Long Term Development Statement 2016

October 2016

Contents

This page is intentionally left blank

Foreword

This document provides a ten-year forecast of transportation system usage and likely system developments that can be used by companies contemplating connecting to our system or entering into transport arrangements, to identify and evaluate opportunities. It is produced in accordance with Standard Condition D3 of Northern Gas Networks' Gas Transporters Licence.

The Statement explains our latest volume forecasts, system reinforcement projects and investment plans. It has been published at the end of the 2016 planning process following an appraisal of the current market conditions.

Layout

The Statement contains essential information on actual volumes and the process for planning the development of the system, including demand and supply forecasts, system reinforcement projects and associated investment. The main body of the document provides an overview of the key issues, with all details contained in the appendices.

Version and Circulation

Version Number: Final October 2016

This document and any updates to this document will be circulated electronically.

Circulation List:

Asset Risk Management and Safety Director
Regulation Director
Network Supply Strategy Manager

Background

The document sets out our assessment of the future demand and supply position for natural gas in Northern Gas Networks and outlines proposals for investment in the Local Transmission and Distribution Systems.

Northern Gas Networks manages the development, operation and maintenance of the High Pressure and below 7bar Distribution Networks. These extend from the inlet valves of the pressure regulating installations at the National Transmission System interface, to the outlet of the consumer's emergency control valve in the North East of England, Northern Cumbria and West, North and East Yorkshire.

The restructuring of the gas industry during 2005 led to the formalisation of relationships between various parties, not least between the Distribution Networks and National Grid Gas (NGG). Network staff have been involved in the development of key documents, which describe this relationship and the resulting processes. In order to fulfil its Licence obligation as a Gas Transporter, Northern Gas Networks is required to confirm to NGG the quantity of gas required at a number of different demand levels. This is stated as a request for Offtake Daily Quantity (Flat Capacity) and the amount of Storage (Flexibility) at each offtake. We also indicate the Peak Hourly Flow and associated Minimum Inlet pressure required for each point in the Network where gas is taken from the National Transmission System. After discussion between the two parties, NGG allocates these quantities in the Offtake Capacity Statements (OCS).

The forecasts described within this document have been prepared by Northern Gas Networks. The methodology for production of the forecasts is compliant with the demand forecasting requirements of Section H of the Uniform Network Code Offtake Arrangements Document.

Chapter One - Demand

1.1 Overview

This Chapter describes the forecast for gas demand ten years ahead for each Local Distribution Zone (LDZ) within Northern Gas Networks. It also includes discussion on how current forecasts relate to previously published forecasts. Further information is provided in Appendix 2.

Demand forecasts have been prepared as part of an exchange of information that is intended to inform respective capacity planning processes between the Gas Distribution Networks and NGG. These forecasts are compliant with the demand forecasting requirements of Section H of the UNC Offtake Arrangements Document.

1.2 Demand Forecasts

This section provides an outline of our latest gas demand forecasts and the key underlying assumptions.

The demand forecasts are based on planning assumptions derived from market observations and the view of specialist consultancies.

Demand forecasts are developed without knowledge of what weather conditions will prevail into the future, as such, they are made at seasonal normal temperatures (SNT). In order to compare actual throughput with the actual demand data is adjusted to account for the variance of actual weather and SNT. This is known as weather corrected demand.

Network Code requires a revision to seasonal normal values every five years and as such the basic seasonal normal temperatures were revised during 2014/15 to be implemented on the 1st October for gas year 2015/16. These values reflected the generally warm weather that had been experienced over the past decade and also looked forward for the first time, using long term weather forecasts supplied by the Met Office, in conjunction with the Hadley Centre for Climate Prediction and Research. Derivation of the seasonal normal values is designed to reflect the most accurate statistical relationship between demand and weather. It does not attempt to estimate any potential impact of global warming and as such the peak 1 in 20 weather assumptions have not altered.

Prior to the 2005 revision, seasonal normal values were carried out using 35 years of weather data, this was revised and implemented in 2005 using 17 years of data.

The models have again been influenced by the recent demand patterns impacted by factors such as the warm weather, financial state of the economy, improved energy conservation and continuing high fuel prices.

1.2.1 Forecast Demands

This section provides an overview of our latest gas demand forecasts through to 2025/26. A more detailed view can be found in Appendix 2, which includes our forecasts for both annual and peak demand on a year-by-year basis.

On a Network basis annual gas demand is forecast to decrease by 5.02% over the next 10 years, with an average yearly decline of 0.57%.

2016 is the sixth year that NGN has forecast a decline in overall annual gas demand and this is related to a less than favourable economic outlook, increases in UK gas prices, and a reduction in 1 in 20 peak day forecasts.

North East LDZ annual demand suggests a steady decline over the whole forecast period of 3.99%. The Northern LDZ forecast suggests a steeper decline resulting in an overall reduction of 6.23% over the forecast period.

Load Band	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
0-73 MWh	37.84	37.66	37.58	37.23	36.91	36.38	35.96	35.47	35.16	34.59
73-732 MWh	5.04	5.04	5.06	5.05	5.05	5.00	4.99	4.97	4.99	4.96
732-5860 MWh	4.41	4.41	4.44	4.47	4.51	4.48	4.49	4.50	4.52	4.51
Small User	**47.29**	**47.11**	**47.08**	**46.75**	**46.47**	**45.86**	**45.44**	**44.94**	**44.68**	**44.06**
Firm> 5860 MWh	22.31	22.22	22.27	22.41	22.51	22.33	22.32	22.25	22.26	22.12
Total Large / V. Large User	**22.31**	**22.22**	**22.27**	**22.41**	**22.51**	**22.33**	**22.32**	**22.25**	**22.26**	**22.12**
LDZ Consumption	**69.61**	**69.33**	**69.36**	**69.16**	**68.98**	**68.20**	**67.75**	**67.20**	**66.94**	**66.18**
LDZ Shrinkage	0.37	0.36	0.35	0.33	0.33	0.32	0.31	0.30	0.29	0.28
LDZ Demand	**69.98**	**69.69**	**69.70**	**69.50**	**69.31**	**68.51**	**68.06**	**67.49**	**67.23**	**66.46**

Table 1.2.1A – Northern Gas Networks Forecast Annual Demand – By Load Category

Note

- Figures may not sum exactly due to rounding.
- All figures in TWh

Peak demand is forecast to decline by 7.62% over the 10 year period within Northern LDZ and 5.11% in North East. This compares with a decline of 11.44% and 6.95%, respectively, for these LDZs in the 2014 forecast.

1.2.1.1 Annual Flows

The basis for any calculation of future demand is the accuracy of the previous forecast.

Table 1.2.1.1A below provides a comparison of actual and weather corrected throughput during the 2015 calendar year with the forecast demands presented in the 2015 Demand Statement. Annual forecast demands are presented in the format of load bands/categories, consistent with the basis of system design and operation.

Load Band	Actual	Weather Corrected	Forecast	Corrected v Forecast (%)
0-73 MWh	37.93	38.14	37.51	1.7
73 – 732 MWh	5.47	5.50	5.13	7.2
>732 MWh	26.01	26.04	27.26	-4.5
Network Shrinkage	0.39	0.39	0.39	-0.4
Network Total	69.80	70.07	70.30	-0.3

Table 1.2.1.1A

Note

- Figures may not sum exactly due to rounding.
- All figures in TWh

On a Network basis, the weather corrected annual throughput in 2015 (70.07 TWh) shows a reduction of 1% from 2014 (70.49 TWh).

2015 was the thirteenth consecutive year when weather corrected annual throughput has reduced at a Network level.

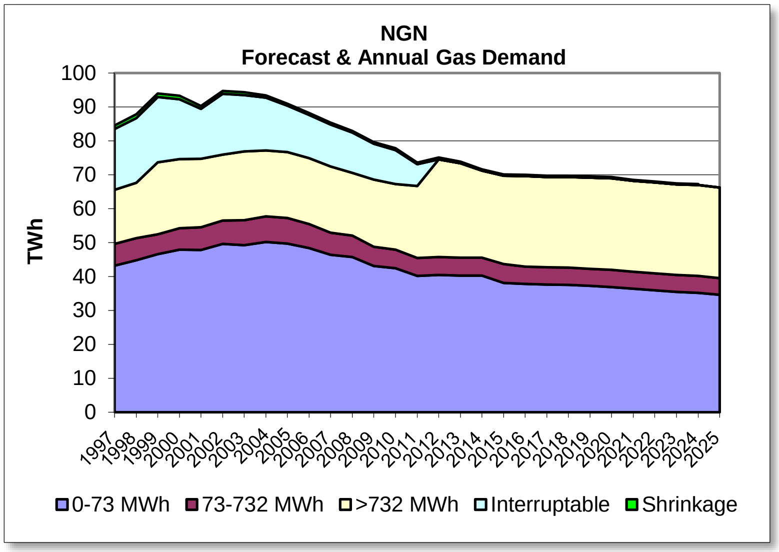


Figure 1.2A - Historical Throughput & Forecast Annual Gas Demand by Load Band

The chart above shows actual and forecast gas demand by load band through to 2025. The most significant change in this chart is the change in the Interruptible load in October 2011. Following a change in UNC Interruption Arrangements (Mod 90) which came into effect 01 October 2011, Interruptible contracts were now only available at specific supply points where NGN had identified an area in which interruption is necessary. This change to the Interruption process resulted in a significant reduction in Interruptible Load.

