



Technical Options Report

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Customer:

Date

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Executive Summary

(To contain the customer key requirements as taken from the PARCA application)

This Technical Options Report documents National Grid's network analysis and design work carried out in order to investigate the impact on the National Transmission System (NTS) of a new connection point at

(ENTER HERE THE KEY RESULTS OF THE TECHNICAL OPTIONS ANALYSIS)

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1 Introduction

The Technical Option Report is part of the procedures adopted by National Grid for major national infrastructure projects that may require an application to the Planning Inspectorate¹ for development consents orders.

[To contain the customer requirements as taken from the PARCA application form]

This Technical Options Report provides:

- An overview assessment of the capability and capacity of the Transmission System that is available to meet the changes to customer requirements
- The main conclusions from National Grid's analysis work on the investment options available.

This Technical Options Report also includes appendices that contain more detailed information. The appendices provide:

- A summary of National Grid's legal obligations of relevance to this document (Appendix A).
- An overview of transmission system policies standards and guidelines (Appendix B) analysis principles including details of compliance requirements, key assessment criteria, factors that limit transmission system capability, possible consequences of exceeding capability limits and references to generic options for enhancing transmission system capability are included in the Transmission Planning Code which can be found on the National Grid website at <http://www.nationalgrid.com/uk/Gas/TYS/>

¹ Further information is available from the National Infrastructure Planning website at <http://infrastructure.planningportal.gov.uk/>.

2 Background

2.1 Overview of Gas Industry

A single gas market serves the whole of Great Britain. In this competitive, wholesale market shippers and traders trade gas on a daily basis. Gas is supplied from a variety of sources, including the UK Continental Shelf, Norway, LNG Imports, European Interconnectors and storage. Suppliers purchase gas in the wholesale market and supply to end customers.

The forecast peak gas demand in Great Britain is over 570 mscm/d and occurs during winter. The combined capacity of all the ASEP connected to and/or using the NTS is greater than this peak demand.

Network infrastructure is needed to ensure that gas can be transported from where it first enters the system to where it is used. The Transmission System transports bulk supplies of gas from entry terminals to demand centres. Distribution systems are mainly used to transport gas from NTS offtakes (interface points with the NTS) to the majority of end customers.

Gas can also be traded on the single market in Great Britain by shippers and traders in other European countries. Interconnectors with transmission systems in Holland, Northern Ireland and Belgium are used to import gas to and/or export gas from the NTS.

2.2 National Grid's Role

Transmission of gas in Great Britain requires permission by a licence granted under the Gas Act 1986 ("the Gas Act"). National Grid has been granted a transmission licence and is therefore bound by the legal obligations primarily set out in the Gas Act and its transmission licence. A summary² of legal obligations is included in Appendix A.

National Grid is the owner and operator of the NTS for Great Britain. It has a duty to plan and develop the system in an economic and efficient manner. The Transmission

² Summary is not intended as an exhaustive list of National Grid's legal obligations but provides information about the obligations that are particularly relevant to this report.

Planning Code³ describes National Grid's approach to planning and developing the NTS in accordance with its duties as a Gas Transporter and other statutory obligations relating to safety and environmental matters.

Part of National Grid's role is to provide the contractual interface with customers that are seeking to connect to and that are connected to the NTS.

In order to use the NTS for both entry and exit flows, shippers must first buy entry capacity to flow gas onto the NTS, as well as exit capacity to take gas off the NTS. If shippers do not buy sufficient capacity for the actual amounts of gas they flow, they will incur overrun charges, which are set out in the Uniform Network Code (UNC).

National Grid is obliged under the Licence to offer certain amounts of firm entry and exit capacity for sale. For exit capacity, these amounts are the baseline values set out in the Licence plus any previously released incremental capacity. National Grid is funded through its price control revenue allowance to provide this capacity and does not receive additional funding unless it receives a capacity booking for a level of capacity in excess of the prevailing obligated level (i.e. incremental capacity is requested). Additional funding is only available if it has been agreed through the revenue driver mechanism.

