduce or eliminate venting must be considered.

151. National Grid is required to comply with certain legal requirements in the planning, development and operation of the National Transmission System (NTS) in Great Britain including Pressure Systems Safety Regulations (PSSR) and the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR).

152. The Health and Safety Executive (HSE) have developed guidelines to enable the management of process safety for high hazard industries, such as transporting gas, based on a number of layers of controls. Each layer of control forms a barrier between hazards and potential incidents, removal of any of these barriers increases the potential of an incident occurring. These layers include the process and equipment design, protective devices and maintenance requirements. Below are a few examples where venting is required for the safety of the system:

- In certain locations on the NTS, quick valves are needed to reduce the risk of potentially serious events. Gas actuated valves that vent on actuation are quicker than other currently available valve actuation systems and therefore are required for a number of safety critical valves.

- Bulk transportation of gas requires compressors to move gas around the NTS. Both electric drives and gas turbines can potentially cause gas to ignite if restriction is not applied. When equipment or systems fail, to prevent an explosive mixture coming in contact with an ignition source, the process gas is vented to a safe environment as quickly as possible. Similarly, flaring stacks cannot be situated within certain hazardous zones due to the potential for ignition.

- To protect systems from over pressurisation. If the pressure in a part of the system reaches a high level, relief valves are used to vent gas to atmosphere to quickly reduce the pressure to within safe limits. Additionally, assets on the NTS also need to be tested for fitness for use at pressure – this maintenance process currently leads to venting of a range of assets including valves, scrubbers, filters and pig traps.

- Block valve maintenance is essential to ensure that pipelines can be isolated. This maintenance requires the valve to be operated, resulting in a vent of gas from the both valve body and actuator if this is gas powered.

Potential Options to Reduce Emissions of Natural Gas

153. There are a number of potential emissions reduction options that could be used for some of the vent types. Below, the potential for the use of gas recompression, flaring, gas capture, asset replacement and other techniques to reduce or eliminate the need to vent are considered briefly. Further details of each are given in Appendix 7.

Pipeline recompression

154. Currently, where pipelines need to be de-pressurised, gas is recompressed where feasible and fed back into an adjacent section of the NTS. However, the current technologies used only enable the pipeline to be de-pressurised down to about 7 barg. The remaining gas within the pipeline is then vented to enable further work on the pipeline to continue safely.

155. National Grid has commissioned research into the potential to use a low pressure (LP) recompression unit as an input into the higher pressure (HP) recompression rig, to enable further venting reductions than the HP recompression unit currently used could deliver. If successful, the gas in the pipeline could be taken to a lower pressure prior to venting, reducing the mass of gas vented.

Compressor venting recompression

156. We are investigating the potential for a compressor to be used to recompress some of the different vent types that have been identified on a compressor site, concentrating on the main compressor casing vent.

157. A recompression unit and the associated infrastructure to enable connection and onwards use of the gas would need to be assessed on a site by site basis. If suitable units can be manufactured and installed, there would be a reduction in the environmental impact, but not a complete elimination as energy is used in recompressing the gas and the units would also not be able to reduce the contained gas to zero, so a small mass of gas would still be required to be vented.

158. There are some vents that this system would not be able to cover because if the compressor trips, for example if the compressor control system detects a fire, recompression could not be used.

Flaring Gas

159. Flaring (i.e. burning) gas has a substantially lower environmental impact than venting the same volume of unburnt gas. Further work is required to

understand the impact of using this technology at an operational site where hazardous zoning is in place to reduce the likelihood of any safety issues.

160. Recompression and flaring processes can be run in conjunction, allowing gas to be recompressed to a low pressure and then the final gas volume to be flared instead of vented, reducing dramatically the environmental impact.

Capturing vented gas

161. An alternative to venting or flaring gas is to capture it for use or re-injection into the system. National Grid have started a project to consider the potential to use Adsorbed Natural Gas (ANG) technology to store gas that would otherwise be vented from a compressor.

162. The natural gas is adsorbed by an appropriately adsorbent material with high porosity to achieve a high energy density within the storage vessel. However, the gas will only flow into the vessel (and reduce venting) until the pressure in the storage vessel is equal to that in the compressor, and therefore not all gas would be captured under this system. This process requires energy input which should be taken into account when looking at the feasibility and the overall environmental impact of such an installation.

Asset Replacement

163. For some vent types, asset replacement or retrofitting new equipment could be used to reduce or eliminate venting. Many of these potential solutions to reduce the environmental impact of the NTS would need significant capital investment at a number of sites around the UK.

164. Following discussion of the potential for environmental investments in the 2010/11 incentive consultations, responses were received that stated that any capital intensive or high value environmental investments in this area be considered as part of next Price Control Review discussions[29].

165. The costs in this section are based on estimates and do not include any capital efficiencies or early asset life write offs associated with asset replacement or retrofitting of equipment.

Asset Replacement of Valve Actuators

166. Some valves on the NTS use the pressure of gas on the NTS to actuate (open or shut) the valve. Other types of valve actuators include compressed air or electrically driven actuators. Safety critical valves currently need to be gas

[29] Consultation Two on Environmental Incentives and industry responses to this consultation are available from http://www.nationalgrid.com/uk/Gas/soincentives/archive/2009_10.

actuated to ensure that the valve opens or closes quickly to reduce the risk of potentially serious events[30].

167. Any studies into the replacement of assets need to take into account the usage characteristics of a given site and the facilities on the site to lead to the optimal solution - reducing venting is just part of the optimisation between the environment, cost and reliability.

Asset Replacement of Compressor starter motors

168. Approximately a third of NTS compressors have gas starter motors that use high pressure gas from the NTS to spin the compressor up to a speed where the main turbine can start, which is then vented. Approximately 76 tonnes of natural gas was vented from compressor starter motors in 2009[31].

169. An alternative could be to use an electric starter motor with a much lower environmental impact on use. Site surveys and detailed costings have not been completed for the replacement of gas starter motors with electric starter motors, but the total cost is estimated to be in the order of £2m to £3.5m, giving about a 30 year breakeven horizon, though the breakeven will vary between compressors with different usage patterns. Some compressors may not be able to have an alternative starter motor retrofitted to the existing compressor.

Asset Replacement of Compressor gas seals

170. On any compressor, there is a small amount of leakage around a seal on the compressor shaft when the compressor is either running or pressurised. The gas seal is used to separate combustion products from the areas where pipeline gas is being compressed. Approximately half of the compressors have wet gas seals that vent more natural gas than the dry gas seal alternative. Approximately 1,100 tonnes of natural gas was vented from compressor seals in 2009[32], which accounts for over a third of the compressor venting on the NTS in that year.

171. To replace all of the wet gas seals with dry gas seals, which vent substantially less gas on all relevant NTS compressors would cost between approximately £11m and £18m. We estimate that the payback for this type of investment would be of the order of 12 years at the non-traded price of carbon, which additionally is much higher than the current market value for carbon. The actual payback for any particular compressor would be dependent on the

[30] Critical valves need to be able to close in timescale of 1 second per inch of pipeline diameter.

[31] The gas starter motor vent value for 2009 was recalculated following a methodology review and site surveys – details are available here: http://www.nationalgrid.com/NR/rdonlyres/8A990F49-FF4E-40DE-BEE6-77DF1152E048/39981/GasVentingMethodologyUpdate240210.pdf

[32] http://www.nationalgrid.com/NR/rdonlyres/8A990F49-FF4E-40DE-BEE6-77DF1152E048/39981/GasVentingMethodologyUpdate240210.pdf

usage characteristics of the compressor. Some compressors may not be able to have an alternative gas seal system retrofitted to the existing compressor.

Asset Replacement of Compressors

172. To eliminate the fuel gas vent from compressors, all of the gas compressors on the NTS would need to be changed out for electric compressors. This would cost in the region of £2bn, or £1.3bn if only those compressors under main duty were changed out. This would result in only a very small impact on the level of venting from the NTS (~4 tonnes / annum) which has an environmental cost of approximately £4000[33] per year which on a simple payback over the expected life of the compressors would be around £91k on an equivalent basis. Without considering the substantial environmental impact of these site works and new machines, this would not be an economic investment given the excessive payback period.

Other

173. As part of the review of environmental performance, it is necessary to also consider the systems in place, to ensure that they are fit for purpose.

174. A gas compressor and the associated pipework needs to be purged of air prior to starting the compressor to remove the risk of air entering the pipeline system. The compressor is purged by allowing gas to flow through the compressor until there is minimal air in the compressor, with a mixture of gas and air vented to atmosphere.

175. A project has been started that considers whether the time that the gas flows through the compressor is no longer than required to ensure a full purge of the compressor. If any changes are identified, there will need to be control system changes on each compressor to put this in place.

3.5 Efficient Level of NTS Venting

176. This section discusses how an efficient level of venting may be derived for use within a target, including how this may be adjusted in line with network requirements.

177. Natural gas venting from the NTS results from activities associated with the commissioning, operation, maintenance and de-commissioning of assets on the NTS. Some of these vents result from safety led processes, such as where venting is required under international standards or for critical valves where gas actuated valves are required due to their speed, and therefore could not be reduced with current technologies.

[33] Using the environmental cost in the current NTS environmental incentive (£1100/tonne natural gas vented)

178. To efficiently reduce environmental emissions, it would be prudent to consider which investments or actions are the most effective at reducing emissions at the lowest cost. For some of the options identified to reduce venting, the environmental cost of the emissions reduction over the life of the asset is less than the incremental cost of making that investment, such that not all of the potential investments to reduce venting would be economic.

179. The optimisation between costs and environmental emissions can also be affected by other emission types, such as energy use such that the minimum venting option may not be the optimal environmental solution.

180. Given the safety, environmental and economic factors, a level of venting that considers the efficient potential to reduce venting may be more a suitable target than a requirement to reduce venting irrespective of other factors.

Use of Benchmarking in Environmental Emissions Schemes

181. Environmental schemes generally use benchmarking years to set base levels of emissions which are then used to drive improvements and reductions in the overall level going forwards. Although these benchmarks are used in market based schemes such as the European Union Emissions Trading System (EU ETS) and the CRC Energy Efficiency Scheme, National Grid considers that a benchmark approach to drive reductions in the environmental scheme would be equally applicable once the understanding, data collection and validation is developed further. A benchmark for the environmental scheme could provide the basis for continuous improvement in the levels of venting in the longer term.

182. EU ETS has used historic emissions to set the level of National Allocation Plans (NAP's) from the start of Phase 1, each time trying to drive improvements and reductions in the levels emitted. Under EU ETS for Phase III (2013 – 20), ex ante benchmarks are being used to develop fully harmonised rules for the free allocation of allowances to installations.

183. The EU ETS applies a gradual phase out of the free allocation of allowances. Auctioning of allowances is starting from 2013, with the level of auctioning currently proposed to reach 70% in 2020, with a view to 100% auctioning in 2027.

184. CRC covers emissions outside of those already covered in EUETS, i.e includes electricity usage. Under CRC, which is currently in its first year, performance metrics are based upon the previous year's performance on the scheme (where they exist) building up a 5 year rolling average. With the scheme driving and incentivising improvements and reductions.

Benchmarking by Vent Type

185. The amount of venting is related to National Grid's operation of the network, network topology, safety requirements and external triggers such as a third party requirement for a pipeline diversion.

186. To enable the marginal cost of environmental actions to be included fairly within an incentive, it may be necessary in the long term to include activity indicators that align the target with system requirements and ensure that there are neither windfall profits or losses from changes in the level of venting outside National Grid's control.

Benchmarking Compressor Venting

187. Compressor venting is driven by the requirement to pressurise, run and de-pressurise each compressor. Therefore analysis has been completed to consider whether there is any correlation between demand, supply, system flows or compressor fuel use and the overall level of compressor venting.

188. The analysis showed some correlation between models based on 2009/10 data and various indicators and combinations of indicators, but the correlation was at best similar to that between 2009/10 data and 2010/11 data for the same months.

189. Correlations between venting and demand, supplies at various points, compressor fuel use and combinations of these drivers have been considered. Though a relationship can be seen between the level of demand on the NTS and the level of venting in particular, the period of historic data used in the analysis is limited due to the change in the methodology in April 2010 and the level of historic data held. In order for confidence to be gained in the robustness of the forecast, more historic data is needed to test the model. I.e. Due to limited experience of the model performance under a wide range of conditions, we do not believe it is yet appropriate to use this model to adjust the incentive target. At the next review of this incentive, we will reconsider the potential to adjust the target for external factors.

190. In recent years the growth of LNG importation has led to more locational supply flexibility on the NTS, this greater supply flexibility is likely to increase the volatility of flows on the NTS and therefore impact on the level of venting, however the level of this is currently unknown. As more history and experience of the effect these changes have on the level of venting from compressors, then the analysis can be reviewed and a correlation may be confirmed or further correlations identified.