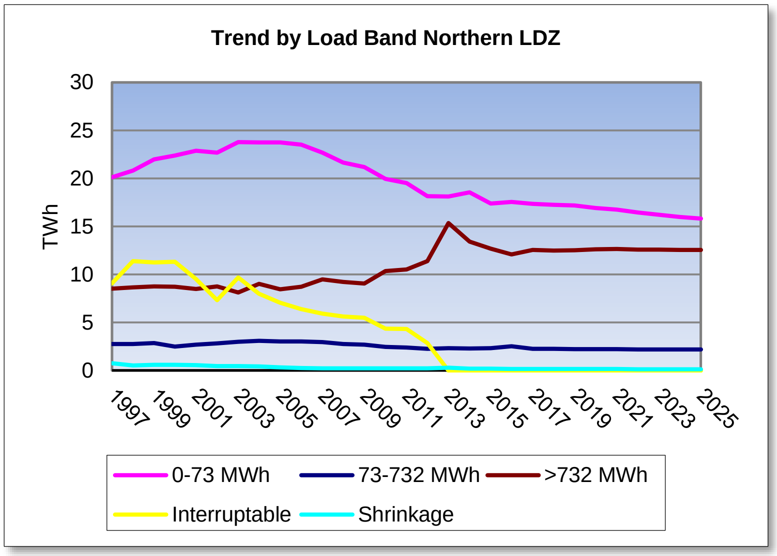


Figure 1.2B – Trend by Load Band Northern LDZ

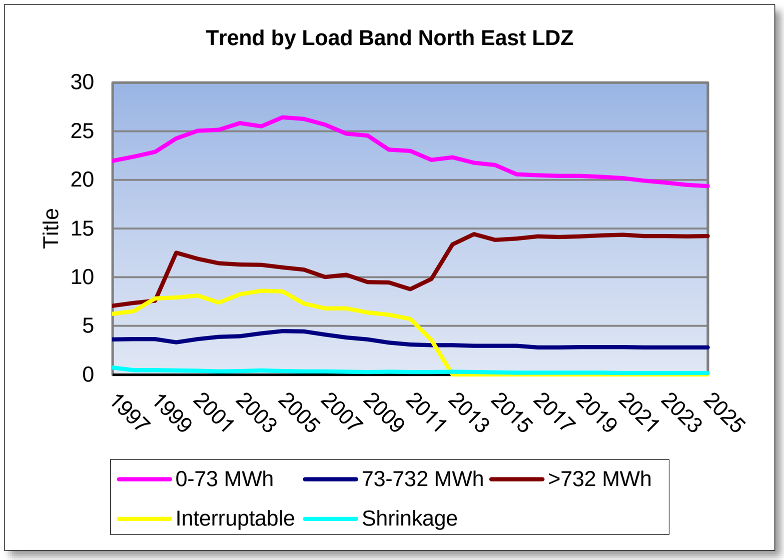


Figure 1.2C – Trend by Load Band North East LDZ

The trend graphs 1.2B and 1.2C above show energy by load band category for Northern and North East LDZ since 1997. The values from 1997 to 2015 are weather corrected annual throughput, and thereafter, the figures are taken from the 2016 Forecast Demand Statements.

Chapter Two - Supply and Storage

2.1 Supply

Gas is brought into the network through offtakes, above ground installations that are connected to the National Transmission System, which can operate with inlet pressures up to 85bar. Gas then passes through the Local Transmission System, into the Distribution System and onward to consumers.

The amount of gas NGN requires to satisfy its 1 in 20 Peak Day Firm commitment is requested from NGG on an annual basis via the Offtake Capacity Statement (OCS) process.

This process involves the Network requesting an Offtake Daily Quantity (Flat Capacity) and an amount of Storage (Flexibility) for each offtake. We also indicate the Peak Hourly Flow and associated Minimum Inlet pressure required for each offtake. After discussion between the two parties, NGG will allocate these products in the Offtake Capacity Statement. The pressures quoted in the OCS are then modelled for each offtake to determine if any upgrade work is necessary.

An example of the Offtake Capacity Statement is shown below.

NE LDZ

2016/17

STATEMENT OF FORECAST DEMAND

40.106 MJ/m3

All figures in mcm/d are at the above CV.

Offtake Name	Maximum Capacity Required		Assured Pressures	
	Demand	Storage	SOD	EOD
ASSL	0.351	0.051	41.00	38.00
BALD	0.129	0.019	38.00	38.00
BURL	1.373	0.040	43.50	43.50
GANS	1.516	-0.175	47.30	38.00
PANL	11.450	1.534	49.00	44.10
PAUL	3.392	0.300	46.00	44.00
PICK	0.752	0.060	41.00	38.00
RAWC	0.319	0.046	38.00	38.00
TOWT	5.379	0.350	45.70	38.00
OFFTAKE TOTAL	**24.661**	**2.226**		

Appendix Four gives more information about the Networks' offtakes.

2.2 Storage in the Network

Gas is stored using linepack facilities within the Network, and is utilised on a daily basis. OFGEM have approved NGN's plans for the phased demolition of gasholders over a 16 year period starting April 2013. The output target for RIIO-GD1 is to decommission a minimum of 23 gasholders.

The program to decommission and demolish all L.P. holders continues with all 47 holders now permanently decommissioned, and to date, there have been 20 holder sites purged of gas:

St Marks, Keighley No 3, North Shields, Ayres Quay, Bishop Auckland, Clay Flatts /Workington, Minton Lane, Elswick (x2 holders), St Anthony's, Portrack Ln/Stockton and Redheugh. Crossgates, Cannon Park (x2), Howdon (x2), Darlington, Meadow Lane (x2), Birkshall No 1, South Gosforth, South Shields, Blyth, New Wortlet, Sheepscar and Penrith.

Demolition works at Howdon (x2), Meadow Lane (x2), Penrith, Ayres Quay and Minton Lane have started and should be completed during the timescales of this report. St Mark Street (East Hull), St Anthony's,Bishop Auckland, Portrack and Elswick have been demolished. The tanks at St. Anthonys and Elswick No 2 are now backfilled.

It is intended to isolate and purge York, Harrogate, Carlisle and Jarrow, Holder stations before Christmas 2016, in addition to this it is the intention to isolate and purge Bridlington, Bankside, Birkshall and Cleckheaton before the end of winter (April 2017).

The HP vessels at Clay Flatts (x4) have also been isolated, purged and demolished.

Chapter Three - Investment in the Distribution Networks

3.1 LTS Development Plan

The Local Transmission System is designed for transmission and storage of gas on the basis of satisfying the 1 in 20 peak day firm only forecast demands. The system is developed, based on demand and supply forecasts, to ensure that this capability is maintained.

Major projects currently in the 2017 Plan are shown below: -

BRS 1 refers to Gas Transportation capacity upgrades, BSR 2 refers to pre-heating upgrades (no capacity increase).