Revenue drivers automatically adjust National Grid's revenue allowances in response to the release of incremental capacity requiring investment. Revenue drivers seek to represent the costs (operating expenditure, depreciation and return) of the amount of investment deemed necessary at a particular entry or exit point to facilitate the release of incremental capacity. This sets an incentive on National Grid to drive down the actual costs and hence 'beat' the allowed revenue whilst also providing a benefit to customers when lower actual investment costs pass through to the Regulated Asset Base and hence future charges.

³ Gas Transmission Planning Code 2010: <http://www.nationalgrid.com/uk/Gas/TYS/TPC/>

2.3 National Grid's Existing Transmission System

The NTS was developed to transport gas in bulk from entry terminals to demand centres. The development of National Grid's NTS began in the 1960s. Incremental changes to the transmission system have subsequently been made to meet increasing customer demand and to connect new supply sources and interconnectors⁴ with other transmission systems.

The NTS consists of approximately 7200 km of pipe lines and 75 compressor units at 24 compressor stations, operating at up to 94 barg. These pipelines connect 30 entry points and 204 offtakes to Distribution Networks (DNs), transmission connected demand customers (e.g. large industrial customers), storage facilities and interconnectors. Further details of the Transmission System including geographic and schematic representations are published by National Grid annually as part of the Ten Year Statement⁵.

2.4 Drivers for Customer Requirement Changes

There are currently significant changes within the gas industry, particularly as a result of changes to UK and European legislation.

National Grid's customers make decisions in respect of developments that require connection to and/or use of the Transmission System and in respect of which developments will be taken forward. These customer decisions are influenced by the parameters set by Government as well as other commercial factors (including the works required to connect to the Transmission System).

2.5 Impact of Customer Requirement Changes on the Transmission System

National Grid is required to provide an efficient, economic and coordinated transmission system in Great Britain. The transmission infrastructure needs to be capable of maintaining a minimum level of security of supply and of transporting gas from and to customers. National Grid is required to ensure that its transmission system remains capable as customer requirements change.

⁴ Interconnectors can be used to transfer gas to and from the Transmission System.

⁵ Ten Year Statement 2011: <http://www.nationalgrid.com/uk/Gas/TYS/current/TYS2009.htm>
Appendix A: Figure A.1.1 (2011/12 Transmission System) and Figure A.4.1 (Existing National Grid transmission system, 2011/12)

The Transmission System needs to cater for demand changes. The locations of demand centres are broadly constant. National Grid prepares demand forecasts on an annual basis. These forecasts take account of forecast information that is provided to National Grid by Transmission System customers, as well as new connection requests and other economic factors. Demand forecasts are published in National Grid's Ten Year Statement.

For any new connection or connection modification (demand, supply, storage or interconnector), the amount of change needed to the Transmission System is dependent on the:

- Capability of the part of the existing Transmission System that is closest to the connection point, and

Capacity on the existing Transmission System that is (or is expected to be) available when the connection is made or modified.

2.6 Transmission System Development

National Grid has a statutory duty to develop and maintain an efficient, coordinated and economical system of gas supply under Section 9 of the Gas Act⁶. These duties, which are documented in more detail in Standard Licence Conditions⁷, are included as part of the summary of legal obligations in Appendix B of this report.

Section 31 of the Planning Act 2008 ("the Planning Act") requires a Development Consent Order for a development that is or forms part of a Nationally Significant Infrastructure Project (NSIP), and under Section 14(f) of the Planning Act "the construction of a pipe-line by a gas transporter" is an NSIP provided that each of the conditions in subsections (2) to (5) of Section 20 of the Planning Act is expected to be met.