Benchmarking Other Vent Types

191. In order to create benchmarks for other vent types, the system requirements to collect and collate the vent mass data need to be understood and the

systems then developed and implemented to enable the benchmark level to be calculated for use in future years.

192. A number of drivers are likely to contribute to the level of venting on the NTS , for example the number of pig runs or the length and number of NTS diversions required in any given year.

3.6 Environmental price of venting natural gas

193. This section details the various environmental costing methods that could be used within any incentive arrangements.

194. There are many ways in which the environmental cost of an action can be valued including the value set under government policy (non-traded price of carbon) and the market traded value.

195. The price signal is important both when considering investment to reduce emissions and in making optimal marginal decisions, such as in the current NTS Environmental Incentive between venting and leaving a compressor on standby (electricity usage).

Non-traded Carbon price

196. Venting natural gas is not currently covered under any environmental trading mechanisms such as the European Union Emissions Trading System (EUETS) and therefore, according to the DECC policy, should be valued at a non-traded price of carbon. There is a substantial difference between the traded and non-traded values currently, with an expectation that in the longer term (2030 onwards) the development of a more comprehensive global carbon market will lead to the traded and non-traded prices of carbon converging into a single traded price of carbon.

197. The current government policy valuation is based on the marginal cost of mitigating emissions if emissions targets are to be met. This approach values non-traded carbon at approximately £52 per tonne of CO_2 equivalent in 2010[34].

198. Further updates to the government carbon values are expected in the future if there are any changes in the EU emissions target or pricing policy could affect the level of carbon pricing as signalled by DECC[35].

[34] DECC guide to new carbon values and their use http://www.decc.gov.uk/media/viewfile.ashx?filepath=what we do/a low carbon uk/carbon valuation/1_20090901160357_e_@@_carbonvaluesbriefguide.pdf&filetype=4

[35] DECC Annual Energy Statement was published in July 2010. Actions 15 and 16 concern providing more certainty and support to the carbon price and pressing for a higher EU emissions reduction target. http://www.decc.gov.uk/assets/decc/what%20we%20do/uk%20energy%20supply/237-annual-energy-statement-2010.pdf

199. The current NTS Environmental Incentive is aligned to the government policy such that the price of venting is calculated as the non-traded price for carbon multiplied by the environmental CO_2 equivalent of 1 tonne of natural gas (approximately 21 tonnes CO_2e). The environmental price used in the current incentive is updated below with the latest carbon price and gas components. More detail on the calculation of these prices is available in Appendix 8.

	2010/11	2011/12	2012/13
Environmental Price (£/tonne of natural gas vented)	£1,100	£1,201	£1,257

Table 3.2: Cost of venting natural gas using the DECC non-traded cost of carbon

Traded Carbon price

200. The current traded price is set by an open market that trades emissions credits and allowances internationally. The UK takes part in the European Union Greenhouse Gas Emission Trading System (EU ETS).

201. By using a trading mechanism, the market should enable the most efficient emissions reductions to be targeted, such that the overall reduction targets are met at a lower price than if the same reductions were required at a company or sector specific level.

202. In this market, the current traded price is approximately £13.50/ tCO_2e[36], which is lower than the traded price set within DECC's latest policy on carbon prices and much lower than the non-traded price.

Carbon Price Comparison

203. There is a substantial difference between the current market traded price (approximately £13.50/ tCO_2e) and the current government policy carbon prices (£14/ tCO_2e traded and £52/ tCO_2e non-traded[37]) and therefore it is necessary to consider the consistency of approach to ensure that any longer term decisions are made using the correct price signal.

204. The major component of natural gas is methane, that is not included as part of the current phase of the EU Emissions Trading Scheme (EU ETS). At present there is no plan for methane to be part of Phase III (2013-2020), however it is likely that this emission type will be included in the future.

205. In the current arrangements where National Grid is subject to revenue (or charge) if it vents less (or more) than the target level of venting at an environmental price for venting. An alternative would be for National Grid to

[36] Price as at 22 October 2010
[37] DECC's first annual update of Carbon values was published in June 2010: http://www.decc.gov.uk/assets/decc/what%20we%20do/a%20low%20carbon%20uk/carbon%20valuation/1_20100610131858_e_@@_carbonvalues.pdf

purchase and retire traded emissions allowances or credits[38] within the EU ETS to offset the environmental impact any venting above the target (benchmarked) level driving economic emissions reductions.

206. If allowances or credits are retired then this would have the impact of reducing the overall level of credits in circulation and should therefore drive reductions in emissions from another area.

3.7 Incentive scheme proposals

207. This section details our shorter term proposal for the NTS Environmental Incentive and sets out the plans for the development of a medium term incentive scheme.

208. In order to incentivise the desired behaviour of reducing venting where feasible, in an efficient, economic and co-ordinated manner, it is necessary to consider:

- The level of control available to the NTS to manage venting and the relationship between venting and System Operator and Transmission Owner activities.
- The current assets and systems of the National Transmission System.
- The state of development of various technological or other emissions reduction options (i.e. initial optioneering through research and development and initial pilot schemes to larger scale deployment).
- The potential expenditure requirements to enable environmentally driven investment.
- What signals could be used to drive behaviours that lead to the optimal sustainable level of change.

209. National Grid has developed an incentive scheme proposal with options for various parameters in the shorter term and the outline structure for a scheme that that could be developed for the longer term.

210. To deliver progress towards zero emissions, as the UK drives towards a low carbon economy, National Grid believes that it is important both to have a scheme that values the marginal cost of venting and to push towards understanding further vented emissions and alternatives.

211. To design an efficient incentive, it is necessary to be able to measure performance and understand the impact of and ability to perform under the incentive.

[38] Emissions credits such as EUAs or CERs. These are explained further in the Glossary in the Appendix 1.

212. At the moment, compressor venting is the only vent type that is formally calculated. As this is the only auditable venting data source, National Grid believe that it is not appropriate to extend the incentive to other vent types until the venting can be measured, the current level of venting is understood and more progress is made towards understanding the potential to reduce venting.

213. Therefore, National Grid's shorter term incentive proposal options cover compressor venting only and include both an operational incentive and funding to enable future reductions in vented emissions to be both identified and analysed for environmental and economic suitability. This would inform discussions in advance of RIIO-T1.

214. The scope, cost and deliverables of any research or pilot projects under the funding proposal are being developed before a further consultation with more detail this Winter. Retention of some or all of the funding for these projects would be dependent upon achievement of these deliverables, in so far as delivery is within National Grid's control.

Marginal Cost Incentive Scheme

215. Incentives are important in setting drivers to encourage better performance, with financial rewards where targets have been outperformed and penalties where they have not been met. For better performance, the incentives must be structured to enable that better performance. For example, if an investment is required to improve performance, the incentive would need to be over an appropriate period such that there is a net positive benefit in delivering the improvement.

216. The below incentive proposal includes various options for setting the target level and deadband:

Proposed Shorter Term Environmental Scheme (2011/12 – 2012/13)

Key Features:

Incentive Scheme

- **To cover compressor venting only**
- **Marginal environmental cost based on DECC non-traded price of carbon**
- **Target based on recent outturn vent masses, with the option to include a deadband**

£2-3m Additional Funding to:

- **Develop venting measurement & benchmarking**
- **Evaluate alternatives to venting**
- **Enable more complete discussions in advance of RIIO-T1**

217. For efficient environmental performance, National Grid believes it is necessary to consider the ability to reduce the environmental impact, the cost of implementing any reductions and a wide range of emissions types (not just venting natural gas) to incentivise an efficient level of emissions reduction.

218. In this proposal, the aim is to incentivise the efficient level of natural gas venting by ensuring that National Grid is exposed to the marginal environmental cost of venting, such that optimal decisions are incentivised including all of the costs and environmental impacts.

219. Zero emissions is not a feasible goal in the shorter term, as we have discussed in the consultation document, due to safety and technological constraints and where vented emissions can be reduced this may not always be economic due to the size and frequency of vents compared to any alternatives.

220. Therefore this proposal would be based on what National Grid considers to be an achievable target with both an upside and a downside to ensure that any possible reductions (or increases) are all at the marginal environmental cost for the vent.

221. No adjustments to the target are proposed for drivers of compressor venting outside National Grid's control, because, as discussed in paragraph 189, with limited available data a robust relationship has not yet been found.

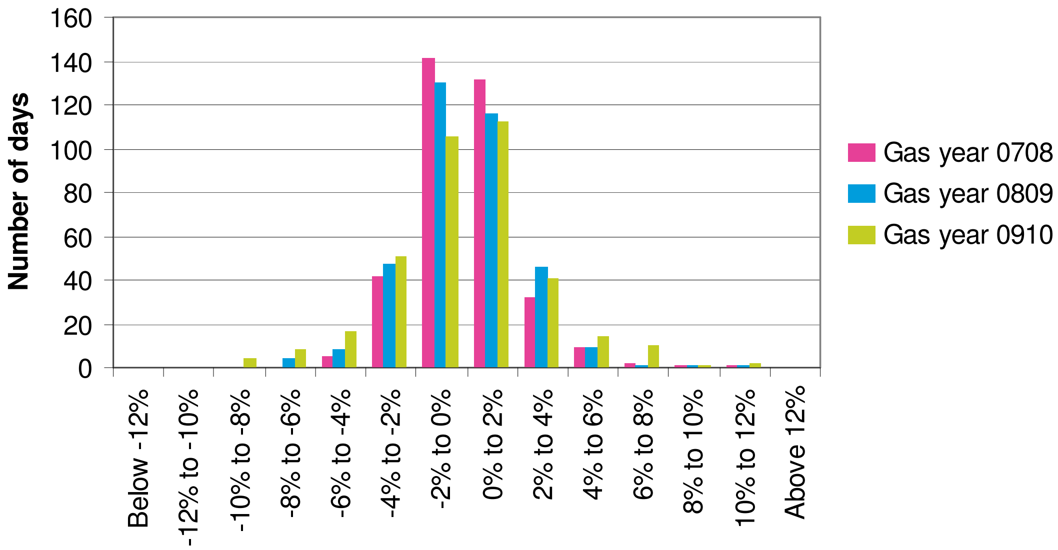

Figure 3.4: Percentage day-to-day difference in supplies from Northern ASEPs[39]

222. National Grid believes the requirement to vent compressors is likely to rise as volatility in supply and demand increases, for example as shown in the figure above. This leads to more uncertainty about when a compressor is next

[39] Northern supplies from St Fergus, Teesside, Easington and Barrow have been added (for simplicity) to the total supply at medium and long range storage sites (as this is concentrated in Northern England) and expressed as a percentage of total supply. The graph is plotted for the period 1 October 2007 to 30 September 2010.

required to run and therefore whether it is better to de-pressurise the compressor (leading to a process vent) or keep it pressurised (leading to seal leakage venting and energy use) ready for the next use of the compressor.

223. Given the increased volatility in distribution of supplies, as seen in figure 3.4, National Grid believes that the setting of the target based on recent historic levels provides both a relevant and challenging target over the 2 year incentive period. The increasing levels of supply diversity and levels of LNG importation being seen suggest that there is no reason to assume the level of volatility will reduce in the near term. National Grid therefore considers that the previous year outturn includes a level of efficiency, such that in order to outturn at that level in the following year would mean a reduction in the level of venting in real terms.

224. Due to this, National Grid believes that the most recent historic outturns are an appropriate basis for a target. Therefore, two options are proposed for setting the target level:

a. Previous calendar year outturn vent mass

b. Average of the previous two calendar years outturn vent mass

225. The proposed target in option a for 2011/12 is the 2010 calendar year outturn vent mass and for 2012/13 target is the 2011 outturn. National Grid considers that the most recent historic outturn is an appropriate target because supply and demand patterns, in particular their location, are becoming increasingly more volatile as shown in figure 3.4 above. A forecast for the 2010 outturn for this target option in 2011/12 is 3391 tonnes[40].

226. In option b, the proposed target for 2011/12 is the average of the outturn vent mass for the 2009 and 2010 calendar years. The proposed 2012/13 target under this option would be the average of the outturn vent mass for the 2010 and 2011 calendar years. This option takes account of the previous two years' vent mass to reduce the impact of any particularly high or low venting in any one year contributing to an equally high or low target for the following year. However, this option would not account for most recent data or trends as fully such as in flow volatility. A forecast for the target in this option in 2011/12 is 3199 tonnes[41].

227. The 2010 calendar year outturn used in these options would need to be calculated rather than based purely on regulatory submissions because the methodology used in 2009/10 was updated to reflect a number of identified improvements, which led to a substantial change in the recorded vent mass[42]. Therefore it is proposed that the outturn figures for January to March 2010 will be recalculated such that they are on the same basis as the new methodology

[40] The target is only a forecast, because the 2010 outturn is not yet available.
[41] The target is only a forecast, because the 2010 outturn is not yet available, therefore this is the average of the 2009 outturn and the forecast 2010 calendar year outturn.
[42] More detail on the changes to the vent mass calculation are available here: http://www.nationalgrid.com/NR/rdonlyres/8A990F49-FF4E-40DE-BEE6-77DF1152E048/39981/GasVentingMethodologyUpdate240210.pdf

and added to the outturn figures for April to December 2010. More detail is available in Appendix 9.