BSR	LDZ	Project Name	Design	Build	Indicative Cost
1	NO	Chopwell - Previously PRI upgrade. Downscaled to no longer include a capacity increase while remaining under BSR1	15/16	16/17	£750,000
1	NO	Saltwick - Offtake Metering upgrade	15/16	16/17	£2,000,000
1	NO	Bishop Auckland - Offtake and PRI upgrade	16/17	17/18	£1,800,000
1	NE	Towton - Offtake regulator upgrade	15/16	16/17	£1,400,000
1	NE	Burley Bank - Offtake upgrade	16/17	17/18	£1,800,000

BSR	LDZ	Project Name	Design	Build	Indicative Cost
2	NO	Brenda Road - PRI preheating (new) and PRI upgrade	15/16	16/17	£1,300,000
2	NO	Durham Lane - PRI preheating upgrade	15/16	16/17	£533,000
2	NO	Clay Flatts - PRI preheating upgrade	17/18	18/19	£2,000,000
2	NO	Corbridge - Offtake preheating upgrade	17/18	18/19	£500,000
2	NO	Lamesly - PRI preheating upgrade	17/18	18/19	£2,000,000
2	NO	Newby - PRI preheating upgrade	17/18	18/19	£500,000
2	NE	East Bierley - PRI preheating cabinets upgrade	15/16	16/17	£50,000
2	NE	Saltend - PRI preheating upgrade	15/16	16/17	£1,400,000
2	NE	Pickering - Offtake preheating and Offtake upgrade	16/17	18/19	£2,400,000
2	NE	Kieghley - PRI preheating upgrade	17/18	18/19	£500,000
3	NO	Humbleton - Offtake preheating upgrade	15/16	16/17	£540,000

2016 / 17 Regulatory year projects completed prior October 2016:

BSR	LDZ	Project Name	Design	Build
1	NO	Warden Law - PRI preheating upgrade	15/16	16/17
1	NE	Asselby - Offtake and PRI upgrade	15/16	16/17
2	NO	ICI Westgate - PRI preheating upgrade	15/16	16/17
2	NO	Little Burton - Offtake preheating upgrade	15/16	16/17
2	NO	Low Thornley - PRI preheating upgrade	15/16	16/17
2	NO	Ushaw Moor - PRI preheating upgrade	15/16	16/17
2	NE	Carcroft - PRI preheating and PRI upgrade	15/16	16/17
2	NE	Ganstead - Offtake preheating band Offtake upgrade	15/16	16/17
2	NE	Knottingley - PRI preheating upgrade	15/16	16/17

3.2 Below 7barg Distribution System

The NGN below 7barg system is designed to operate between levels of pressure defined by statute, regulation and safe working practices.

We continue to develop our below 7barg Distribution system, investing in mains, services and associated plant and machinery providing capacity to meet the needs of consumers wishing to connect to our network and other Gas Transporters requests for transportation services.

The distribution systems are designed and reinforced to meet a peak six-minute (Pk6) demand level, which is the maximum demand level, averaged over a six minute period, that may be experienced in a network under cold winter conditions.

We also continue to invest in the replacement of our transportation network assets, primarily for the renewal of mains and services within Distribution systems. This includes expenditure associated with decommissioning of mains and services to a programme agreed with the Health and Safety Executive. This covers the decommissioning of all smaller-diameter iron gas pipes (<= 8" diameter) within 30 metres of occupied buildings before April 2032, and the progressive decommissioning of larger iron pipes based on their Risk and Condition. Ofgem has agreed funding for this programme.

Chapter Four - Commercial Developments

There are ongoing significant industry developments to note over the period 1st April 2013 to 31st March 2021:

- **RIIO-GD1** – an ongoing regulatory price control period with the introduction of the new RIIO framework to the gas distribution industry and will run until March 2021. This framework has introduced a number of significant developments and changes to the funding of distribution networks and the delivery of key services for customers. These include:

  - **Outputs Based** – NGN must measure and deliver a range of Outputs over the RIIO-GD1 period. These Outputs cover the six key categories of activity carried out by gas distribution networks – Safety, Reliability, Environment, Social Obligations, Connections and Customer Service.

  - **Incentives** – The framework includes strong financial and reputational incentives that ensure that good performing companies that exceed the delivery of their outputs will be rewarded, whilst those that fail to meet the necessary output requirements will be penalised.

  - **Innovation** - There are many elements of the RIIO framework designed to encourage innovation including a time-limited innovation stimulus package to fund innovation where the commercial benefits may be uncertain. This investment will be focussed on promoting and delivering a more sustainable energy sector within the UK.

  With the RIIO-GD1 framework now in place and embedded within NGN we are focussed on continuing to deliver a safe, reliable and environmentally responsible network and maintaining our position as the most efficient operator in the UK.

- **Gas Network Innovation Competition (NIC)** – Under the RIIO-GD1 price control period OFGEM have introduced an annual opportunity to compete for funding for the development and demonstration of new technologies, operating and commercial arrangements. Funding is provided for the best innovation projects which help all network operators understand what they need to do to provide environmental benefits, cost reductions and security of supply as Great Britain (GB) moves to a low carbon economy.

  NGN made a successful bid in 2013 for the Low Carbon Gas Pre Heating project (LCGP). This project is trialling two new pieces of pre heating technology (low pressure steam and Hotcat) on small medium and large gas sites. The project will then measure and monitor each technologies efficiency against each other and exiting heating systems.

  In 2015 NGN put forward an application for City Compressed Natural Gas (CNG) to the NIC, which after a review period and taking on board OFGEMs feedback was resubmitted and accepted at an NIC project. The aim is to build a city-scale CNG fuelling station aiming to be a proof of concept for UK cities, accelerating private sector investment in greener fuel sources. Four submissions were received for the 2015 NIC seeking a total of £18.73m, the City CNG project was awarded £0.7m.

  In 2016 Northern Gas Networks acted as a Project Partner for National Grid Distributions NIC submission project 'HyDeploy'. The objective is to demonstrate that natural gas containing levels of hydrogen beyond those in the GS(M)R specification can be distributed and utilised safely & efficiently in a representative section of the UK distribution network. Successful demonstration has the potential to facilitate 25TWh of decarbonised heat, and more by unlocking extensive hydrogen use as exemplified by the Leeds H21 project. The deadline for full submission was the 8th August 2016, two submissions were received seeking a total of £11.5m. The projects that have been approved and granted funding will be announced in November 2016.

More information on the NIC and NGN's project submissions is available here:- https://www.ofgem.gov.uk/network-regulation-%E2%80%93-riio-model/network-innovation/gas-network-innovation-competition

- **Distribution Network Entry** – Over recent years there has been an increasing level of interest in injecting gas directly into distribution networks from a range of conventional and non-conventional sources. These include gas derived from coal bed methane, landfill sites, anaerobic digestion and onshore gas fields. These developments have the potential to contribute significantly to increased security of supply and the transition to a low carbon economy.

  The industry has been fully engaged in addressing the technical, regulatory, legislative and commercial challenges that these developments present over this time. NGN will be continuing to work with the industry to seek ways of facilitating the development and deployment of these approaches in accordance with its licence obligations and targets set out within RIIO and in doing so play a direct role in the UK achieving its legally binding commitments to reduce Green House Gas emissions.

  NGN currently has 9 Gas to Grid bio-methane producers connected to its network, with 4 more anaerobic digestion plants scheduled to be built and begin injecting renewable bio-methane into our network within the next 12 months.

More detail about the RIIO process can be found on Ofgem's website:-

https://www.ofgem.gov.uk/network-regulation-%E2%80%93-riio-model

More detail about NGN RIIO-GD1 Business Plan can be found on Northern Gas Networks website:-

http://corporate.northerngasnetworks.co.uk/company-background/riio/

Appendix One - Process Methodology

A1.1 Demand

The purpose of this section is to give a brief overview of the methodology that is adopted to develop forecasts of annual and peak demand. The methodology can be categorised into three main modelling areas; annual demand, demand/weather and peak demand modelling.

A1.1.1 Annual Demand Modelling

The development of annual gas demand forecasts considers a wide range of factors, from complex econometrics to an assessment of individual load enquiries. For any forecasting process a set of planning assumptions is required, which if necessary can be flexed to create alternative scenarios. In the case of the forecasts presented in this document, assumptions include economic, fuel prices, environmental and tax policies. A number of these assumptions are based on data from independent organisations.

These forecasts are also benchmarked against the work of a number of recognised external sources, such as the DTI.

A1.1.1.1 LDZ Modelling

LDZ demand is split into four market sectors according to load size and supply type. The gas demand forecast in each segment is produced using a regression model chosen for that segment. For each sector, models have been developed that make allowance for economic conditions, relative fuel prices, efficiency from new boilers, and smart metering impact that could affect future changes in demand. By adopting this approach we are able to take account of varying economic conditions and specific large loads within different LDZs.

All selected models are estimated using annual as well as quarterly data over 10 years, from 2006 to 2016. The dependent variable in all the models is the annual weather-corrected demand (that is, demand assuming normal weather conditions).

A1.1.1.2 Industrial Loads

The production of forecasts within this sector is dependent on forecasts of individual new and existing loads based on recent demand trends, Transporting Britain's Energy feedback, load enquiries and commercial sources.