⁶ Gas Act 1986: <http://www.legislation.gov.uk/ukpga/1986/44/contents>

⁷ Standard conditions of the gas transporter licence:

http://www.ofgem.gov.uk/Networks/GasDistr/otherwork/Documents1/8355-Attachment_1_Standard_Conditions_for_GT_s.pdf

Section 20 of the Planning Act 2008 states that:

- “1) The construction of a pipe-line by a gas transporter is within section 14(1)(f) only if (when constructed) each of the conditions in subsections (2) to (5) is expected to be met in relation to the pipe-line.*
- 2) The pipe-line must be wholly or partly in England.*
- 3) Either—*
 - a) the pipe-line must be more than 800 millimetres in diameter and more than 40 kilometres in length, or*
 - b) the construction of the pipe-line must be likely to have a significant effect on the environment.*
- 4) The pipe-line must have a design operating pressure of more than 7 bar gauge.*
- 5) The pipe-line must convey gas for supply (directly or indirectly) to at least 50,000 customers, or potential customers, of one or more gas suppliers.*
- 6) In the case of a pipe-line that (when constructed) will be only partly in England, the construction of the pipe-line is within section 14(1)(f) only to the extent that the pipe-line will (when constructed) be in England.*
- 7) “Gas supplier” has the same meaning as in Part 1 of the Gas Act 1986 (c. 44) (see section 7A(11) of that Act).”*

National Grid's Stakeholder, Community and Amenity Policy⁸ (“the Policy”) sets out how the company will meet the duty to the environment placed upon it. These commitments include:

- only seeking to build new pipelines, compressor stations, pressure reduction installations and other above ground gas installations where the existing transmission infrastructure cannot be upgraded technically or economically to meet transmission security standards;
- where new infrastructure is required seek to avoid areas nationally or internationally designated for their landscape, wildlife or cultural significance, and
- minimising the effects of new infrastructure on other sites valued for their amenity.

⁸ National Grid's Stakeholder, Community and Amenity Policy : <http://www.nationalgrid.com/uk/LandandDevelopment/SC/Responsibilities/sched9/schedule+9.htm>

The Policy also refers to the application of best practice methods to assess the environmental impacts of proposals and identify appropriate mitigation and/or offsetting measures. The Policy also promotes effective consultation with stakeholders and the public.

2.7 Assessment of Transmission System Capability

Transmission system capability is determined by the rating of plant and equipment, how individual items are connected to form parts of the transmission system and the technical characteristics of customer equipment connected to that part of the transmission system.

Appendix B provides more detailed information about Transmission System performance requirements, the Institution of Gas Engineers and Managers (IGEM) industry standard compliance requirements and generic options for enhancing transmission system capability.

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3 Technical Terms of Reference

The terms of reference for this technical report were originally set out in the commercial connection agreement between National Grid and the A COMPANY.

(To contain customer key requirements as taken from the PARCA application).

The following areas have not been considered in this report:

- Cost and Construction issues: This report is not intended to cover any cost and construction issues.
- System Outage: The possible construction programmes for the connection will be subject to the availability of the appropriate outages for the works required. System outages associated with the delivery of works associated with the project were not considered in this study and will be identified as the Scheme progresses.

3.1 Existing Transmission System in the Region

(ENTER HERE DETAILS REGARDING THE TRANSMISSION SYSTEM IN THE REGION OF THE PROPOSED CONNECTION)

Appendix B provides more detailed information about the Transmission System requirements, the Institution of Gas Engineers and Managers (IGEM) industry standard compliance requirements and generic options for enhancing transmission system capability.

3.2 Assessment of Transmission System in the Region

The existing transmission system in the South West has been designed to be compliant with the Pipe-Line System Security Standard and is sufficient to support the forecast customer requirements until 2022/23, if no further incremental entry or exit capacity requests are made.

National Grid must assess whether the transmission system will be sufficient for changes to user requirements that are expected in future years such to ensure that the transmission system remains compliant with the Pipe-Line System Security Standard.

The capability and optioneering assessments of the NTS were done by carrying out network analysis using the Simone software package⁹ and the Network Model as described in the Transmission Planning Code.