228. Our proposal does not include a collar on the potential incentive loss associated with compressor venting. This is to ensure that the incentive to reduce venting where this is the optimal trade-off continues, even if the venting in any one year is high.

229. The environmental price of venting is used to define the gradient or strength of the incentive, such that for every tonne of natural gas vented above or below the target or deadband, National Grid would have an incentive revenue or loss equal to that environmental cost of venting one tonne of natural gas.

230. The environmental price proposed within this incentive proposal is based on the latest DECC non-traded carbon price. The forecast of the components of natural gas in 2011/12 and 2012/13 is multiplied by the various Global Warming Potential factors to calculate the CO_2 equivalent for venting natural gas which is then multiplied by the carbon price. The prices calculated are £1,201/tonne and £1,257/tonne for the years 2011/12 and 2012/13 respectively. The environmental price calculation is set out in more detail in Appendix 8.

231. The carbon values published by DECC are due to be updated in 2011. If the values are updated, the environmental price within the incentive could be updated for 2012/13 prior to the start of the incentive year.

232. Three options are proposed for setting the deadband:

1) No deadband

2) ±5% deadband

3) A deadband between 0 and 5%

233. If no deadband were in place, then the incentive to reduce venting where this is the optimal trade-off would be consistent for the full range of venting outcomes.

234. An alternative would be to have a small deadband of up to ±5% around the target, as in the current scheme, such that only material changes in the level of performance rather than year-on-year volatility result in changes to National Grid’s revenue. A ±5% deadband is consistent with both the average level of uncertainty suggested by modelling analysis described above and the level of deadband in the current incentive.

235. A range of target and deadband options have been proposed above. Any of the target options could be used with any of the deadband options. Below two of these combinations are plotted in figures 3.5 and 3.6.

236. The figures below show the structure of the proposals using the environmental price based on the DECC non-traded price of carbon. Figure 3.5 shows the

incentive structure using a target based on calendar year outturn vent mass[43] with no deadband.

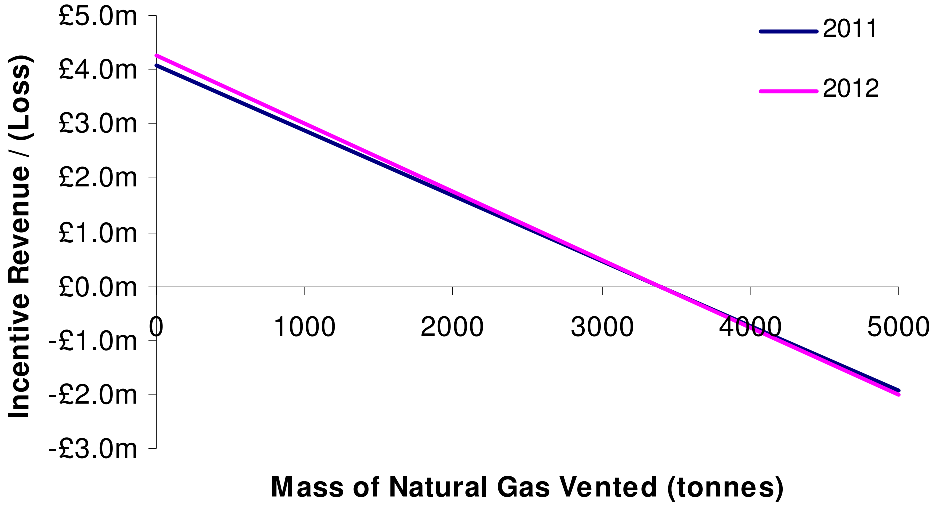

Figure 3.5: Proposed Environmental Scheme – Option 1a: Target of previous calendar year outturn vent mass without a deadband

237. Figure 3.6 shows the structure including a deadband of ±5% around a target based on the two year average outturn vent mass[44].

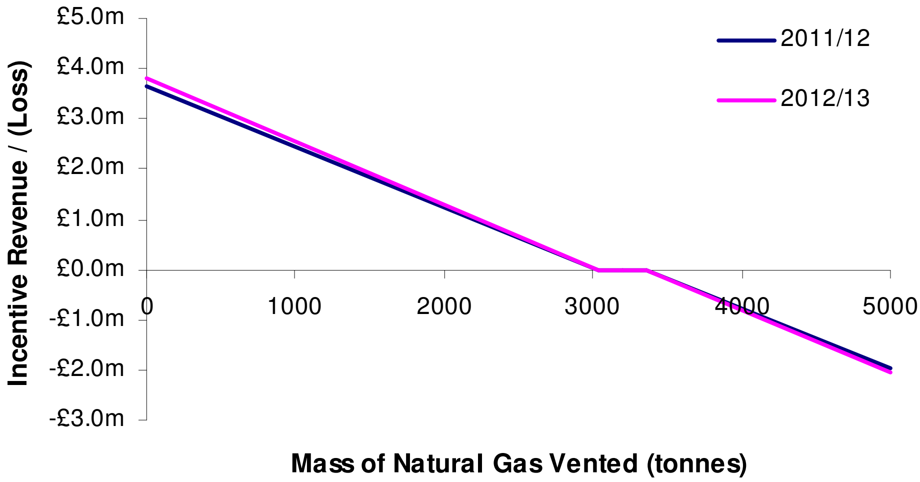

Figure 3.6: Proposed Environmental Scheme - Option 2b: Target of 2 calendar year average of vent mass outturns with ±5% deadband

Enabling future environmental performance schemes

238. To drive forward environmental performance in the medium and longer term, National Grid believes there is a need for further investment to develop

[43] Shown here as the forecast 2010 calendar year outturn, as 2010 and 2011 outturns are not yet available.
[44] Shown here as the average of the 2009 outturn and the forecast 2010 calendar year outturn, as 2010 and 2011 outturns are not yet available.

understanding and technological options in this area. In turn this may enable the NTS Environmental Incentive to cover a wider range of emissions in the future. This is particularly important to enable timely informed discussions in advance of the next price control review under RIIO-T1[45]. In particular, we recognise that it is important to:

- Understand and measure emissions; and
- Develop technologies and processes to reduce or eliminate the effects of venting natural gas from the NTS.

239. To undertake this work over the next two years, National Grid propose that £2-3m is made available to take forward these two areas. National Grid intend to discuss the projects further with Ofgem including an estimate of the costs, outputs and delivery timescales.

240. National Grid expect to consult further on this proposal for further investment to enable the industry to understand in more detail the types of projects, estimated costs and outputs this winter in advance of Final Proposals. This consultation would also include proposals on the mechanism to ensure that any payments are linked to the delivery of outputs.

241. A report would be compiled at the end of year, to enable Ofgem and the industry to track costs and progress towards these goals.

Understanding and measuring emissions

242. National Grid considers that having a greater understanding of emissions through studies and measurement would have many benefits including being able to measure the environmental performance of the NTS such that performance schemes could be introduced if appropriate. The information on the amount of venting could be used to enable better cost-benefit analysis of different alternatives to venting.

243. If environmental performance schemes were to be introduced for further vent types, the venting measurement and data collected to enable its measurement[46] could inform those discussions around venting drivers and targets or benchmarks for each vent type as discussed in Sections 3.3 and 3.5 and in further detail in Appendix 6. This work may include the ability to separate out the vent mass that cannot be reduced, such as following a compressor trip where current safety standards require a vent.

244. To be able to measure the amount of gas vented from the NTS, National Grid would need to develop new processes, systems and technologies which are not currently in place, including:

- Vent calculation methodologies for each vent type;

[45] RIIO-T1 is name of the next Transmission Price Control Review (previously known as TPCR5).
[46] For example, the actual pressures at which a pipeline is de-pressurised rather than an estimate.

- Site surveys and collect asset specific vent data[47];
- Data collection for each vent event, as required in the methodology. This could include collecting data from site using hand-held devices as well as using data from central operational systems; and
- Systems and processes to enable the vent calculation using the data available. This may include interfaces with existing operational systems that would require significant integrity assurance.

245. National Grid believes that putting in place a measurement system may have more value for some larger vent types, where the investment required is more proportional to the mass and environmental cost of the vented gas. The compressor vents that are already calculated using this type of system, are estimated to make up approximately 81% of venting from the NTS.

246. These systems have not previously been put in place as the desire to record this type of data is recent compared to the age of many of the assets on the NTS, and this level of reporting is not currently required by the environmental agencies. The current systems in place that measure various parameters from the NTS have not been designed to record and calculate the vent mass and therefore if this information is now needed, investment is needed to deliver this.

247. National Grid considers that the logistics of putting in place a robust and auditable calculation methodology to capture the vent mass for all vent types would make a two year timescale unachievable. This is due to the number of assets and asset types, the methodologies to be established, data, systems and manpower requirements to deliver this.

248. To improve the measurement of compressor venting, a project to review the vent mass calculation methodology was completed in 2010. The project included reviewing the methodology, surveying sites and implementing the revised methodology using existing systems. This project cost National Grid approximately £140k and took over two years.

Developing technologies & processes to reduce or eliminate venting

249. National Grid considers an important aspect of driving forward environmental performance is to understand and promote the availability of techniques and technologies to reduce environmental impact. By developing options to reduce venting further, this will enable a better cost-benefit analysis, so that the most efficient emissions reduction options can be prioritised.

250. Many of the venting reduction options identified earlier in Section 3.4 and in more detail in Appendix 7 are only at the research and development stage and are therefore not yet ready to use on the NTS. Pilot or demonstration projects could help the technology to mature such that the effectiveness and

[47] This may require laboratory testing.

suitability for use on the NTS are better understood, therefore enabling roll-out where appropriate at a later stage.

251. Pilot projects can also be used to test the characteristics of the system as well as its suitability for use on the NTS. For example, a trial may show the speed at which gas can be flared following a vent and therefore its suitability for various vent types, which again can be used to further develop the cost-benefit analysis for each technology. Similarly, a trial would enable further understanding of the limitations of its use within an operational site that would inform where the technology could be used and implementation timescales.

252. Pilot or demonstration projects would be unlikely to be cost-beneficial in the short term as the technology may be economic only in the longer term and/or unproven. Therefore, National Grid believes that separate funding of these projects is appropriate.

253. Therefore, our proposal is for funding to be available to drive towards understanding and measuring emissions and developing emissions reduction technologies, with the overall aim to reduce emissions in the medium to longer term.

254. National Grid propose that pilot projects would be either be prioritised against a set of criteria agreed with Ofgem and subject to a maximum level of funding or the scope of projects agreed. If this funding were put in place, progress reports would be published to industry to enable progress and costs to be tracked. As described earlier, the detail of this proposal will be subject to further consultation this winter.

255. National Grid considers this arrangement would enable more timely informed discussions in advance of the next Price Control Review (RIIO-T1) on environmental emissions and could form the basis of future wider incentivisation at this important stage in driving environmental performance.

Full internalisation of costs: Zero target, downside only scheme

256. Ofgem's open letter[48] that triggered this incentive review process asked for the full internalisation of the carbon costs associated with vented emissions to be discussed within this document. Full internalisation would mean that for every tonne of natural gas vented from the NTS, National Grid would face the cost of this action. Though National Grid has been funded to look at some potential options to reduce the impact of venting on the NTS[49], National Grid has not been funded for any investments to reduce the level of venting on the NTS.

[48] Ofgem open letter regarding the objectives, process and timetable for the development of the National Grid Gas System Operator Incentives from 2011 http://www.ofgem.gov.uk/Pages/MoreInformation.aspx?file=Gas%20Open%20Letter%20Version%202.pdf&refer=Markets/WhlMkts/EffSystemOps/SystOpIncent

[49] A project has been funded through the Innovation Funding Incentive (IFI). This covers the consideration of the use of a lower pressure recompression unit in series with a high pressure recompression unit when pipelines need to be de-pressurised, followed by flaring the

257. As explained previously, not all of National Grid's venting is controllable, such that a zero target is not an achievable target. Safety obligations limit the amount of venting that could be reduced and further limit the options to reduce venting through flaring or other alternatives.

258. Based on our understanding of the technology available and legislative obligations in place, National Grid does not believe that we could currently achieve zero vented emissions. Also, as zero vented emissions are approached, our analysis has shown that costs become prohibitive with the large (>£2bn) investments delivering only small emissions reductions as identified in Section 3.4 and in more detail in Appendix 7. At the DECC non-traded carbon price, the investments identified vary in years to payback from 5 years to over 100 years as shown in figure 3.3. The total environmental costs of current venting on the NTS is estimated at £4.4m[50] per annum at the DECC non-traded carbon price which, on a simple payback over the expected life of the compressors, would be around £88m on an equivalent basis.