A1.1.2 Daily Demand / Weather Modelling

Temperature explains most of the variation in LDZ demand, but a better fit can be obtained by including other variables. The combination of temperature and other variables is called Composite Weather Variable (CWV). The CWVs are derived from temperature and wind speed data, defined and optimised for each LDZ, and give a straight-line relationship between demand and weather. In order to compare gas demand between different years, we need to take out the variability of weather and see the underlying pattern. We do this by correcting records of actual weather to seasonal normal weather basis which is the same for all years. This allows comparison of demand under the same weather basis which is the same for all years. Thus the Seasonal Normal Value of the Composite Weather Variable (SNCWV) is a key parameter used in various calculations. There is an obligation to review, at least every 5 years, the definition and seasonal normal basis of all

CWVs. The current basis of ‘Seasonal Normal’ was derived during 2014 and became effective from gas year 2015/16. The next review of Seasonal Normal is scheduled to take place during 2019 with a planned implementation effective for gas year 2020/21.

In 2006, the Met Office and three leading energy companies launched a pioneering scoping study into climate change and its potential impacts on the UK energy industry. The study was the first nationwide attempt to identify how climate change may affect energy generation; distribution and transmission, and demand. As well as initial indications on how climate change could impact the industry over the next century, it also identified areas where further research was required.

UNC Modification 0330 introduced the concept of a Climate Change Methodology (CCM) into UNC. There is a requirement for the Gas Transporters to procure: “a methodology suitable for use in adjusting historical data in relation to wind speeds and temperatures at weather stations so that Composite Weather Variables (assuming the Composite Weather Variables were determined taking into account the Weather Station Substitution Methodology) take into account climate change trends” There is also a requirement in UNC to procure associated files of adjusted historical datasets. To meet the Gas Transporters’ obligations, Xoserve appointed the Met Office to develop the Methodology and associated datasets. A small “Stakeholder Group” of experts from the gas industry has supported the Met Office in the development of the Methodology on behalf of the Demand Estimation Sub-Committee of UNCC (DESC). DESC signed off the Methodology in March 2014 (as required by UNC).

A1.1.3 Peak Day Demand Modelling

Once the annual demand forecasts and daily demand/weather models have been developed, a simulation methodology is employed, using historical weather data for each LDZ, to determine the peak day (in accordance with statutory/Licence obligations) and severe winter demand estimates.

There has been some discussion in the industry mainly within the Demand Estimation Sub-Committee (DESC) regarding the relationship between demand and the weather and there have been changes to the basis for establishing the Seasonal Normal Composite Weather Variable (SNCWV). However, there has not been much attention paid to the relationship between annuals and peaks and the historical basis for developing the 1 in 20 peak day remains the methodology currently in use by many forecasters.

A1.2 High Pressure Tier Planning

Although the development of DNs’ Local Transmission Systems (LTS) is largely demand led, LTS capacity planning processes are not dissimilar to those utilised for the development of the NTS. DNs use forecast demand to model system flow patterns and produce capacity plans that take account of anticipated changes in system load and within-day demand profiles.

The options available to relieve LTS capacity constraints include:

- Uprating pipeline operating pressures;
- Uprating offtakes from the NTS, regulators and control systems;
- Constructing new pipelines or storage; and
- Constructing new supplies (offtakes from the NTS), regulators and control systems.

As well as planning to ensure that LTS pipelines are designed to the correct size to meet peak flows, there is a requirement to plan to meet the variation in demand over a 24-hour period. Diurnal storage is used to satisfy these variations and may consist of gas held in linepack and high-pressure vessels.

A1.3 Lower Pressure Tier Planning (<7 barg)

The lower pressure tier system (distribution system) is designed to meet expected gas flows in any peak six-minute period, assuming reasonable diversity of demand. Lower tier reinforcement planning is based on LDZ peak demand forecasts, adjusted to take account of the characteristics of specific networks.

Network analysis is carried out using a suite of planning tools with the results being validated against a comprehensive set of actual pressure recordings. The planned networks are then used to assess future system performance to predict reinforcement requirements and the effects of additional loads. Reinforcement options are then identified, costed and programmed for completion before the constraint causes difficulties within the network. Reinforcement is usually carried out by installing a new main or by taking a new offtake point from a higher-pressure tier. In general, the reinforcement project is of such a size that the work can be completed and operational before the following winter.

A1.4 Investment Procedures and Project Management

All investment projects must comply with our Investment and Disposals Guidelines, which set out the broad principles that should be followed when evaluating high value investment or divestment projects.

The Investment Planning Policy defines the methodology to be followed for undertaking individual investments in a consistent and easy to understand manner. This policy is used to ensure maximum value is obtained. For non-mandatory projects, the key investment focus in the majority of cases is to undertake only those projects that carry an economic benefit.

For mandatory projects, such as safety-related work, the focus is on minimising the net present cost whilst not undermining the project objectives or the safety or reliability of the network. The successful management of major investment projects is central to our business objectives.

Our project management strategy involves:

- Allocating the appropriate project management expertise to manage the project
- Determining the level of financial commitment and appropriate method of funding for the project;
- Monitoring and controlling the progress of the project to ensure that financial and technical performance targets are achieved; and
- Post project and post investment review to ensure compliance and capture lessons learnt.

For major projects, all work is tendered through our design and delivery frameworks which were competitively tendered in 2012 and have been awarded as a 5 +1 +1 +1 contract in order to ‘back to back’ with the RIIO regulatory period.

Tenders are received and evaluated against Project Execution, commercial and program delivery criteria. An award is then made to the tender which demonstrates the best value for NGN against all these criteria. The percentage split against the assessment criteria is determined based on the complexity and/or risk of the project.

All projects are completed in line with the Major projects Integrated Management System (IMS) which covers the 'cradle to grave' project lifecycle. The IMS is critical to ensuring NGN delivers projects consistently and in line with all relevant legislative requirements fulfilling NGN's obligations as the employer.

Our project management of major investment projects is designed to ensure that they are delivered on time, to the appropriate quality standards at minimum cost. The project management process in particular makes use of professional consultants and specialist contractors, all of whom are appointed subject to competitive tender.

Appendix Two - Gas Demand Forecasts

A2.1 Annual Demand

During the next ten years annual gas demand is forecast to decline by 6.23% in Northern LDZ and by 3.99% in North East LDZ. This is a reduced decline when compared to the 2015 forecast of 9.75% in Northern LDZ and 5.66% In North Eat LDZ.

Northern LDZ

Load Band	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
0-73 MWh	17.36	17.26	17.17	16.91	16.74	16.46	16.23	15.98	15.80	15.51
73-732 MWh	2.26	2.24	2.24	2.23	2.23	2.21	2.20	2.19	2.20	2.18
732-5860 MWh	2.04	2.05	2.07	2.09	2.11	2.11	2.12	2.13	2.15	2.14
> 5860 MWh	10.50	10.45	10.47	10.52	10.56	10.47	10.46	10.42	10.42	10.35
Large User	10.50	10.45	10.47	10.52	10.56	10.47	10.46	10.42	10.42	10.35
LDZ Shrinkage	0.17	0.16	0.16	0.15	0.15	0.14	0.14	0.13	0.13	0.13
LDZ Demand	32.33	32.16	32.11	31.90	31.78	31.39	31.14	30.85	30.70	30.32

Table A2.1A - Forecast Annual Demand by Load Category for North LDZ from 2016 Demand Statements (TWh)

Note

- Figures may not sum exactly due to rounding.

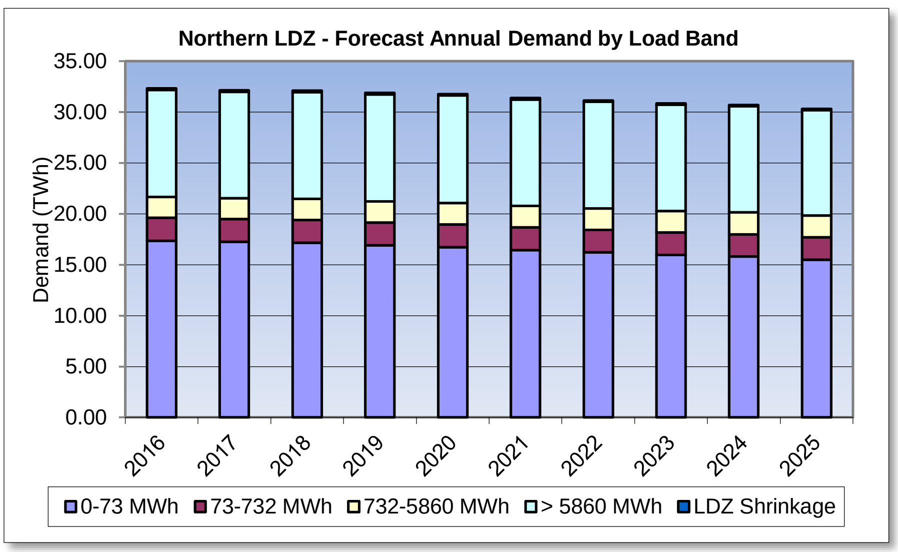


Figure A2.1B - Northern LDZ - Forecast Annual Demand by Load Band

North East LDZ

Load Band	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
0-73 MWh	20.47	20.40	20.41	20.32	20.18	19.92	19.73	19.50	19.36	19.08
73-732 MWh	2.78	2.80	2.82	2.82	2.82	2.80	2.79	2.78	2.80	2.78
732-5860 MWh	2.37	2.36	2.38	2.38	2.40	2.38	2.38	2.37	2.38	2.36
> 5860 MWh	11.82	11.77	11.80	11.90	11.96	11.86	11.86	11.83	11.84	11.77
Large User	11.82	11.77	11.80	11.90	11.96	11.86	11.86	11.83	11.84	11.77
LDZ Shrinkage	0.20	0.19	0.19	0.18	0.18	0.17	0.17	0.16	0.16	0.15
LDZ Demand	37.65	37.53	37.60	37.60	37.53	37.13	36.91	36.64	36.53	36.14

Table A2.1C - Forecast Annual Demand by Load Category for North East LDZ from 2016 Demand Statements (TWh)

Note

- Figures may not sum exactly due to rounding.