3.2.1 Network Topology

(ENTER HERE INFORMATION REGARDING THE NETWORK TOPOLOGY USED FOR ANALYSIS)

3.2.2 Demand Scenarios

(ENTER HERE INFORMATION REGARDING THE DEMAND SCENARIOS USED FOR ANALYSIS)

All Assured Offtake Pressures at Distribution Network exit points, as agreed in the Exit Capacity Allocation Process, were satisfied in the analysis.

3.2.3 Supply Information

(ENTER HERE INFORMATION REGARDING THE SUPPLY PATTERNS AND SENSITIVITIES USED FOR ANALYSIS)

3.2.4 Capability Results

(ENTER HERE THE KEY RESULTS OF THE CAPABILITY STUDY / NEED CASE)

3.2.5 Exit Capacity Substitution

Upon receipt of incremental Exit Capacity requests, National Grid will assess the potential to use substitution according to the Exit Capacity Substitution and Revision Methodology Statement¹⁰ to provide the necessary capacity on the transmission system. Substitution makes additional Exit Flat Capacity available at a recipient NTS Exit Point by reducing the amount of available unsold obligated capacity at a donor NTS Exit Point.

The initial assessment indicates that capacity could not be made available through Exit Substitution.

⁹ <http://www.simone.eu/simone-simonesoftware.asp>

¹⁰ National Grid's Exit Capacity Substitution and Revision Methodology Statement: <http://www.nationalgrid.com/uk/Gas/Charges/statements/transportation/ExCapSubMS/>

3.2.6 Physical Investment Options Considered

The following options were considered when an investment was determined to be required:

New Pipe

A new pipeline can be connected between existing points on the network model. The length of new pipelines is estimated using Google Earth or a similar tool or by using the existing pipeline lengths and increasing by 10% when existing pipeline routes are used.

Pipeline Upgrading

Pipeline upgrading involves increasing the maximum permitted operating pressure of a pipeline so that the capacity of the pipeline is increased. This can be considered as an alternative to a new pipeline.

New Compressor Unit

A new compressor unit can be built within an existing compression site as a replacement for an existing unit or a new addition. A new compressor unit is required when additional compression power is identified as an investment solution.

New Compression Station

A new compressor station can be used as an investment solution as an alternative or to compliment a pipeline investment. The approximate site of a new compressor will be determined by the network analysis.

Compressor Flow Modifications

Modifications to plant at existing compression sites can be carried out to increase the maximum flow that can be achieved through a site and therefore, increasing the compression capacity of the station.

Multi-junction Modifications

A multi-junction is a site where several pipelines met and consists of a series of valves that can control the gas flow between the feeders. By carrying out a multi-junction modification, the gas flow direction can be changed to provide additional capability.

4 Investment Themes

The investment options considered in the optioneering process follow routing themes as shown below:

(ENTER HERE A DESCRIPTION OF ANY THEMES DEFINED TO MAINTAIN A VARIED LIST OF OPTIONS)

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5 Options

(ENTER HERE THE RESULTS OF THE TECHNICAL OPTIONS ANALYSIS)

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6 Conclusion

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Glossary

ASEP (Aggregate System Entry Point) - A term used to refer to a gas supply terminal or group of gas supply terminals for which NTS Entry Capacity is sold.

Bar - The unit of pressure that is approximately equal to atmospheric pressure (0.987 standard atmospheres). Where bar is suffixed with the letter g, such as in bar_g or mbar_g, the pressure being referred to is gauge pressure, i.e. relative to atmospheric pressure. One millibar (mbar_g) equals 0.001 bar.

Calorific Value (CV) - The ratio of energy to volume measured in Megajoules per cubic metre (MJ/m³), which for a gas is measured and expressed under standard conditions of temperature and pressure.

Compressor Station - An installation that uses gas turbine or electricity driven compressors to boost pressures in the pipeline system. Used to increase transmission capacity and move gas through the network.