259. The lowest payback period (not including the time value of money) is about 5 years, which is for a technology that has not been trialled at any sites on the NTS and therefore would be unlikely to be able to be installed widely for a number of years. Therefore full internalisation of costs would mean that National Grid would be faced with costs that it would be unable to reduce or control to any substantially lower level within the foreseeable future.

260. National Grid believes that even where venting reductions are possible, they are not necessarily the most efficient option. Many of the vents identified on the NTS result from a small infrequent vent of a piece of equipment.

261. To replace the equipment, where it is possible, may not be either economically or environmentally beneficial, such as in the case of many gas actuated valves, where the environmental emissions of the newer non-venting valve actuators are higher than those of current technologies on the system.

262. At the DECC non-traded carbon price, National Grid consider that this type of scheme may promote perverse decisions due to the difference in price between traded and non-traded emissions, such that National Grid could be incentivised to increase its overall emissions.

263. If a decision was taken on the basis of the non-traded cost of carbon for venting (£52/tCO_2e[51]) and a traded cost of carbon for energy (£13.50/tCO_2e[52]), this would mean that the emissions reductions from venting would be more highly valued than those from energy. For example, if you could save 1tCO_2e of gas venting by using 2tCO_2e of energy, the emissions and financial implications of these emissions are below:

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remaining gas and the use of ANG gas storage technology to enable use of some gas currently vented from compressors.

50 This is calculated by multiplying an estimate for all NTS venting, multiplied by the cost of venting used in the current NTS Environmental Incentive. The current incentive covers compressor venting only, with losses associated with any venting above a target level.

51 The central case of Non-traded prices for carbon is £52/tCO_2e for 2010 in 2009 prices.

52 Traded carbon price on the market was as at 22 October 2010.

Net Emissions Increase
= Energy emissions increase – vented emissions reduction
= 2 tCO_2e -1tCO_2e = 1tCO_2e

Net financial benefit due to environmental payments
= Vented emissions cost reduction – Energy emissions cost increase
= (£52/tCO_2e x 1 tCO_2e) - (£13.50/tCO_2e x 2 tCO_2e)
= £52 - £27 = £25

264. National Grid considers that uncertainty caused by the current large differential between the traded and non traded costs may not promote efficient decision making on environmental projects. This is because the cost-benefit of a specific project is related to the deemed price of emissions.

265. For example, if an investment decision was taken on the basis of the non-traded cost of carbon (£52/tCO_2e) for venting, the cost-benefit analysis may suggest that it was an efficient decision over a 10 year period to make an investment. If the framework changed such that the traded cost of carbon (£13.50/tCO_2e) was to be used, the investment may no longer be efficient as it may have a longer payback period than the remaining life of the asset. This uncertainty would be in addition to the uncertainties around the effectiveness of any emissions reduction technique, future asset requirements that may drive the level of venting and the cost of implementing the technique.

266. When considering the scale of investment required to reduce emissions, National Grid consider these investments need to be economic and efficient both against the environmental cost saving and also against other alternatives that are available to society, to ensure that the consumer is getting the best value for money, as other sectors may potentially be able to reduce emissions at a lower price.

267. National Grid do not consider that this type of scheme would reflect our level of control over venting given the assets in place and safety limitations and would be the equivalent of putting in place an environmental levy for venting.

Development of a Medium term Environmental Scheme

268. Ofgem and National Grid share a long term goal to reduce emissions to a sustainable level. This proposal could drive further sustainable improvements in environmental performance in the medium term where they would be efficient and economic.

269. Where there has been progress on the types of vent that can be measured and reduced as consequence of the shorter term scheme proposed, National Grid believes it may be possible to set an incentive scheme in this area.

270. As set out in earlier sections, not all emissions types can be reduced, and therefore any reductions would be subject to safety[53] and efficiency tests. Therefore, National Grid believes that any medium term environmental scheme should include a non-zero benchmark.

271. If work progresses to understand and measure emissions as set out in the shorter term proposal, there is the potential for further vent types to be included in an environmental performance scheme.

272. To cover non-compressor vent types would require changes in internal processes, procedures, and various IT systems to enable auditable data collection for reporting under any scheme of this type. There would also be a much greater resource requirement to record, collate and verify the vented amounts.

273. National Grid propose that the scheme target be set using data collected through the measurement and understanding projects set out in the above, and would include activity level adjustments as set out in section 3.5. These adjustments would account for the changes in the requirement to vent from year to year due to a range of factors including the need to commission or decommission equipment and inspect pipelines in accordance with our safety obligations.

274. Many of the vent reduction techniques would need capital investment by the Transmission Owner to install equipment to reduce or eliminate the need for venting. Following discussion of the potential for environmental investments in the 2010/11 incentive consultations, responses were received that stated that capital intensive or high value investments should be considered as part of next Price Control Review discussions.

275. National Grid believes the incentive scheme would need to be considered in parallel with investment discussions, such that either:

- The allowed investment reflects the level of achievable reductions that could be delivered with that level of investment considering technology maturity, cost of investment and timescale to deploy the technology; or
- The target is set at a historic benchmark level, with any improvements in environmental performance driving incentive revenues to enable National Grid to optimise the level of investment required against this potential revenue; or
- A combination of the two options above.

276. National Grid propose that the marginal cost of venting should continue to be valued at a cost based on the environmental price of the emissions. The price signal is important both when considering investment to reduce emissions and

[53] Venting is used in a number of safety critical processes. For National Grid not to be penalised for venting obligations, the scheme would need to either exclude venting driven by safety obligations or have an allowance for such vents.

in making optimal marginal decisions, such as in the current NTS Environmental Incentive between venting and leaving a compressor on standby (electricity usage).

277. The environmental price of emissions could be at a market based price or using the latest government guidance at the time the incentive is set. Currently, there are two government valuations for emissions; a traded and a non-traded price of carbon, at substantially different values in the shorter term.

278. Though vented natural gas emissions are not part of any trading mechanisms currently, National Grid could alternatively purchase and retire traded emissions allowances or credits[54] within the EU ETS to offset the environmental impact any venting above the target (benchmarked) level driving economic emissions reductions. If allowances or credits are retired then this would have the impact of reducing the overall level of credits in circulation and should therefore drive reductions in emissions from another area.

279. Vented natural gas emissions are not currently covered by the EU Emissions Trading Scheme (EU ETS), but could come under the scheme in future phases. Should this occur, then any incentives in place may need to be reviewed.

[54] Emissions credits such as EUAs or CERs. These are explained further in the Glossary in the Appendix to this document

NTS Environmental Incentive Consultation Questions

Question 3.1	Do you agree with the proposed style of incentive where National Grid are exposed to the marginal cost of natural gas venting? If not, what would you suggest to be a suitable style of incentive?
Question 3.2	Do you support either of the two approaches suggested to set the volume target in the Environmental Incentive? • Using the previous calendar year outturn to set the volume target; • Using a 2 year average of outturns to set the volume target. Do you feel these targets reflect an effective and efficient target, given the increasing supply and demand uncertainties? If you do not support either of these target proposals, how would you suggest the volume target should be set?
Question 3.3	Do you support using DECC's non-traded carbon price to set the environmental price for the incentive? Do you support updating the environmental price for 2012/13 should the DECC's non-traded carbon price be updated prior to the start of the incentive year?
Question 3.4	What level of deadband do you think would be appropriate in the NTS Environmental incentive? • ±5% deadband as in current year & suggested by modelling uncertainty • Between 0 & 5% deadband – if so, please quantify this • No deadband If you do not support any of these options, what level of deadband do you think would be appropriate?
Question 3.5	The proposal does not include any caps or collars on the NTS Environmental incentive. Do you agree with this proposed approach?
Question 3.6	Do you support the proposal to make funding available to enable future environmental performance schemes to • Understand and measure emissions? • Develop technologies and processes to reduce or eliminate the effects of venting natural gas from the NTS? If not, how do you think we should be encouraged to plan for future efficient emissions reductions?
Question 3.7	Do you support the proposal of the incentive covering a 2 year period? If not, what time period should the incentive and funding arrangement cover?

Question 3.8	What do you consider to be the right approach to develop the NTS Environmental incentive in the longer term? • Do you agree with the use of benchmarks? • Would it be appropriate to include activity adjustments within the target? • Do you have any views on the level of pricing that should be used?

Section 4
Summary of questions

This section provides a summary of the questions contained within this document. Responses to these questions are requested by 9 December 2010. If you would like to discuss the issues raised in this document or other SO Incentive issues please contact us using the contact details in Section 5 of this document.

Question 2.1	Do you believe Operating Margins should be subject to an incentive scheme or should the current cost pass through arrangements continue?
Question 2.2	What type of incentives do you believe are appropriate for Operating Margins?
Question 2.3	Should any incentive or pass-through arrangement cover the 2 year period?
Question 2.4	If you believe an Operating Margins incentive should be put in place, should it be a single incentive covering both utilisation and holdings costs or should these be considered as separate incentive schemes?
Question 2.5	Do you agree with using a target cost adjustment to enable changes in the regulated prices for OM services from NGLNGS to be reflected? If not, how would you suggest the uncertainty is handled within the incentive scheme?
Question 2.6	Do you agree that it would be appropriate to reassess the incentive target cost if there is: - Further suspension of regulated prices for OM services from National Grid LNG Storage than in the current year? - If regulated prices are outside the analysed range? - A change in the volume of Operating Margins requirement between 2011/12 and 2012/13 of greater than 10%?
Question 2.7	Given the levels of uncertainty in the cost of providing Operating Margins, do the sharing factors, deadband, cap and collar proposed reflect the level of risk and control? If not, what values of these would you think appropriate? Sharing factors: 25% upside & 10% downside, Deadband: £5.5m, Cap: £2m, Collar: £-1m
Question 2.8	Large utilisations are less common than smaller utilisations, and can be triggered by events outside National Grid's control, such as following a supply loss. Do you support the approach of having a volume cap to manage the level of control and risk in utilisation? Do you agree with the approach of using average historical volume of utilisations (35.5GWh) as the utilisation cap? If not, how do you think this would be best calculated?
Question 2.9	Do you agree with the approach of using average historical volume of utilisations (35.5GWh) within the utilisation cost target? If not, how do you think this would be best calculated?

Question 2.10	Should the utilisation cost target be based on the average prices accepted through tender this year? If not, what do you feel would be most appropriate methodology?
Question 2.11	Should all utilisation costs be included in an utilisation performance measure (i.e. including costs from capacity and delivery contracts) or just those costs that are not recovered through neutrality?
Question 2.12	Should the 2012/13 incentive target be based on the outturn in 2011/12? If not what would be an appropriate target?
Question 2.13	Do you agree with the proposal of incorporating the same deadband around the 2011/12 outturn for the 2012/13 scheme? If not, what would you consider to be appropriate?
Question 3.1	Do you agree with the proposed style of incentive where National Grid are exposed to the marginal cost of natural gas venting? If not, what would you suggest to be a suitable style of incentive?
Question 3.2	Do you support either of the two approaches suggested to set the volume target in the Environmental Incentive? • Using the previous calendar year outturn to set the volume target; • Using a 2 year average of outturns to set the volume target. Do you feel these targets reflect an effective and efficient target, given the increasing supply and demand uncertainties? If you do not support either of these target proposals, how would you suggest the volume target should be set?
Question 3.3	Do you support using DECC's non-traded carbon price to set the environmental price for the incentive? Do you support updating the environmental price for 2012/13 should the DECC's non-traded carbon price be updated prior to the start of the incentive year?
Question 3.4	What level of deadband do you think would be appropriate in the NTS Environmental incentive? • ±5% deadband as in current year & suggested by modelling uncertainty • Between 0 & 5% deadband – if so, please quantify this • No deadband If you do not support any of these options, what level of deadband do you think would be appropriate?
Question 3.5	The proposal does not include any caps or collars on the NTS Environmental incentive. Do you agree with this proposed approach?

Question 3.6	Do you support the proposal to make funding available to enable future environmental performance schemes to • Understand and measure emissions? • Develop technologies and processes to reduce or eliminate the effects of venting natural gas from the NTS? If not, how do you think we should be encouraged to plan for future efficient emissions reductions?
Question 3.7	Do you support the proposal of the incentive covering a 2 year period? If not, what time period should the incentive and funding arrangement cover?
Question 3.8	What do you consider to be the right approach to develop the NTS Environmental incentive in the longer term? • Do you agree with the use of benchmarks? • Would it be appropriate to include activity adjustments within the target? • Do you have any views on the level of pricing that should be used?

Section 5
Contact Details

If you would like to discuss any issue on SO Incentives, please contact us via the contact details below.