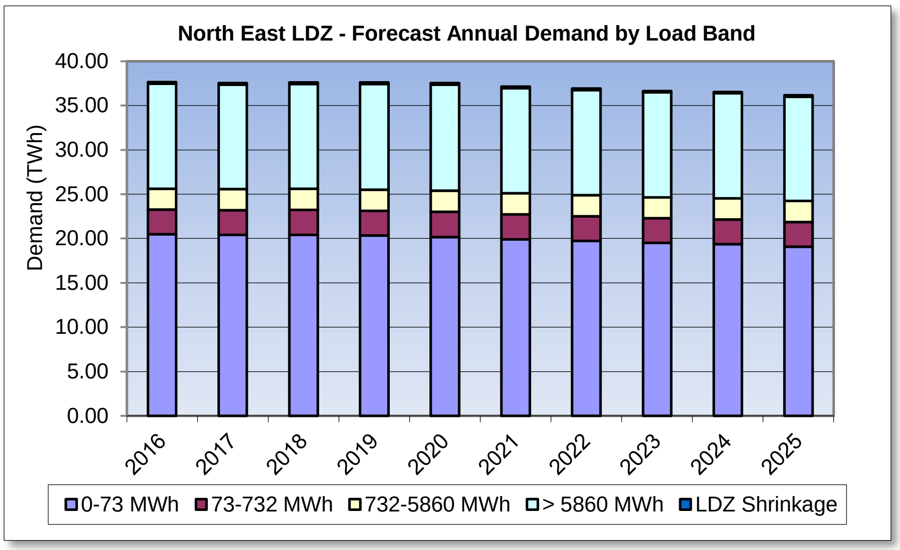


Figure A2.1D – North East LDZ - Forecast Annual Demand by Load Band

A2.2 Peak Demand

1 in 20 Peak Day Demand (GWh)										
LDZ	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**
North	222	222	220	218	216	215	212	210	208	205
North East	267	268	267	265	264	262	259	257	256	253
Total	489	490	487	483	480	477	471	467	464	459

Figure A2.1E - Forecast 1 in 20 Peak Day Firm Demands by LDZ from the 2016 Demand Statements

Notes

- Figures may not sum exactly due to rounding.
- All figures in GWh.

Weather-corrected throughput in the Northern LDZ fell by 0.7% in 2015 when compared with 2014, the thirteenth consecutive year of gas demand falling. In North East LDZ weather corrected throughput fell by 0.5%, the eleventh consecutive year of falling gas demand.

Weather-corrected throughput in NGN for the first eight months of 2015 was 0.6% lower than the same period in 2014. At an LDZ level, the Northern weather-corrected throughput was 0.2% lower, and North East LDZ was 1% lower.

A2.2.1 Key Assumptions in Developing NGN Demand Forecasts

This section provides a general overview of the variable used to predict annual gas demand.

NGN Regional Economic Assumptions

Gross Value Added (GVA) measures the contribution to the economy of each individual producer, industry or sector in the United Kingdom. GVA is used in the estimation of Gross Domestic Product (GDP). GDP is a key indicator of the state of the whole economy. Therefore it is the main driver for gas demand.

A significant decline in GDP occurred during 2008/9 set against a long period of growth from 1992. However as with manufacturing there has been some recovery in GDP since that time.

The latest economic figures included in the graph below taken from the Office of National Statistics show a sustained growth in the economy during 2015 with the latest independent forecasts showing an average growth in national GDP of 2.5% for 2015. The Office for Budget Responsibility (OBR) is forecasting a slightly lower figure for 2015 of 2.4%.

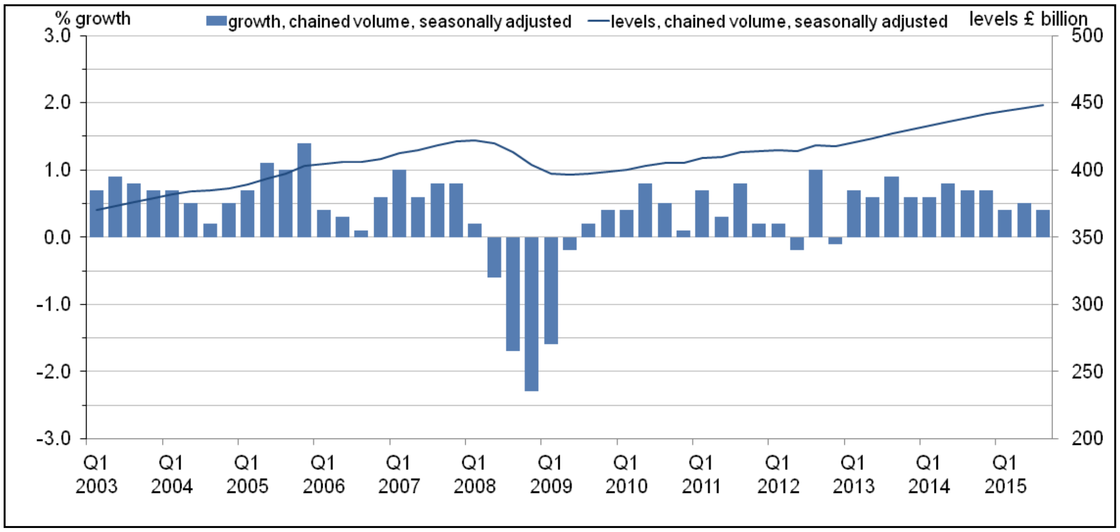


Figure A2.2.1A – UK GDP Growth Percentage and Level 2003 – 2015

This current level of growth is expected to continue for 2016 at around 2.4% in the central case. Independent forecasters expect a small decline to around 2.3% in 2017, and 2.2% in 2018 and 2019. These are marginally lower than the OBR's own forecasts. The OBR published their central forecast in November 2015 which is shown below.

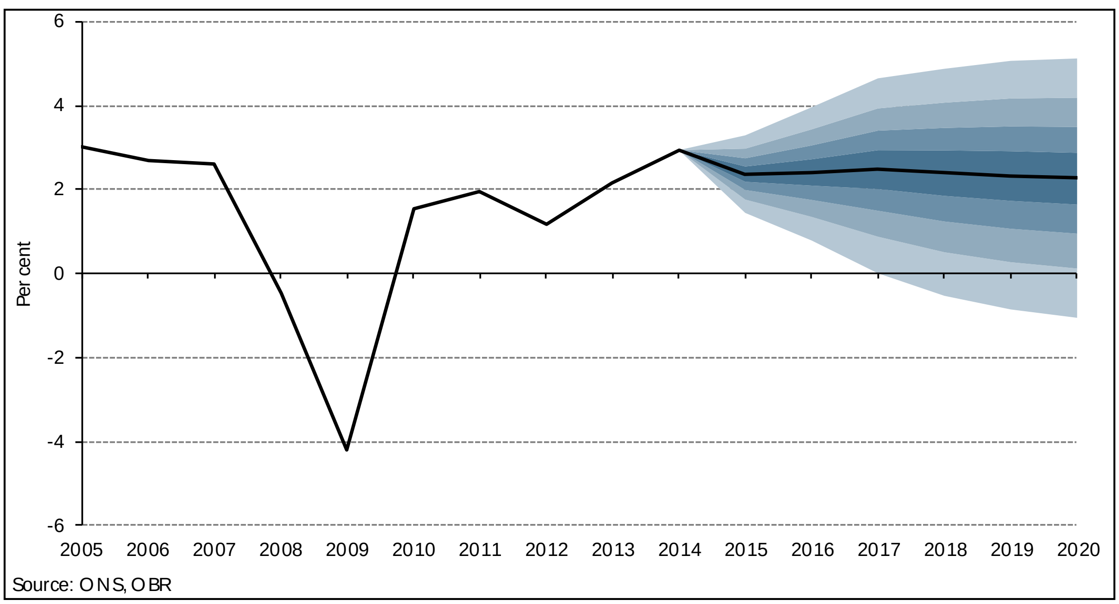


Figure A2.2.1B – UK GDP Growth Percentage Historic and Forecast to 2020

GVA growth in both LDZs has been below the average growth for GB in the period 2004 to 2015, with the impact of the recovery being present at the same time in NE LDZ as GB but less noticeable. With regard to the NO LDZ there was in fact a very small recession in 2010 but recovering after that date, although there was very low growth in 2012.