Cubic Metre (m³) - The unit of volume, expressed under standard conditions of temperature and pressure, approximately equal to 35.37 cubic feet. One million cubic metres (mcm) are equal to 106 cubic metres, one billion cubic metres (bcm) equals 109 cubic metres.

Delivery Facility Operator (DFO) - Operators of the reception terminals, which process and meter gas deliveries from offshore pipelines before transferring the gas to our system.

Distribution Network (DN) - An administrative unit responsible for the operation and maintenance of the local transmission system (LTS) and <7bar_g distribution networks within a defined geographical boundary. There are currently eight DNs, each consisting of one or more LDZs.

Distribution Network Operator (DNO) - The operator of a Distribution Network (DN).

Distribution System - A network of mains operating at three pressure tiers: intermediate (2 to 7bar_g), medium (75mbar_g to 2bar_g) and low (less than 75mbar_g).

Entry Capability – the entry capability of the system is the quantity of gas that can be inputted into the NTS. Entry Capability can be considered on a site specific, regional or wider locational basis and it may vary with respect to the distribution and volume of network supply and demand.

Entry Capacity – the right to flow gas onto the NTS under the UNC.

Gas Transporter (GT) - Formerly Public Gas Transporter (PGT). GTs, such as National Grid, are licensed by the Gas and Electricity Markets Authority to transport gas to consumers.

Interconnector - A pipeline transporting gas to another country. The Irish Interconnector transports gas across the Irish Sea to both the Republic of Ireland and Northern Ireland. The Belgian Interconnector transports gas between Bacton and Zeebrugge. The Belgian Interconnector is capable of flowing gas in either direction. The Dutch Interconnector (BBL) transports gas between Balgzand in the Netherlands and Bacton. It is currently capable of flowing only from the Netherlands to the UK.

Investment – an investment to overcome a system constraint is the building of additional infrastructure or modification of existing infrastructure such as a reinforcement pipeline or modification of a compressor.

Kilowatt hour (kWh) - A unit of energy used by the gas industry. Approximately equal to 0.0341 therms. One Megawatt hour (MWh) equals 103 kWh, one Gigawatt hour (GWh) equals 106 kWh, and one Terawatt hour (TWh) equals 109 kWh.

Liquefied Natural Gas (LNG) - Gas stored and / or transported in liquid form.

Load Duration Curve (1 in 50 Severe) - The 1 in 50 severe load duration curve is that curve which, in a long series of years, with connected load held at the levels appropriate to the year in question, would be such that the volume of demand above any given demand threshold (represented by the area under the curve and above the threshold) would be exceeded in one out of fifty years.

Load Duration Curve (Average) - The average load duration curve is that curve which, in a long series of winters, with connected load held at the levels appropriate

to the year in question, the average volume of demand above any given threshold, is represented by the area under the curve and above the threshold.

Local Distribution Zone (LDZ) - A geographic area supplied by one or more NTS offtakes. Consists of LTS and distribution system pipelines.

Local Transmission System (LTS) - A pipeline system operating at $>7\text{bar}_g$ that transports gas from NTS/LDZ offtakes to distribution system low pressure pipelines. Some large users may take their gas direct from the LTS.

National Balancing Point (NBP) - A notional point which represents the System for balancing purposes.

National Transmission System (NTS) - A high-pressure system consisting of terminals, compressor stations, pipeline systems and offtakes. Designed to operate at pressures up to 85bar_g . NTS pipelines transport gas from terminals to NTS offtakes.

National Transmission System Offtake - An installation defining the boundary between NTS and LTS or a very large consumer. The offtake installation includes equipment for metering, pressure regulation, etc.

Office of Gas and Electricity Markets (Ofgem) - The regulatory agency responsible for regulating Great Britain's gas and electricity markets.

Peak Day Demand (1 in 20 Peak Demand) - The 1 in 20 peak day demand is the level of demand that, in a long series of winters, with connected load held at the levels appropriate to the winter in question, would be exceeded in one out of 20 winters, with each winter counted only once.