To register your interest in receiving future communications on this consultation process please email: SOIncentives@uk.ngrid.com

On the web:

The dedicated web pages for this incentive review process are available at the following addresses:

Gas:	http://www.nationalgrid.com/uk/Gas/SOIncentives/
Electricity:	http://www.nationalgrid.com/uk/Electricity/SOincentives/

Contact us:

Gas

Juliana Urdal	Tel: 01926 656195	juliana.urdal@uk.ngrid.com

Electricity

Ian Pashley	Tel: 01926 653446	ian.pashley@uk.ngrid.com

General enquiries: SOincentives@uk.ngrid.com

Appendix 1
Glossary

Term	Definition
ASEPs	Aggregate System Entry Point
C3	Special Condition C3 “Restriction of Prices for LNG Storage Services” is a licence condition in National Grid Gas’ Gas Transporter Licence in respect of the NTS
CER	Certified Emissions Reductions (CERs): Tradable units equal to one tonne of carbon dioxide equivalent gases that are generated by projects in developing countries under the Clean Development Mechanism (CDM) that can be used within the EUETS.
CRC	The CRC Energy Efficiency Scheme (formerly known as the Carbon Reduction Commitment) is the UK's mandatory climate change and energy saving scheme. The scheme started in April 2010 and is administered by the Environment Agency.
CO_2	Carbon Dioxide The Carbon Dioxide equivalent (CO_2e) is used to enable direct comparisons between some types of emissions.
Deliverability	Rate at which a facility can flow gas onto the NTS or the equivalent level of demand reduction, usually measured in GWh/day or mcm/d. e.g. For Storage, LNG Importation terminals and supply increases the rate at which gas can be delivered to the NTS E.g. For demand reduction, the volume of gas not offtaken from the NTS in a given timescale, that would otherwise be a demand on the NTS.
DECC	Department of Energy and Climate Change
DSEAR	Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) require employers to control the risks to safety from fire and explosions.
EUA	EU Allowance (EUA) – Units in the EU Emission Trading Scheme, (EU ETS) that are equal to one tonne of carbon dioxide equivalent gases.
EU ETS	European Union Greenhouse Gas Emission Trading System A trading scheme across Europe to reduce emissions of carbon dioxide and combat the serious threat of climate change. Phase I: 1 January 2005 to 31 December 2007 Phase II: 1 January 2008 to 31 December 2012 Phase III: 1 January 2013 to 31 December 2020
HSE	Health and Safety Executive
IPCC	Intergovernmental Panel on Climate Change
OM	Operating Margins. Operating Margins gas is used to maintain National Transmission System (NTS) pressures in the immediate period following operational stresses and before market balancing measures become effective.
NGLNGS	National Grid LNG Storage

NTS	National Transmission System
PIGs	Pipeline Inspection Gauges (PIGs) are tools used to monitor the condition of the NTS pipelines
PSSR	Pressure Systems Safety Regulations. Users and owners of pressure systems are required to demonstrate that they know the safe operating limits, principally pressure and temperature, of their pressure systems, and that the systems are safe under those conditions.
Re-profiling	Moving gas stocks into, out of or between facilities.
RIIO-T1	RIIO-T1 is the first transmission price control review under a new regulatory framework following Ofgem's RPI-X@20 review. RIIO-T1 was formerly known as TPCR5. The RIIO model is based on Revenue = Incentives + Innovation + Outputs
Space	The right to hold gas within a facility
Storage Year	1 May to 30 April
tCO_2e	Tonnes of Carbon Dioxide Equivalent
UNC	Uniform Network Code
WACOG	Weighted Average Cost of Gas. This is the calculation of price of gas stored for Operating Margins by National Grid, as defined in Section K of the UNC.

Appendix 2
Operating Margins Service Cost Structures

This appendix outlines the different types of Operating Margins services and their cost structures.

Operating Margins services can be in either of two contract forms:

- Delivery contracts; or
- Capacity contracts.

Delivery Contracts

Delivery contracts enable National Grid to call upon increased gas flows (or a reduction in demand) when it is needed. This form of contract could be entered into by:

- Storage facilities and primary capacity holders;
- LNG importation facilities with storage and primary capacity holders;
- Shippers that could facilitate a reduction in gas offtake from the NTS, either by demand deferral or use of alternative fuels;
- Shippers that could facilitate the delivery of additional gas to the NTS (i.e. increase in supply); and
- A portfolio of the above provision types.

The costs associated with this contract are:

- The 'holdings' cost element that is the tendered 'option fee' to have the access to the service when required; and
- The utilisation cost element in the form of a charge if the contract is utilised – this is sometimes called an Indexed Delivery Charge. There may also be imbalance revenues or charges associated with any imbalance following the utilisation. In a utilisation event the Operating Margins manager wants to facilitate an increase in physical flows onto the network and will therefore not be in a balanced position at the end of the gas day. This will result in an imbalance on the account on the day of utilisation, this will be charged at the relevant SMP under the Energy Balancing rules.

The utilisation fee can be fixed or indexed[55], with the charging methodology defined at the tender stage.

The contract may include a maximum level of utilisation, or a further fee to enable utilisations above a defined level.

The holdings cost element is recovered through licence arrangements. The utilisation cost element is recovered through neutrality[56].

Capacity Contracts

Capacity contracts enable National Grid to hold its own OM gas within a facility (e.g. a storage facility), such that National Grid can nominate flows of its own gas onto the NTS.

The holdings costs relating to capacity contracts are:

- Space, injectability and deliverability costs. These are the costs of rights to hold gas in, to inject gas into the facility or to withdraw gas from a facility.
- Re-profiling costs. Where the level of gas held by National Grid for Operating Margins in a facility changes from the end of one contract period (usually the Storage Year) to the start of a new contract period, the gas needs to be re-profiled to enable stock levels to match the booking level. If the level of gas in a facility needs to increase re-profiling costs may include the costs of injecting gas into the facility and the associated injectability rights (or overruns). If the level of gas in a facility needs to reduce re-profiling costs may include the costs of withdrawing gas from the facility and the associated deliverability rights (or overruns).
- Standby costs. Some facilities charge a standby cost to bring the facility to a ready state, such that gas can be injected or withdrawn at shorter notice.
- When gas is bought for storage as Operating Margins gas the cost is faced by National Grid until that gas is used or sold when no longer required to be held for Operating Margins purposes. The cost of gas is recovered through neutrality.

[55] The Indexation Principles for Gas Operating Margins document sets out the principles of indexation methodologies that National Grid is prepared to use, which is available here: http://www.nationalgrid.com/uk/Gas/OperationalInfo/GasOperatingMargins
[56] Operating Margins costs are recovered via the OMC_t term as detailed in Special Condition C8F in the Gas Transporter licence.

The utilisation costs relating to capacity contracts are:

- When gas is required for Operating Margins, the gas will be withdrawn from the facility. This will incur withdrawal charges per unit of gas withdrawn and if deliverability has not been booked, interruptible or overrun deliverability charges for the right to withdraw the gas. There may also be imbalance revenues or charges associated with any imbalance following the utilisation.

- If following a utilisation it is necessary to replenish the gas stocks, there may be injection charges per unit of gas injected into the facility and if injectability has not been booked, interruptible or overrun injectability charges for the right to inject the gas.

- Following a utilisation of Operating Margins, National Grid can recover the Weighted Average Cost of Gas (WACOG) in that facility at the original cost paid for that gas.

The costs mentioned above can either be at a fixed price or defined by an indexation methodology.

The holdings cost element is recovered through licence arrangements. The utilisation cost element is partly recovered from neutrality and partly through licence arrangements.

Appendix 3
Operating Margins Incentive Deadband Adjustment

This appendix summarises the steps that could be used to calculate the deadbands for the bundled and unbundled Operating Margins incentive proposals.

Prices for the current incentive period were set according to Special Licence Condition C3 of the Gas Transporter's Licence. However, a number of changes have taken place within NGLNG and a review has been undertaken by Ofgem with respect to regulated prices for the proposed incentive period. The findings of the review are not yet known and this is expected to remain the case throughout the current incentive consultation period.

As regulated prices are not part of the incentive process, the proposal for the new incentive period incorporates a number of scenarios that allow the proposed incentive to remain unaffected by the outcome of the C3 regulated prices review.

Lower Deadband

- Regulated prices in place and range from current prices as in Special Licence Condition C3 to a level of current C3 prices multiplied by 3.
- Competitive tenders from shippers are assumed to be minimally affected by changes in the regulated prices.

Upper Deadband

- There is some shipper reaction in response to the regulated price changes

For simplicity, the proposed deadband is the same size for the target adjustment proposed. The scenario analysis does not suggest a large variation in the deadband at the different pricing levels.

The deadband is designed to reduce the influence of regulated price changes on incentive performance, whilst keeping the focus on areas that are more within the control of National Grid.

Deadband Calculation Formulae

The deadband calculations below are based on a linear adjustment of the regulated prices (C3 prices) and would need to be updated if any changes to the C3 prices were not the same for all facilities.

Bundled OM Incentive Deadband

The bundled incentive includes both holdings and utilisation costs. The bundled OM incentive deadband calculation is outlined below, such that it adjusts for movements in regulated prices. The deadband includes the utilisation element of the cost target, which is described in more detail in Appendix 4.

$$\textbf{Lower Deadband} = \textbf{£10.4m} + \left(\textbf{£9.14m} \times \left(\frac{\textbf{C3 Prices in Incentive Year}}{\textbf{C3 Prices in 2010/11}} \right) \right)$$

$$\textbf{Upper Deadband} = \textbf{£15.9m} + \left(\textbf{£9.14m} \times \left(\frac{\textbf{C3 Prices in Incentive Year}}{\textbf{C3 Prices in 2010/11}} \right) \right)$$

Unbundled OM Holdings Cost Incentive Target

The unbundled incentive proposal has separate holdings and utilisation cost targets. The holdings incentive deadband calculation is outlined below, such that it adjusts for movements in regulated prices. The utilisation element of the cost target is described in more detail in Appendix 4.

$$\textbf{Lower Deadband} = \textbf{£9.9m} + \left(\textbf{£9.14m} \times \left(\frac{\textbf{C3 Prices in Incentive Year}}{\textbf{C3 Prices in 2010/11}} \right) \right)$$

$$\textbf{Upper Deadband} = \textbf{£15.4m} + \left(\textbf{£9.14m} \times \left(\frac{\textbf{C3 Prices in Incentive Year}}{\textbf{C3 Prices in 2010/11}} \right) \right)$$

Appendix 4
Operating Margins Utilisation Cost Calculation

This appendix summarises the steps used to calculate the utilisation cost target for the bundled and unbundled Operating Margins incentive proposals.

Utilisation Cost Target

The proposed utilisation cost target is calculated using all of the different utilisation costs, including costs that are recovered through neutrality (e.g. the Net WACOG) and licence arrangements (e.g. deliverability costs). This would mean that the cost performance measure for the incentive would not be the same as the level of funding required through the licence, but would enable the full range of utilisation costs, irrespective of the contract type to be incentivised.

In figure A4.1 below is an example of how a cost target could be calculated. The figures in the example are representative of the prices involved but not based on actual tendered prices. The same methodology would be employed to calculate the performance measure.

The volume of utilisation assumed in the target calculation is 35.5GWh for each incentive year. The utilisation target proposed using this methodology is £0.5m, including all aspects of utilisation costs.

The target has been calculated using the utilisation prices tendered in the 2010/11 tender, with the total volume booked under the scenarios considered in calculating the utilisation performance measure. In order to calculate the value of this target the 35.5GWh utilisation volume was assumed to be exercised as a percentage of each accepted tender to ensure an element of each utilisation cost was factored into the overall cost performance measure.