Gas & Energy Prices

Gas price is the other very significant gas demand driver, which shows a negative impact on gas demand. This implies that an increase in gas price would lead to reduction in gas consumption especially in domestic sector.

All prices in all markets have shown, until very recently, significant rises from 2002 for households and effectively from 1999 in the non-domestic market. This has been driven by the wholesale gas price rises, which has in turn been driven by rising oil prices. However this has been turned around significantly with the recent sharp decline in oil price, driven by the entry into the market of the shale oil in North America, decline in worldwide consumption and the refusal of OPEC to cut back production.

There is extreme uncertainty regarding the likelihood and timing of any recovery in oil price. Additional factors that can be expected to impact oil prices are the ongoing crisis in the Ukraine and any knock on effects in the neighbouring countries like Azerbaijan and Turkmenistan, and the growing tensions in the Middle East and Africa.

On balance it can be expected that oil prices will rise again, but slowly, unless there is a major supply disruption, which would almost certainly see a dramatic rise in oil prices, and hence wholesale gas prices. Any assertions made by commentators regarding the delinking of gas prices from oil, do appear to have been unfounded given the fact that wholesale gas prices have fallen broadly in line with oil prices although not as dramatically.

Wholesale Price

There has been some significant fluctuation in the wholesale gas price (as represented by the UK NBP price) over time but the general trend until recently has been upwards. Following the steep decline in oil prices in 2015 the wholesale price has also fallen in 2015. The forecast used is based on forecasts that are used by DECC for their energy demand forecasts. The forward prices published by Heren however are significantly lower than these, but the average wholesale price of gas is made up of a combination of this forward gas and other contracts both short and long term.
.

Retail Price – Domestic

There has been a dip in the real price of domestic gas prices this year as a result of the impact of the wholesale price drop which has an impact on a proportion of the costs incurred by domestic suppliers. In addition competition from smaller suppliers is increasing and there is increasing pressure from within the Government to make switching supplier easier and quicker. Beyond 2015 with forecast wholesale prices due to remain fairly stable initially and then rise slowly, we have assumed that the major suppliers will as a minimum control prices using the full wholesale price plus a 2% premium for the ongoing costs associated with smart metering and the development of smart grids.

The index provided in the assumptions is a real price index with 1987 having an index of 100. The current retail gas price as calculated using the above assumptions is adjusted for inflation to create the real price index.

Efficiency

As a general observation it has been noted that gas demand has been declining in recent years, but it is difficult to separate the impact of efficiency improvements from the impact of variations in gas prices and the effects of variations in the number of supply points.

It is a fact that there has been a steady and substantial programme of gas fired domestic boiler replacement for several years now and the high levels of efficiency achieved with these new boilers is a possible contributory factor in the decline in gas demand. However the increases in efficiency could have been used to provide higher comfort levels, especially in winter. There has also been a concerted effort by gas suppliers and other parties to encourage the use of loft and cavity wall insulation. This has been extensively used to reduce household consumption.

The DECC statistics as at the middle of 2015 show that there are only 338,000 homes with solid wall insulation which equates to 4% of the total properties that do not have a cavity wall. This figure is almost five times the number in 2008.

Smart Meters

On the subject of Smart Metering and information provision to customers it was observed by Ofgem in their report for the energy Demand Research Project (EDRP) from December 2010 that there is evidence to suggest that smart meters can be a vehicle for effective action to reduce domestic energy demand. However there was no distinction between gas and electricity meters.

In the final reports produced in June 2011 the following conclusion was reached with respect to the impact of smart meters on gas consumption. “The smart meter itself (e.g. the information provided on consumption and cost) or some aspect of the experience of getting a smart meter appears to be a positive mechanism, resulting in savings of around 3%. E.ON found that these effects were persistent into the first quarter of the second in-trial year (i.e. for 15 months) and for one or two further quarters in some groups. The literature and other EDRP findings indicate that this effect may require support over time from other interventions (e.g. advice or billing information) to be sustained for longer periods.”

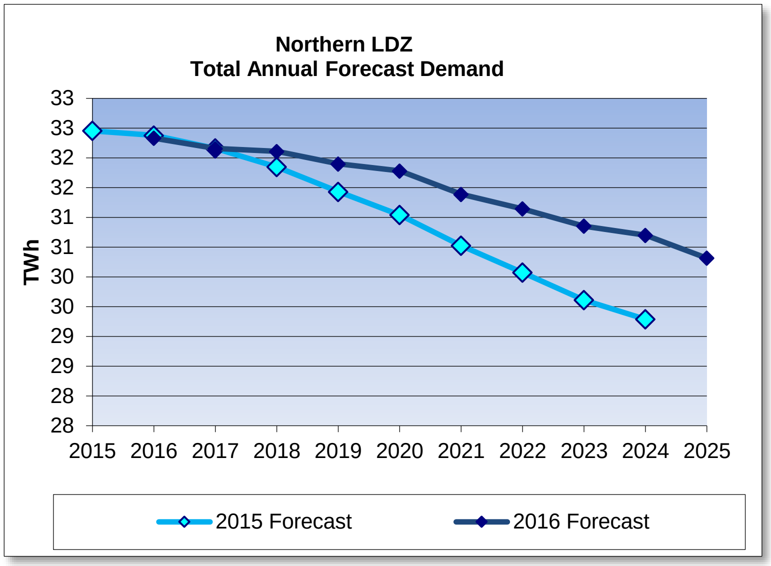
The latest news on the full roll-out programme from the DECC 4th Annual Report states the target date for full roll-out stays at the end of 2020, with 53 million smart meters expected to be installed. The main installation stage commences 2016-17 though some suppliers have been installing meters in advance of the official roll-out. At the time of publication (July 2016) 3.1 million smart and advanced meters are operating in homes and businesses across Great Britain.

1 in 20 Peak Day Demand Methodology

NGN is continuing with the use of the traditional methodology for calculating the 1 in 20 peak day and have seen some evidence of some small changes in the behaviour of customers in severe weather which suggested that there may be a need to review the methodology. This There is clear evidence that average consumption per customer (especially in the domestic sector) has been falling, driven by rising gas prices, which has been encouraging the replacement of inefficient gas boilers and installation of cheaper forms of insulation. But it is also possible that customers are trying to conserve energy by turning thermostats down when heating is on, particularly during the shoulder months of April and September.

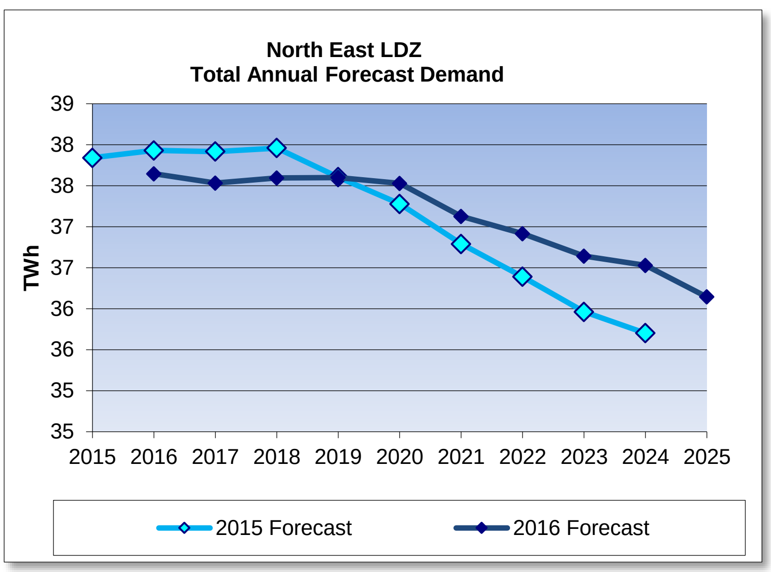
A2.3 Forecast Comparisons

The following charts provide a comparison of the current forecasts with those published in the 2015 Demand Statements.