QSEC - Quarterly System Entry Capacity

Shipper or Uniform Network Code (Shipper) User - A company with a Shipper Licence that is able to buy gas from a producer, sell it to a supplier and employ a GT to transport gas to consumers.

Substitution – the transfer of unsold non-incremental entry capacity from an entry point at which it is not required to another entry point where incremental capacity is required.

Supplier - A company with a Supplier's Licence contracts with a shipper to buy gas, which is then sold to consumers. A supplier may also be licensed as a shipper.

Therm - An imperial unit of energy. Largely replaced by the metric equivalent: the kilowatt hour (kWh). 1 therm equals 29.3071 kWh.

Transmission Planning Code - The Transmission Planning Code describes National Grid's approach to planning and developing the NTS in accordance with its duties as a gas transporter and other statutory obligations relating to safety and environmental matters. The document can be found at <http://www.nationalgrid.com/uk/Gas/TYS/>

TSO - Transmission System Operator

TYS - Ten Year Statement

Uniform Network Code (UNC) - The Uniform Network Code replaced the Network Code and, as well as covering the arrangements within the Network Code, covers the arrangements between National Grid Transmission and the Distribution Network Operators.

Appendix A – Summary¹¹ of National Grid Legal Obligations

1. National Grid owns and operates the gas National Transmission System (NTS) in Great Britain.
2. The Gas Act is the primary UK legislation that governs the transport and supply of natural gas within Great Britain. National Grid holds Gas Transporter Licences in respect of its gas transportation activities for the NTS and the four retained distribution network businesses.
3. These licences are granted and administered by the Gas and Electricity Markets Authority (“the Authority”), established by the Utilities Act 2000.
4. Section 9 of the Gas Act states a Gas Transporter has general duties in the planning and development of their system, which are:
 - a. “To develop and maintain an efficient and economical pipe-line system for the conveyance of gas; and
 - b. Subject to paragraph (a) above, to comply, so far as it is economical to do so, with any reasonable request for him –
 - i. To connect to that system, and convey gas by means of that system to, any premises, or
 - ii. To connect to that system a pipe-line system operated by an authorised transporter.”
5. Section 31 of the Planning Act 2008¹² requires a Development Consent Order for a development that is or forms part of a Nationally Significant Infrastructure Project (NSIP).and under Section 14(f) “the construction of a pipe-line by a gas transporter” is defined as such a project.

¹¹ Summary is not intended as an exhaustive list of National Grid’s legal obligations but provides information about the obligations that are particularly relevant to this report.

¹² Planning Act 2008: http://www.legislation.gov.uk/ukpga/2008/29/pdfs/ukpga_20080029_en.pdf

6. National Grid is bound by the terms of its Gas Transporter Licence (“the Licence”) in respect of the NTS. This contains a number of Standard, Standard Special and Special Conditions that National Grid must abide by in developing and operating the network and in conducting its transportation business. The licence obligations that are relevant to the planning and development of the NTS are described below.
7. **Standard Special Condition A9: Pipe-Line System Security Standards** - This condition sets out the security standard for the NTS. It requires that National Grid NTS plan the system to meet the 1-in-20 peak aggregate daily demand, including but not limited to, within day gas flow variations on that day. The condition states that the 1-in-20 peak demand level should be calculated to include the load reduction through interruption or for contractual reasons and requires that historic data from at least the 50 previous years should be used when identifying the 1-in-20 peak day.
8. **Special Condition C2: Long Term Development Statement** - Under this obligation, National Grid NTS must publish an annual Long Term Development Statement for the NTS that sets out the likely use of the NTS, and the likely developments of the NTS, any other facilities or pipeline systems that may affect the connection charging and transportation charging arrangements over the next ten years. National Grid NTS publishes the Ten Year Statement (TYS) each year in accordance with this condition and the Uniform Network Code Transportation Principal Document (UNC TPD) Section O after consultation with the gas industry through the Transporting Britain’s Energy process.
9. **Special Condition C8D: NTS gas entry incentives, costs and revenues** - The NTS entry condition sets out the entry capacity incentive arrangements that National Grid NTS operate under, the obligations on National Grid NTS to offer entry capacity for sale, the levels of entry capacity that must be offered for sale, and the process for increasing the levels of entry capacity that must be offered for sale. The condition describes two incentive mechanisms that incentivise National Grid NTS to manage its lead times for additional entry capacity release around a default lead time of 42 months. The details of the Entry Capacity release process are set out in Section B of the UNC and the Incremental Entry Capacity Release (IECR) Methodology Statement.