The below example demonstrates this:

Total bookings: 1200 GWh
Utilisation volume cap: 35.5 GWh
% of each accepted tender to be utilised: 2.96%

Facility	Potential Utilisation Volume (GWh)	Utilisation price (p/kWh)
A	600	0.6
B	350	1.9
C	150	2.3
D	100	3.25

Facility	Volume Utilised (GWh)	Cost
A	17.75	£ 106,499.99
B	10.35	£ 196,729.14
C	4.44	£ 102,062.49
D	2.96	£ 96,145.82
Totals	**35.50**	**£ 501,437.44**

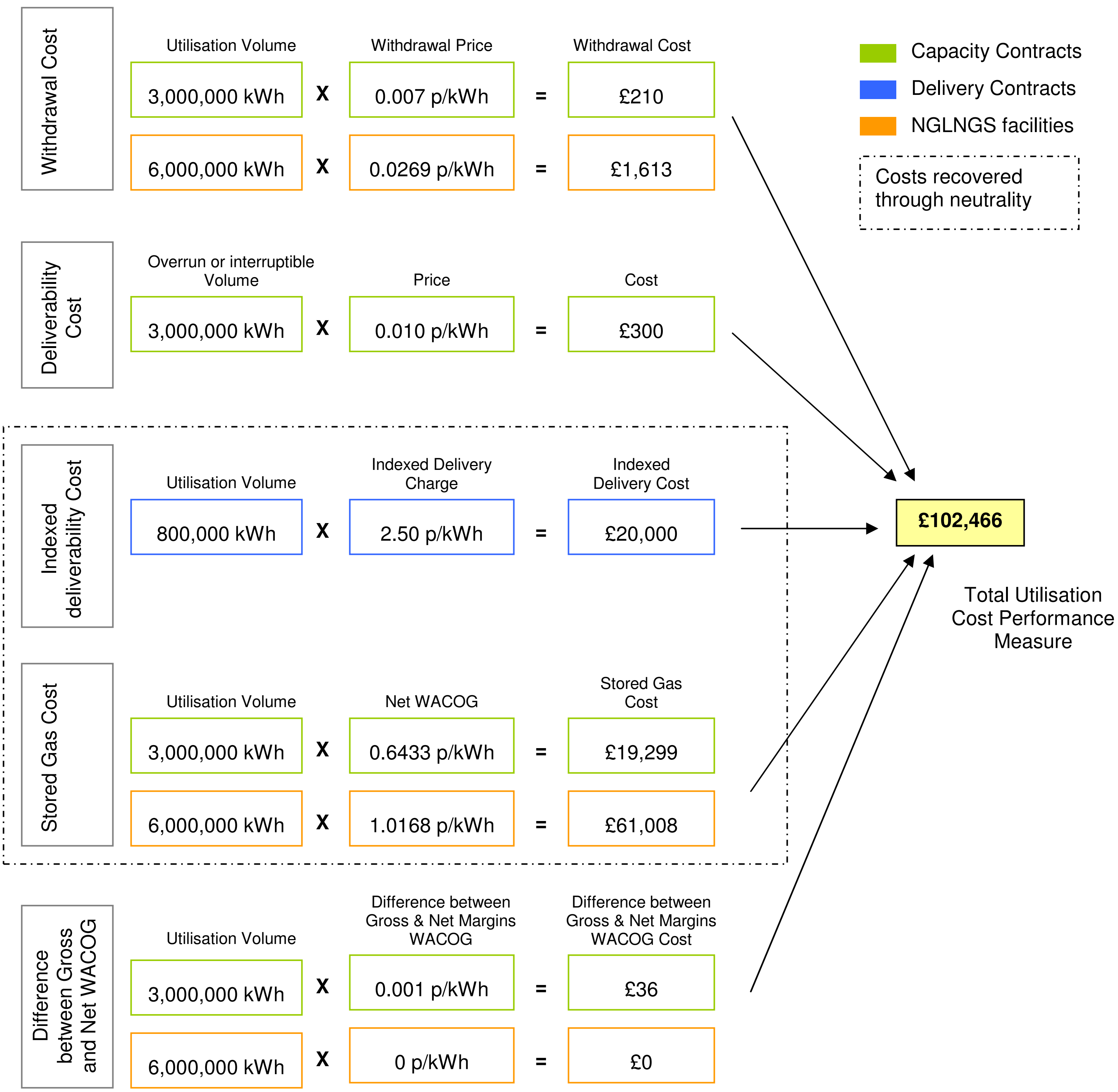

Figure A4.1: Calculation of Utilisation Cost Performance Measure & Target

Notes

The costs within the dotted line are recovered through neutrality, but are included within the utilisation incentive performance measure.

WACOG is the Weighted Average Cost of Gas as defined in the UNC.

Utilisation Volume Cap

The utilisation volume cap is designed to ensure that National Grid is incentivised to reduce the cost of utilisation actions without exposing National Grid to the risk of a major event such as a major Supply Loss, leading to a large volume of OM being utilised, which would not be within National Grid's direct control.

The proposed utilisation volume cap is 35.5GWh which is in line with the incentive target. This has been calculated based on the historic average utilisation volume in previous incentive years to calculate an annual expected utilisation volume to form the proposed volume cap in the utilisation incentive.

Using the Utilisation Volume Cap

The volume cap within the incentive would work in two ways depending on the actual utilisation volume within the given incentive year:

If the volume utilised in the given incentive year is below the volume cap of 35.5GWh, then the actual costs of utilisation would be used as the performance measure.

For example:

Utilisation	Utilisation Volume (kWh)	Utilisation Price (p/kWh)	Cost (£)
1	25,000,000	2.5	£625,000

Utilisation volume (25,000,000kWh) less than Volume cap (35,500,000)
Weighted Average Price (WAP) of utilisation = 2.5p/kWh
Utilisation Cost Performance Measure: £625,000
Incentive Revenue in unbundled utilisation incentive proposal: -£12,500

If the volume utilised is above the volume cap of 35.5GWh then the weighted average price of all utilisations would be calculated and multiplied by the volume cap, such that an element of all utilisations in any year are factored into the outcome of the performance measure.

For example:

Utilisation	Utilisation Volume (kWh)	Utilisation Price (p/kWh)	Cost (£)
1	25,000,000	2.5	£625,000
2	70,000,000	0.6	£420,000
3	5,000,000	3.5	£175,000
Total	100,000,000		£1,220,000

Utilisation volume (100,000,000kWh) greater than Volume cap (35,500,000)
Weighted Average Price (WAP) of utilisation = 1.22p/kWh
Utilisation Cost Performance Measure = 1.22p/kWh x 35,500,000 = £433,100
Incentive Revenue in unbundled utilisation incentive proposal: £16,725

Appendix 5
NTS Environmental Incentive Performance

This section details National Grid's performance under the NTS Environmental Incentive and where performance updates can be found.

The below table shows National Grid's performance under the NTS Environmental Incentive.

	Target (tonnes natural gas vented)	Deadband	Outturn (tonnes natural gas vented)	Incentive Profit / Loss (£m)
2008/09	2086	10%	1850	£0.058m
2009/10	1977[57]	10%	1634	£0.140m
2010/11 forecast	3007	10%	3301 to 3480	-£0.158m to -£0.355m

Table A5.1: NTS Environmental Incentive Performance

Regular Information Provision

An overview of our performance on the gas system operator incentives for the National Transmission System is updated for each quarter and is available on our website at the following address:
http://www.nationalgrid.com/uk/Gas/soincentives/QuarterlyReports

An overview of the Gas System Operator incentives for the NTS, including incentive performance and its effect on charges is available on our website at the following address:
http://www.nationalgrid.com/uk/Gas/soincentives/SupportingInformation

[57] The 2009/10 target was updated following consultation from 1777 to 1977 tonnes.

Appendix 6
Sources of Vented Gas on the NTS

There are a number of sources of natural gas venting. Below, the vent types are explained including the drivers, and estimated mass where possible.

NTS Pipelines

A6.1. The NTS pipeline system is a welded steel system which operates at pressures of up to 94 bar. In normal operation, the pipelines do not release natural gas; however maintenance and connection activities can result in a requirement for a controlled release of natural gas. These activities are described in the following paragraphs.

Pipeline inspections

A6.2. In order to monitor the condition of the NTS pipelines, pipeline inspections using in line vehicles (known as Pipeline Inspection Gauges or PIGs) are undertaken. These inspections are essential for safety reasons and are used to ensure that the integrity of the buried high pressure pipelines can be assessed. The frequency of inspections is determined following a risk based assessment of the criticality and maintenance regime required, with a maximum interval frequency of 15 years. A pig trap (shown below) is used to introduce and remove each pig from the live section of the NTS under inspection.

Figure 3.3: An NTS pig trap

A6.3. Before commencing the pipeline inspections, maintenance of the pig trap is completed to ensure that the pig trap is safe and fully operational, which include a de-pressurisation and purge of the pig trap before it is re-pressurised. The de-pressurisation involves venting the pig trap from NTS pressures. The purge vent as part of the pressurisation process is a much smaller vent that is necessary to purge the air out of the pig trap, via an intermediate inert gas, to remove the risk of introducing air into the pipeline system, as mixtures of natural gas and can be explosive.

A6.4. Prior to launching the pig into the pipeline system, the pig trap is de-pressurised to enable the pig to be put into the trap before purging the pig trap in advance of the pig entering the NTS. Once the pig has been launched into the pipeline system, the pig trap will then be vented again, if necessary, to allow the pig trap to be depressurised for subsequent pigs to be loaded into it. The reverse processes happens at the pig trap which receives the pig on completion of the pipeline inspection, allowing the pig to be removed from the pipeline system under safe conditions.

A6.5. In any year, the actual amount of natural gas vented from pig traps will depend on the number of pipeline inspections, the number of pig runs required per inspection, diameter of the pipelines and the prevailing NTS pressures.

A6.6. De-pressuring a typical 36 inch pig trap from NTS pressure (e.g. 70 bar) would release natural gas that the current environmental incentive would value the environmental impact at approximately £230. An estimation of the total environmental cost of all pig trap venting is approximately £63k per annum.

A6.7. A pig trap is one of the NTS assets that is operated at high pressure and therefore falls within the Pressure Systems Safety Regulations (PSSR). The integrity of the pig trap must be tested at regular intervals to comply with these regulations, and as part of this each pig trap is vented from NTS pressures (~70 bar) every 6 years and purged to enable re-pressurisation. On average, the order of 9 tonnes of natural gas is vented each year due to this activity, that the current environmental incentive would value the environmental impact at approximately £10k per annum.

Pipeline Depressurisation

A6.8. Under certain circumstances (e.g. to cut into the NTS and carry out the necessary welding to facilitate the connection of a new pipeline or offtake), it is necessary to isolate a section of the NTS and purge it to air. National Grid will seek to minimise the amount of natural gas vented to atmosphere by isolating the shortest possible section of pipeline and by minimising the pressure in it prior to venting.

A6.9. National Grid uses recompression rigs to reduce the amount of gas to be vented by taking the gas from the isolated section of pipeline and recompressing it from the lower pressure back to the prevailing pressure on the non-isolated pipeline outside the isolation. This would typically reduce the pressure from NTS operational pressures to approximately 7 barg.

A6.10. The exact amount vented in any section will depend on the diameter of the pipe, distance between the block valves used to isolate the section of the NTS and the pressure from which venting occurs. To give an indication of the order of magnitude of the environmental costs associated with venting an isolated pipeline section, a 36 inch diameter pipeline, with block valves used for isolation 30 km apart, vented from 7 bar[58] would release natural gas with an environmental cost of approximately £115k.

A6.11. The depressurisation of pipeline sections are infrequent events and the number of occurrences each year will change based on the requirements for connections, diversions and other work to be carried out. Going forward, we would expect a handful of occurrences each year, however, in some cases the vented sections could be significantly shorter than the 30km used in the example above (even as small as 1km or less).

Pipeline Purging

A6.12. In order to re-commission a depressurised pipeline or commission a new pipeline, it is necessary to purge the air from the pipeline for safety reasons. National Grid has developed a method of 'Direct Purging' that eliminates the need for an inert buffer gas to be used, thus reducing time and costs.

A6.13. In purging the pipeline, a small amount of natural gas will be released into the atmosphere as it is necessary to ensure all of the air is removed from the pipe before it can be reconnected to the NTS.

A6.14. The amount of natural gas released is not metered and hence it is difficult to quantify the average amount released per year. However, using the direct purging technique, the amount per event is believed to be very small compared to the amount released on the depressurisation of the same pipeline. These releases would only occur on an infrequent basis when a pipeline is commissioned or re-commissioned after being depressurised.

NTS Valves

A6.15. There are of the order of 10,000 valves on the NTS, comprising of a number of different valve types. Maintenance of some valve types result in venting as described below. Each valve has an actuator that enables the valve to be moved from an open to a closed position and vice-versa. Some valve actuator types vent natural gas as part of their normal valve operation. These are also discussed below.

Block valves

A6.16. Block valves are installed at regular intervals along NTS pipelines. These valves allow sections of the NTS to be isolated should the need occur (e.g. to facilitate a connection or in response to an emergency situation).

A6.17. Although these valves are normally left open, as part of National Grid's normal maintenance work, these valves will be closed to check their operation and to provide certainty should the valves be required in an emergency situation to safely isolate a section of the NTS.

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[58] Pressures can be lowered to ~7 bar using recompression. See Appendix 6 for further details.

A6.18. The operation and maintenance of these valves results in the emission of natural gas from the following areas:

- In order to check that the valve is operating correctly, the small internal cavity of the valve will be vented and then monitored for any gas passing the valve seals. This type of maintenance will typically be undertaken once per year on each valve; and
- A proportion of the valves use gas actuators to open or close the valves. These actuators use the pressure of the gas in the NTS to move the valve. Once the valve has moved, the gas in the actuator is vented to allow the valve to be moved in the opposite direction when required. The figure below shows a gas actuator on a buried valve.