Year	Forecast (TWh) 2015 DS	2016 DS	% Difference
2016	32.38	32.33	-0.14
2017	32.16	32.16	-0.01
2018	31.85	32.11	0.81
2019	31.43	31.90	1.48
2020	31.04	31.78	2.38
2021	30.52	31.39	2.83
2022	30.07	31.14	3.56
2023	29.61	30.85	4.19
2024	29.29	30.70	4.81
2025		30.32	

Figure 2.3A – Northern LDZ Total Annual Forecast Demand



Year	Forecast (TWh) 2015 DS	2016 DS	% Difference
2016	37.93	37.65	-0.75
2017	37.92	37.53	-1.01
2018	37.96	37.60	-0.96
2019	37.60	37.60	-0.01
2020	37.28	37.53	0.67
2021	36.79	37.13	0.91
2022	36.39	36.91	1.45
2023	35.96	36.64	1.89
2024	35.70	36.53	2.31
2025		36.14	

Figure 2.3B – North East LDZ Total Annual Forecast Demand

Appendix Three - Actual Flows 2014

A3.1 Annual Flows

Annual forecasts are based on average weather conditions. Therefore, when comparing actual throughput with forecasts, throughput has been adjusted to take account of the difference between the actual weather and the seasonal normal weather.

The result of this calculation is the weather corrected throughput.

The weather corrected throughput and forecast demands listed below assume a weather condition based on weather data for a 17 year period from 1987 to 2004.

The basis for any calculation of forecast demand is the accuracy of the previous forecast.

Table A3.1.A and chart A3.1.B provide a comparison of actual and weather corrected throughputs during the 2015 calendar year, with the forecast demands presented in the 2015 Demand Statements. Annual demands are presented in the format of LDZ and NTS load bands/categories, consistent with the basis of system design and operation.

NO 2015	Actual	Weather Corrected	Forecast	Corrected v Forecast (%)
NDM Firm 0 to 73.2 MWh	17.39	17.56	17.23	1.9
NDM Firm 73.2 to 732 MWh	2.52	2.54	2.28	11.0
Firm >732	12.05	12.08	12.77	-5.4
Shrinkage	0.18	0.18	0.18	-0.7
Total LDZ	32.14	32.35	32.46	-0.3

Table A3.1A Northern LDZ Throughput

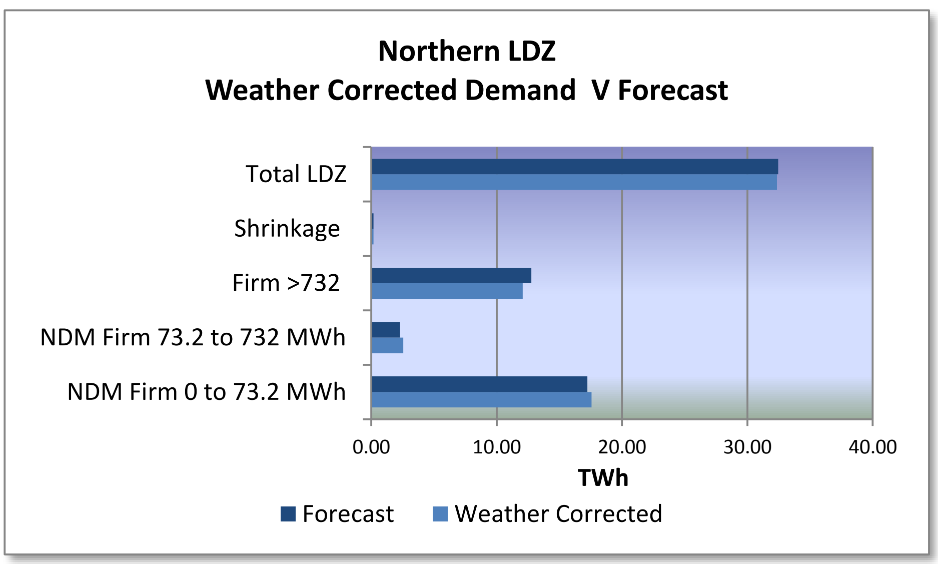


Table A3.1B 2015 Northern LDZ Weather Corrected Demand V Forecast

Looking at the Northern LDZ throughput in comparison with the forecast we can see that in the 0 – 73.2 MWh and 73.2 – 732 MWh load bands the forecasts were understated. Overall the total LDZ weather corrected throughput was 0.3% lower than forecast.

NE 2015	Actual	Weather Corrected	Forecast	Corrected v Forecast (%)
NDM Firm 0 to 73.2 MWh	20.53	20.58	20.29	1.4
NDM Firm 73.2 to 732 MWh	2.96	2.97	2.85	4.2
Firm >732	13.96	13.96	14.49	-3.7
Shrinkage	0.21	0.21	0.21	-0.1
Total LDZ	37.66	37.71	37.84	-0.3

Table A3.1C North East LDZ Throughput

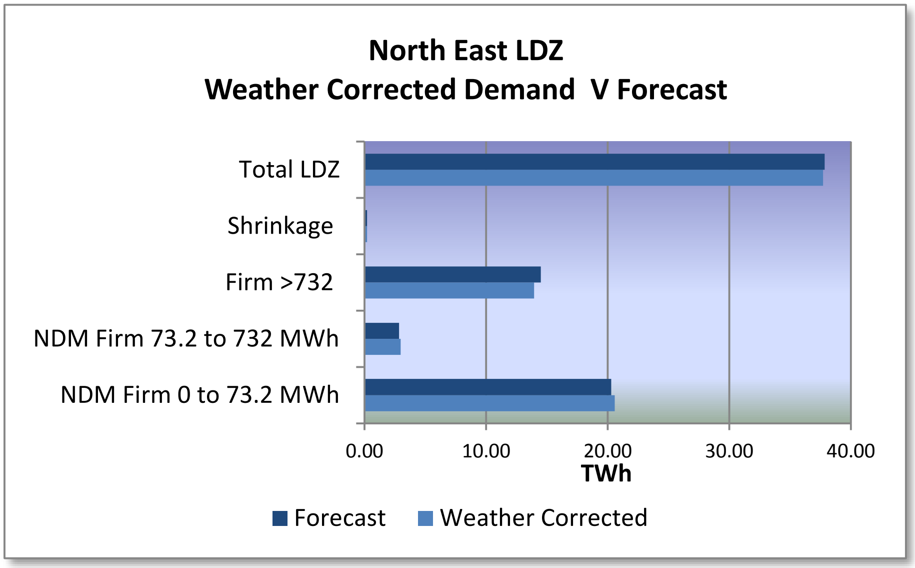


Table A3.1D 2014 North East LDZ Weather Corrected Demand V Forecast

Similarly, the North East LDZ forecast were understated in most load bands, with the exception of the Firm >732. At an LDZ level the weather corrected throughput was 0.3% lower than forecast.

A3.2 Peak Flows

During the last winter period, the day of highest total throughput in the Network was 14th January 2016. In the North East LDZ demand levels were 17.23 mscm, 7.27% lower than the winter of 2014/15. In the Northern LDZ this day was also the highest throughput, when demand levels were 14.88mscm – this was 3.5% lower than the previous winter.

The throughput in North East LDZ on the 14th January equated to 69.8% of peak day firm only forecast demand. In Northern LDZ the throughput was 74.3% of peak day firm only forecast demand.

Over the next ten years, peak day forecast demand is expected to decline by 7.62% in Northern and 5.11% in North East LDZ.