10. National Grid NTS can only permanently increase the level of entry capacity at an Aggregated System Entry Point (ASEP) having first assessed how much entry capacity may be substituted to meet the increase as a result of applying its Entry Capacity Substitution Methodology. Entry Capacity substitution is the process of substituting Unsold Firm entry capacity from one or more ASEPs to another ASEP where demand for entry capacity exceeds the available capacity quantities for the relevant period.
11. **Special Condition C8E: NTS gas exit incentives, costs and revenues** - The NTS exit condition sets out similar requirements to that for entry capacity. Under the enduring exit arrangements there is an incentive for National Grid NTS to manage lead times for additional exit capacity release around a default lead time of 38 months. The details of the Exit Capacity release process are set out in Section B of the UNC and the NTS Exit Capacity Release Methodology Statement.
12. National Grid NTS can only permanently increase the level of exit capacity at an exit point having first assessed how much exit capacity may be substituted to meet the increase as a result of applying its Exit Capacity Substitution Methodology. Exit Capacity substitution is the process of substituting Unsold Firm exit capacity from one or more exit points to another exit point where demand for exit capacity exceeds the available capacity quantities for the relevant period.

Appendix B – National Transmission System Analysis Principles

- B.1 Policy and Guidelines for NTS Planning
- B.2 A number of policy and guideline documents are maintained for the purposes of planning and development of the NTS. Some of these are industry guidelines applicable to all high pressure pipelines. Others are maintained and developed by National Grid to ensure compliance with legislation, industry standards and best practice. This section lists the particular industry standards and National Grid NTS policies used for network planning.
- B.3 Industry Standards and Guidelines
- B.4 The guidelines adopted by National Grid are maintained and developed by the Institute of Gas Engineers and Managers (IGEM), which is a recognised authority on technical standards relating to the natural gas industry. These are available from the IGEM website at: <http://www.igem.org.uk/>.
- B.5 IGE/TD/1: Edition 4 Steel Pipelines For High Pressure Gas Transmission This document contains a comprehensive set of guidelines covering the design, construction, inspection, testing, operation and maintenance of high pressure steel pipelines and associated installations used for natural gas transmission, operating between 16 bar(g) and 100 bar(g).
- B.6 IGE/TD/13 Pressure Regulating Installations for Transmission and Distribution Systems
- B.7 This document contains a comprehensive set of guidelines covering the design, construction, inspection, testing, operation and maintenance of pressure reduction installations used for natural gas transmission and distribution systems up to 100 bar(g).
- B.8 IGE/GL/2 Planning of Transmission and Storage Systems Operating at Pressures Exceeding 7 bar

- B.9 This document contains guidance on the planning of high pressure natural gas networks, including the required agreements and processes between Gas Transporters operating different systems to ensure the continuity of supply across the system boundaries.

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Appendix C – Technical Filter

(ENTER HERE DETAILS OF ANY OPTIONS REMOVED VIA THE TECHNICAL FILTER)

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Appendix D – Benefit Filter

(ENTER HERE DETAILS OF ANY OPTIONS REMOVED VIA THE BENIFIT FILTER)

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Appendix E – Potential Commercial Solutions

(ENTER HERE DETAILS OF POTENTIAL COMMERCIAL SOLUTIONS THAT WOULD MITIGATE PHYSICAL REINFORCEMENT OF THE NTS)

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