Figure 3.4: A gas actuator on a buried valve

A6.19. For example, to vent the body cavity of a valve during maintenance, venting 60 bar of natural gas from a 36 inch valve would release natural gas with an approximate environmental cost of under £100. To operate the actuator on the same valve, when the valve opened or closed, assuming it vented natural gas at a pressure of 60 bar, would have an environmental cost of the order of £2.

A6.20. The exact amount vented for any valve and actuator would depend on the valve and actuator sizes and the prevailing NTS pressures at the time of operation.

Site valves

A6.21. Each operational site (e.g. compressor stations and multi-junctions) will have some valves similar to those discussed in the block valve section above. These valves can also vent natural gas in the ways previously described. Some valves have been modified to recharge and not release natural gas.

Recycle valves

A6.22. Recycle valves are used on the NTS to ensure the compressor is protected from high or low pressures. The recycle valve maintains a continuous open pipework circuit which allows the compressor to run within its design envelope, and not to be subject to extremes of pressure that could cause damage. There are different types of recycle valves on the NTS, many of which continually vent gas from the actuator as the valve modulates to regulate the flow of gas. There were 71 recycle valves and anti-surge systems on the NTS in 2009/10, which at a rough estimate would vent over 100 tonnes at an approximate annual environmental cost of £130k.

Pressure Control / Relief Valves

A6.23. Pressure Control valves are used to maintain the pressure within some parts of the NTS between operational parameters. They also prevent the pressure from rising above a safe limit in vessels and pipelines by releasing natural gas to relieve the pressure. Operation of these valves is extremely infrequent since other measures are used to maintain normal operating conditions.

Other NTS Emissions

A6.24. This section describes the other assets which as part of their normal operation or maintenance can result in the release of natural gas.

Instrumentation

A6.25. At strategic points around the network, instrumentation such as gas chromatographs take small samples of pipeline gas in order to provide information on gas quality. This information allows National Grid to meet its safety obligations in relation to gas quality and to help with the billing process (through the measurement of calorific value).

A6.26. Once the instruments have completed their analysis, these small samples of gas are vented to allow the instrument to carry out subsequent analysis.

A6.27. There are over 130 chromatographs at different points around the NTS, that it is estimated vent in total over 100 tonnes per annum at an environmental cost of approximately £140k per annum[59].

Flow Control Valves

A6.28. There are 20 flow control valves located at sites where a number of pipelines converge and are used to direct flows around the NTS enabling linepack to be transferred between zones. An example of such a valve with the gas actuator at the top is shown in the figure below.

[59] Using the £1100/tonne of vented natural gas cost from the 2010/11 NTS Environmental Incentive.

Figure 3.5: Example of a flow control valve

A6.29. There are various types of control and actuation devices installed. Some of the control / positioning devices vent small amounts of natural gas continuously. National Grid has an ongoing project, where a third party is looking at the natural gas released from the NTS compressor sites. An estimate of the amount of gas vented from the flow control valves on these sites is of the order of 1.7 tonnes per year, which equates to an environmental impact of around £1900 per year[60].

Filtering

A6.30. Filters are used at offtakes to remove any particulates from the gas, prior to the gas being metered. Scrubbers and Strainers are used on the NTS at compressor sites to remove any particulates and condensates from the gas prior to it entering the compressor. An example of a scrubber used on the NTS is shown in the photograph below:

Figure 3.6: Example of a scrubber on the NTS

[60] Using the £1100/tonne of vented natural gas cost from the 2010/11 NTS Environmental Incentive.

A6.31. To allow the filters, scrubbers and strainers to be cleaned and then returned to service requires them to be depressurised and then subsequently purged of air, resulting in an amount of natural gas being released to atmosphere. These units are typically inspected and cleaned infrequently (e.g. for scrubbers every five years). It is estimated that the environmental value of the gas per released per inspection is of the order of £200.

Appendix 7
Potential Options to Reduce Volume of Vented Gas

There are a number of potential emissions reduction options that could be used for some of the vent types. Below, the potential for the use of gas recompression, flaring, gas capture, asset replacement and other techniques to reduce or eliminate the need to vent are considered.

Recompression

Pipeline recompression

A7.1. Currently, where pipelines need to be de-pressurised, gas is recompressed where feasible and fed back into an adjacent section of the NTS. However, the current technologies used only enable the pipeline to be de-pressurised down to about 7 barg. The remaining gas within the pipeline is then vented to enable further work on the pipeline to continue safely.

A7.2. National Grid has commissioned research into the potential to use a low pressure (LP) recompression unit as an input into the higher pressure (HP) recompression rig, to enable further venting reductions than the HP recompression unit currently used could deliver. If successful, the gas in the pipeline could be taken to a lower pressure prior to venting, reducing the mass of gas vented. The below figure shows the lower pressure and higher pressure recompression rigs at the first trial on the NTS earlier this year.

Figure A7.1: Higher and lower pressure recompression rigs

A7.3. A trial has been successfully completed on a short 3km section of NTS pipeline, reducing pressures in the pipeline to below 1 bar in twenty-seven hours, substantially reducing the mass of gas vented. Our next aim is to test this technology on a larger pipeline when a de-pressurisation is needed on the NTS.

A7.4. Recompression of a 50 km 900mm pipeline from 55 bar to about 7 bar would take approximately 12 to 25 days. In an emergency situation, where the gas needs to be evacuated as quickly as possible to maintain safety, such as in the rare occurrence of a third party strike, this technology could not be used as the quickest way to safely evacuate the gas is to vent.

A7.5. Though recompressing gas back into the NTS reduces the impact of venting natural gas, there are other environmental impacts to consider. Energy is used to run the recompression unit and the unit also needs to be transported to site. The chart below shows the environmental impact of the energy used in the recompression trial against the impact of the gas that is not vented as a result of the recompression.

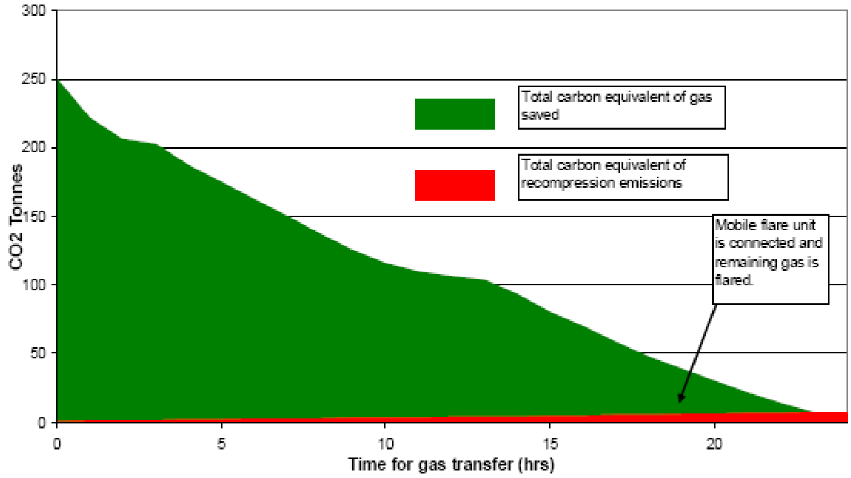

Figure A7.2: Environmental impact (in CO_2 equivalent) of venting gas and energy use by the recompression rig

A7.6. Three high pressure recompression rigs are already in use on the NTS, substantially reducing the potential impact of venting from NTS pipelines. A lower pressure recompression rig would cost over £1m, and would need to be used with the current recompression equipment for a reduction of the order of 6 bar pressure in the pipeline.

A7.7. When the cost of purchasing and operating the recompression rig is compared to the environmental cost saving and staff cost savings resulting from a shorter recompression period, an investment in a recompression rig would have an approximate payback period of 30 years, at the levels of work currently planned over the next 5 years.

Compressor venting recompression

A7.8. Compressor site venting recompression is currently at the research and development stage. We are investigating the potential for a compressor to be used to recompress some of the different vent types that have been identified on a compressor site, concentrating on the main compressor casing vent.

A7.9. To purchase and install a small lower pressure system recompression unit on a compressor site would be likely to cost in the region of £300,000 per site. The installation of this type of system would need to include the unit, new infrastructure, process pipework, energy supply and process control modifications.

A7.10. A recompression unit and the associated infrastructure to enable connection and onwards use of the gas would need to be assessed on a site by site basis to ensure that any site space constraints and configurations are considered.

A7.11. The payback at this rough cost estimate would be on average about 5 years, though the actual payback will be different at various sites depending on the venting level of the site and site constraints, such that the payback will vary substantially between compressor sites.

A7.12. If suitable units can be manufactured and installed, there would be a reduction in the environmental impact, but not a complete elimination as energy is used in recompressing the gas and the units would also not be able to reduce the contained gas to zero, so a small mass of gas would still be required to be vented.

A7.13. There are some vents that this system would not be able to cover because if the compressor trips, for example if the compressor control system detects a fire, recompression could not be used. This limitation is because current safety standards state that venting should be used to quickly evacuate the gas within the compressor unit[61], and any attempt to recompress the gas would add a significant delay in this process. About 1500 tonnes was vented last year from process vents, including an unknown proportion of vents following compressor trips.

A7.14. If it is shown that ‘static’ recompression could deliver efficient reductions in emissions when used in practice on an operational site to the emissions from venting, we would consider further whether the system could be used for other vent types.

Flaring Gas

A7.15. Flaring (i.e. burning) gas has a substantially lower environmental impact than venting the same volume of unburnt gas. Until the recent IFI funded project, flaring had not been used by National Grid and therefore an evaluation of the process is required to ensure that it is possible, safe and environmentally efficient. The trial was at a non-operational site, and therefore further work is required to understand the impact of using this technology at an operational site where hazardous zoning is in place to reduce the likelihood of any safety issues.

A7.16. Recompression and flaring processes can be run in conjunction, allowing gas to be recompressed to a low pressure and then the final gas volume to be flared instead of vented, reducing dramatically the environmental impact.

A7.17. During the Bathgate compressor site decommissioning works, National Grid completed its first field trials of these two processes. The findings from the trial are being analysed, to assess the equipment and procedural requirements for the possible adoption of the processes in the future.

[61] British Standard for Gas Turbines applications – Safety BS ISO21789:2009

Figure A7.3: Flaring rig

A7.18. Each tonne of gas vented is equivalent to releasing approximately 21 tonnes of Carbon Dioxide into the atmosphere. By flaring the gas, approximately 2.7 tonnes of Carbon Dioxide would be released into the atmosphere, such that in its burnt state the environmental impact is substantially reduced by a factor of about 8.

A7.19. The flaring process requires some energy input other than the gas being burnt in order to ensure stable complete combustion. To flare gas, a flaring stack is required and must be used outside certain hazardous zones, such that the number of sites where flaring stacks could feasibly be installed may be constrained by the available space on site. Flaring stacks can be static or mobile, which could enable flaring at temporary locations, though issues with situating the flare stack, its visual impact and the noise associated with flaring must also be considered.

Capturing Gas

Capturing compressor venting

A7.20. An alternative to venting or flaring gas is to capture it for use or re-injection into the system. National Grid have started a project to consider the potential to use Adsorbed Natural Gas (ANG) technology to store gas that would otherwise be vented from a compressor.

A7.21. The natural gas is adsorbed by an appropriately adsorbent material with high porosity to achieve a high energy density within the storage vessel. However, the gas will only flow into the vessel (and reduce venting) until the pressure in the storage vessel is equal to that in the compressor, and therefore not all gas would be captured under this system. This process requires energy input which should be taken into account when looking at the feasibility and the overall environmental impact of such an installation.

A7.22. A prototype is currently under design, such that field trials should be able to start this winter. If the trials are successful, further work may be triggered to consider other potential applications for this technology.

A7.23. The gas being captured in such systems must be within current quality standards to enable safe storage and onwards use, such that this technology may not be able to be used for purging activities where a piece of equipment needs to be purged from air to gas. Gas on the NTS is not odourised, and therefore the use of any captured gas must be carefully considered such that any leakage can be detected.

A7.24. To be able to use this gas, commercial arrangements may need to be put in place as this gas does not belong to National Grid.

A7.25. This technology could not be used in all circumstances as if the compressor trips, for example if the compressor control system detects a fire, ANG technology could not be used as current safety standards[62] state that venting should be used to quickly evacuate gas from the area.

A7.26. As this technology is at an early stage of development, the cost of an ANG system and any systems to ensure safe use of captured gas is currently unknown.

Asset Replacement

A7.27. For some vent types, asset replacement or retrofitting new equipment could be used to reduce or eliminate venting. Many of these potential solutions to reduce the environmental impact of the NTS would need significant capital investment at a number of sites around the UK.

A7.28. Following discussion of the potential for environmental investments in the 2010/11 incentive consultations, responses were received that stated that any capital intensive or high value environmental investments in this area be considered as part of next Price Control Review discussions[63].

Asset Replacement of Valve Actuators

A7.29. Some valves on the NTS use the pressure of gas on the NTS to actuate (open or shut) the valve. Other types of valve actuators include compressed air, or electrically driven.

[62] British Standard for Gas Turbines applications – Safety BS ISO 21789 2009
[63] Consultation Two on Environmental Incentives and industry responses to this consultation are available from http://www.nationalgrid.com/uk/Gas/soincentives/docs.

A7.30. Safety critical valves currently need to be gas actuated valves to ensure that the valve opens or closes quickly to reduce the risk of potentially serious events[64].

A7.31. The figure below compares the environmental impact of using various types of valve actuators on a site[65]. The pink bars show the estimated environmental impact of the natural gas vented in a year through using each type of valve. The blue bars show the estimated impact from other emissions, in particular energy use from the different valve actuator types i.e. an air actuated valve uses compressed air which must be provided using a small electrically powered compressor. The production of this electricity results in indirect environmental emissions at the electricity generator.

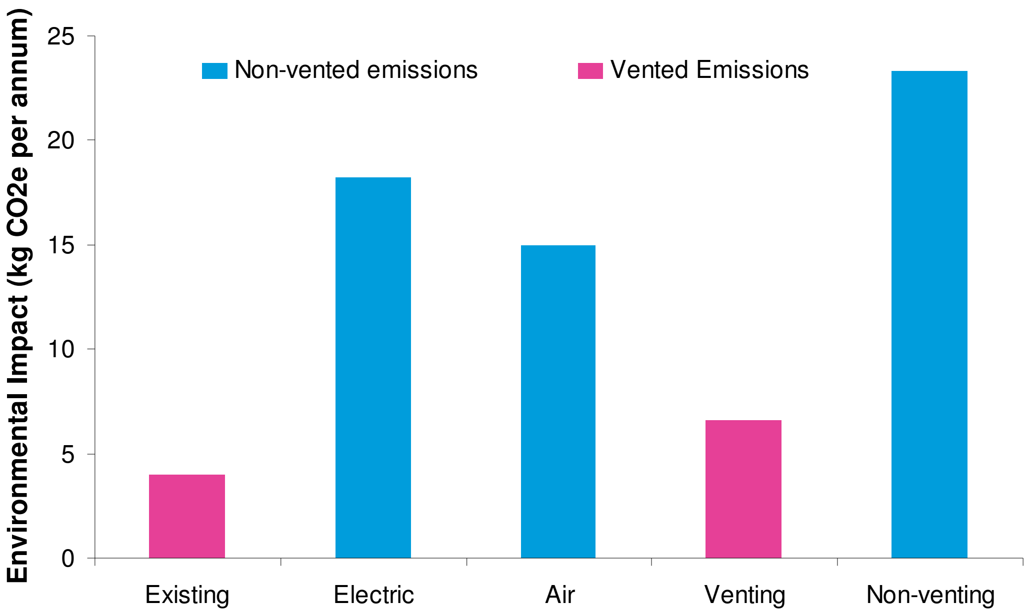

Figure A7.4: Environmental impacts of various types of valve-actuators

A7.32. The figure above shows that although there are alternatives to gas actuators used on non-critical valves that would lead to less emissions due to natural gas venting, when all emissions types are considered it is presently not environmentally efficient to replace the current valve actuators. Any studies into the replacement of assets need to take into account the usage characteristics of a given site and the facilities on the site to lead to the optimal solution, but this example shows that reducing venting is just part of the optimisation between the environmental impact, cost and reliability.

A7.33. In addition to the drivers mentioned above, when considering the potential to use electrically driven valve actuators, some valves are remote from operational sites and do not have an electricity supply. In these locations, the impact of works to connect the valve actuator to an electricity supply may be

[64] Critical valves need to be able to close in timescale of 1 second per inch of pipeline diameter.
[65] Environmental impact study considers a range of sizes of valves and their utilisation characteristics at a compressor station.

greater than the environmental benefit from vent reductions when the frequency of valve use is considered[66].

Asset Replacement of Compressor starter motors

A7.34. Approximately a third of NTS compressors have gas starter motors that use high pressure gas from the NTS to spin the compressor up to a speed where the main turbine can start, which is then vented. Approximately 76 tonnes of natural gas was vented from compressor starter motors in 2009[67].

A7.35. An alternative could be to use an electric starter motor with a much lower environmental impact on use. Site surveys and detailed costings have not been completed for the replacement of gas starter motors with electric starter motors, but the cost is estimated to be in the order of £2m to £3.5m, giving about a 30 year breakeven horizon, though the breakeven will vary between compressors with different usage patterns.

A7.36. For options such as this, an outage of NTS assets would be required, and therefore any investment plans would need to consider the phasing of investment to reduce any impact on the capability of the NTS. Additionally, some compressors may not be able to have a different starter motor retrofitted to the existing compressor.

Asset Replacement of Compressor gas seals

A7.37. On many compressors, there is a small amount of leakage around a seal on the compressor shaft when the compressor is either running or pressurised. The gas seal is used to separate combustion products from the areas where pipeline gas is being compressed. Approximately half of the compressors have wet gas seals that vent more natural gas than the dry gas seal alternative. Approximately 1,100 tonnes of natural gas was vented from compressor seals in 2009[68], which accounts for over a third of the compressor venting on the NTS in that year.

A7.38. To replace all of the wet gas seals with dry gas seals, which vent substantially less gas on all relevant NTS compressors, would cost between approximately £11m and £18m. The payback for this type of investment would be of the order of 12 years at the non-traded price of carbon, which additionally is much higher than the current market value for carbon. The actual payback for any particular compressor would be dependent on the usage characteristics of the

[66] Many of these valves are operated approximately once per year, with each vent approximately 1m^3 of gas.

[67] The gas starter motor vent value for 2009 was recalculated following a methodology review and site surveys – details are available here: http://www.nationalgrid.com/NR/rdonlyres/8A990F49-FF4E-40DE-BEE6-77DF1152E048/39981/GasVentingMethodologyUpdate240210.pdf

[68] http://www.nationalgrid.com/NR/rdonlyres/8A990F49-FF4E-40DE-BEE6-77DF1152E048/39981/GasVentingMethodologyUpdate240210.pdf

compressor. Some compressors may not be able to have an alternative gas seal system retrofitted to the existing compressor.

Asset Replacement of Compressors

A7.39. To eliminate the fuel gas vent from compressors, all of the gas compressors on the NTS would need to be changed out for electric compressors. This would cost in the region of £2bn, or £1.3bn if only those compressors under main duty were changed out. This would result in only a very small impact on the level of venting from the NTS (~4 tonnes / annum) which has an environmental cost of approximately £4000[69] per year. Without considering the substantial environmental impact of these site works and new machines, this would not be an economic investment given the excessive payback period.

Other

A7.40. As part of the review of environmental performance, it is necessary to also consider the systems in place, to ensure that they are fit for purpose.

A7.41. A gas compressor and the associated pipework needs to be purged of air prior to starting the compressor to remove the risk of air entering the pipeline system. The compressor is purged by allowing gas to flow through the compressor until there is minimal air in the compressor, with the gas/air mix vented to atmosphere.

A7.42. A project has been started that considers whether the time that the gas flows through the compressor is no longer than is required to ensure a full purge of the compressor. If any changes are identified, there will need to be control system changes on each compressor to put this in place.

[69] Using the environmental cost in the current NTS environmental incentive (£1100/tonne natural gas vented)

Appendix 8
Environmental Cost Estimation Methodology

This appendix summarises the steps used by National Grid to estimate the environmental costs associated with releasing natural gas from the NTS. An example application of these steps to the depressurisation of a NTS pipeline is provided.

Calculating the Environmental Cost of Venting 1 tonne of Natural Gas

Step 1. Obtain forecast gas supply composition by volume data as used in the Ten Year Statement (% of Nitrogen, Carbon Dioxide, Methane, Ethane etc by volume).

Step 2. Multiply the molecular mass of each component by the supply composition by volume in % and divide each component by the total. This converts the gas supply composition by volume to a gas supply composition by mass (%).

Step 3. Multiply each component by the CO_2 equivalent as published by the IPCC[70].

Step 4. Sum the different CO_2 equivalent components to calculate the CO_2 equivalent of 1 tonne of natural gas (20.84 tCO_2e in 2011/12).

Step 5. Calculate the weighted average of the Central Case Non-traded price of carbon in 2009 prices[71] for the incentive year from the calendar year prices published by DECC.

E.g. For 2011/12:
Carbon price (£/tCO_2 2009 prices) is 52.5 in 2011 & 23.3 in 2012
2011/12 Carbon price (2009 prices) = ((9 x 52.5) + (3 x 53.3)) / 12
= £52.7/tCO_2

Step 6. Multiply the carbon price from Step 5 by the forecast RPI increase from 2009 prices to 2011/12 prices.

E.g. For 2011/12:
2011/12 Carbon price (2011/12 prices) = 52.7 x (233.6/213.7)
= £57.6/tCO_2

Step 7. Multiply the CO_2 equivalent of venting 1 tonne of natural gas from Step 4 by the Carbon price calculated in Step 6.

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[70] CO_2 equivalents based on the 100 year Net Global Warming Potentials from Tables 2.14 & 2.15 Chapter 2 of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change "Climate Change 2007 - The Physical Science Basis. Next update is expected September 2013. http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter2.pdf

[71] Non-traded price of Carbon from DECC's publication: Updated short term traded carbon values for UK public policy appraisal (June 2010) http://www.decc.gov.uk/assets/decc/what%20we%20do/a%20low%20carbon%20uk/carbon%20valuation/1_20100610131858_e_@@_carbonvalues.pdf

E.g. For 2011/12:
2011/12 environmental price of venting natural gas
= 57.6 x 20.84
= £1201 per tonne natural gas vented

Estimating the environmental costs of releasing a volume of natural gas

The costs in the document are based on the environmental price of venting within the 2010/11 NTS Environmental Incentive.

Step 1. Calculate the volume of natural gas at 1 bar pressure in cubic metres, (i.e. multiply the volume of the gas in the asset by the pressure change in bar)

Step 2. Convert this volume into kg by multiplying by a factor of 18/23.63[72]

Step 3. Divide by 1000 to convert to tonnes

Step 4. Multiply by £1100[73] to calculate the total environmental cost.

Example application

This example calculates the environmental cost of venting 30km of 36 inch diameter (0.914mm) from 7 bar to atmosphere.

Step 1. The volume of natural gas at 1 bar pressure in cubic metres is calculated using (π x radius^2 x length x pressure change)
= π x 0.457^2 x 30000 x 7
=137,785m^3

Step 2. Convert this volume into kg by multiplying by a factor of 18/23.63
=104,957kg

Step 3. Divide by 1000 to convert to Tonnes
=105 Tonnes

Step 4. Multiply by £1,100 to calculate the total environmental cost
=£115k

[72] 18 is the assumed molecular weight of natural gas. 23.63m^3 is the volume occupied by a kg mole (18kg) of natural gas at standard conditions (1 bar, 15^{o}C)
[73] The current NTS Environmental Incentive uses a value of £1100/tonne of vented natural gas

Appendix 9
Environmental Incentive Target Calculation

This appendix summarises the steps that will be used by National Grid to calculate the outturn natural gas venting in 2010 in the new calculation methodology.

A new vent mass calculation methodology for natural gas venting from compressors and associated pipework was put in place in April 2010, which is should increase the accuracy of the mass of natural gas vented from compressors through improvements to the venting calculation methodology and improvements to the source data. The new methodology leads to an increase in the magnitude of the calculated vent mass.

It is important that any incentive mechanism should use a consistent methodology for setting the target and for measuring performance. This would ensure that any incentive payments or penalties reflected National Grid's actual performance, not just any changes to the methodology used to calculate it (i.e. National Grid should not profit or lose as a result of improvements to the calculation methodology).

As the methodology improvements were put in place part way through the 2010 calendar year, it is necessary to consider the vent mass that would have been calculated for January to March 2010 had the new methodology been in place at the time to ensure consistency with the current methodology.

The proposed target for the NTS Environmental Incentive is the outturn of the venting from compressors in the 2010 calendar year. To calculate this on a consistent basis to the performance measurement, the following steps will be followed:

Step 1. Collect compressor vent data by compressor and vent type for the period January to March 2010 under the methodology in place at that time.

Step 2. Collect further input data to enable the recalculation (pressurised hours by compressor for this period).

Step 3. Use the impact of the improvements identified through the methodology review to recalculate the venting from compressors in the period using data from Steps 1 and 2.

Step 4. Collect compressor vent data by compressor and vent type for the period April to December 2010 under the new methodology in place.

Step 5. Add together the recalculated venting data or January to March and the vent for April to December 2010 to get the estimated outturn venting figure for 2010 under the new methodology.