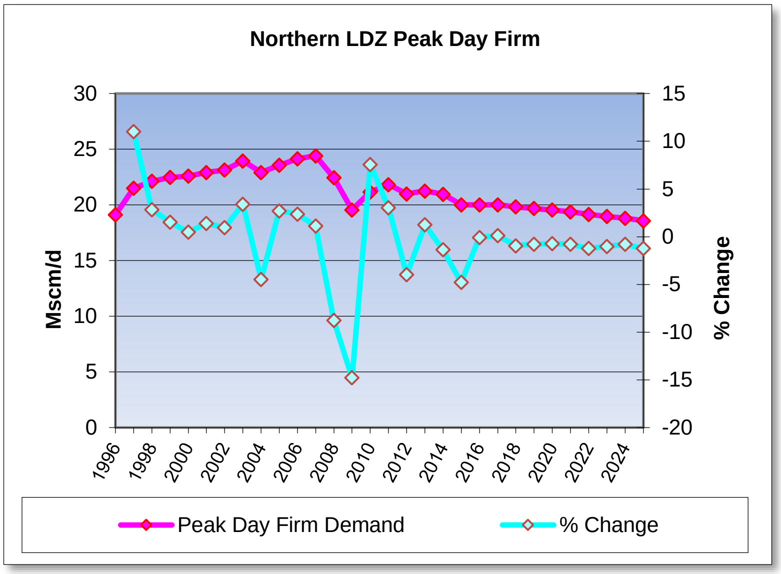


Figure 3.2a – Historical Throughput & Forecast Peak Day Firm Demand for Northern LDZ

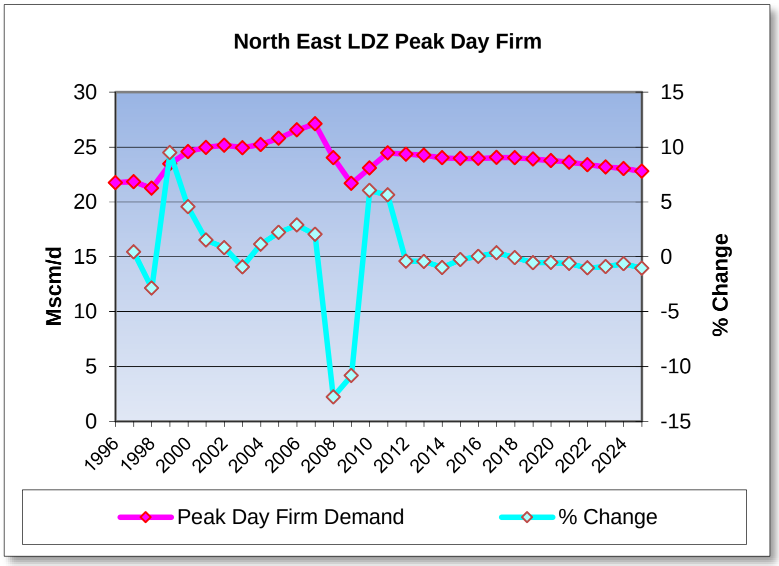


Figure 3.2b – Historical Throughput & Forecast Peak Day Firm Demand for North East LDZ

Appendix Four - Offtakes

As an indication of available capacity at the Network's offtakes, the 2019 requested Peak Flow from NTS has been plotted against the Maximum Offtake Capacity.

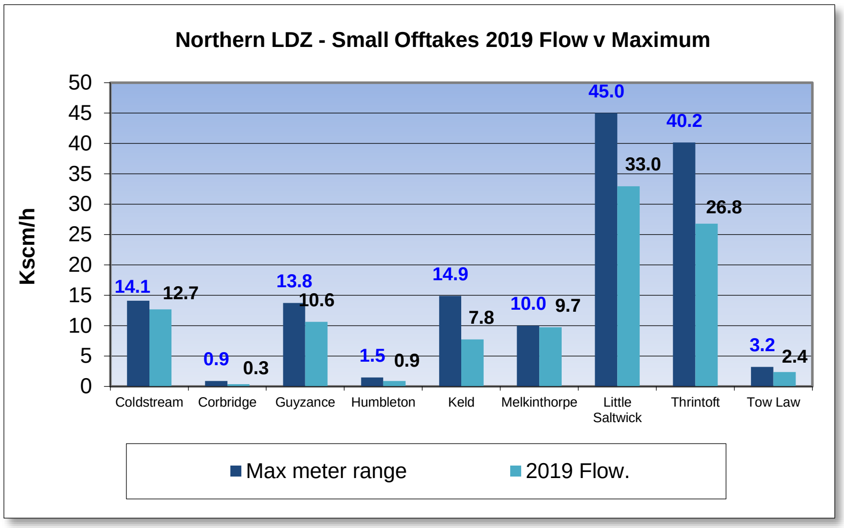


Figure 4.0a – Northern LDZ Small Offtakes 2019 Flow Vs Maximum

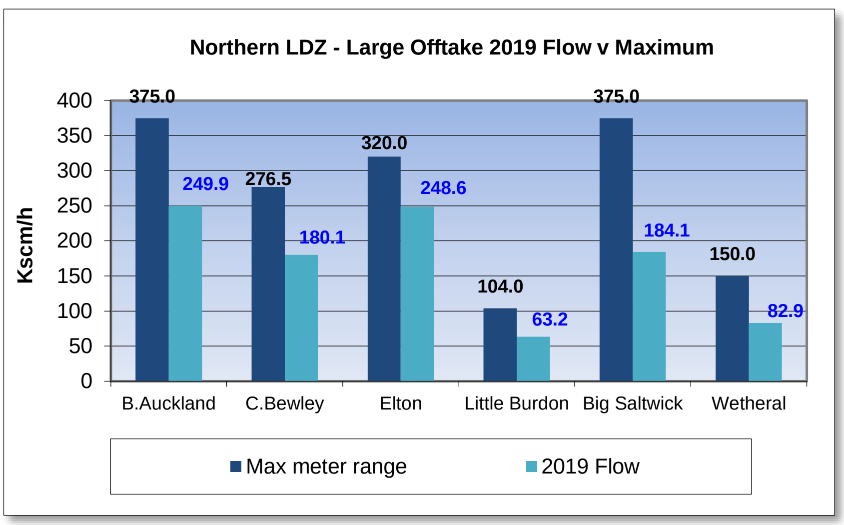


Figure 4.0b – Northern LDZ Large Offtakes 2019 Flow Vs Maximum

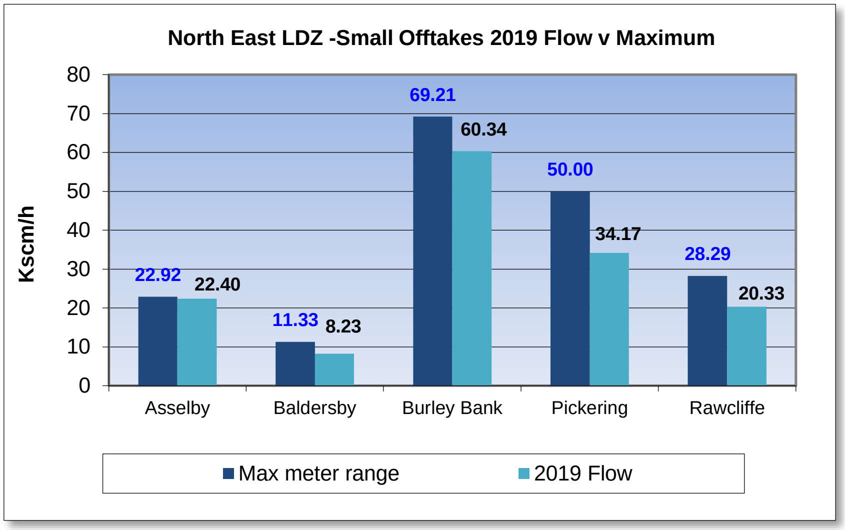


Figure 4.0c – North East LDZ Small Offtakes 2019 Flow Vs Maximum

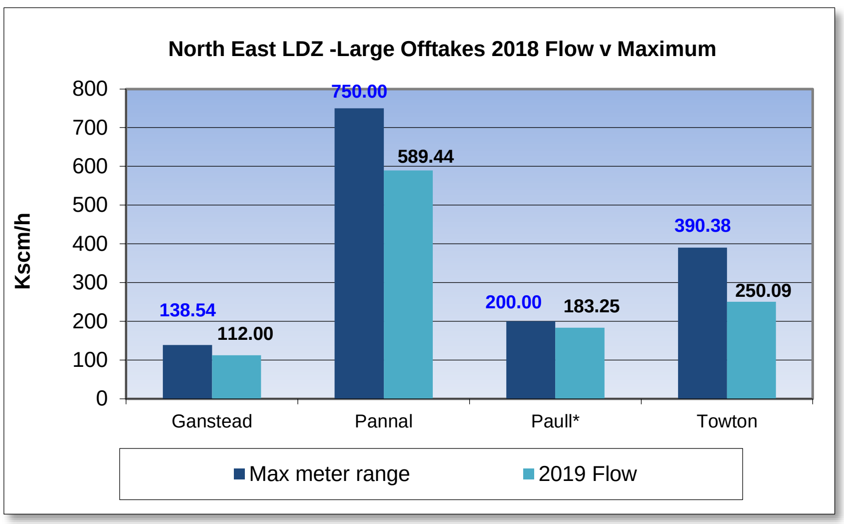


Figure 4.0d – North East LDZ Large Offtakes 2019 Flow Vs Maximum

Appendix Five - The Gas Transportation System

A5.1 Northern LDZ Schematic

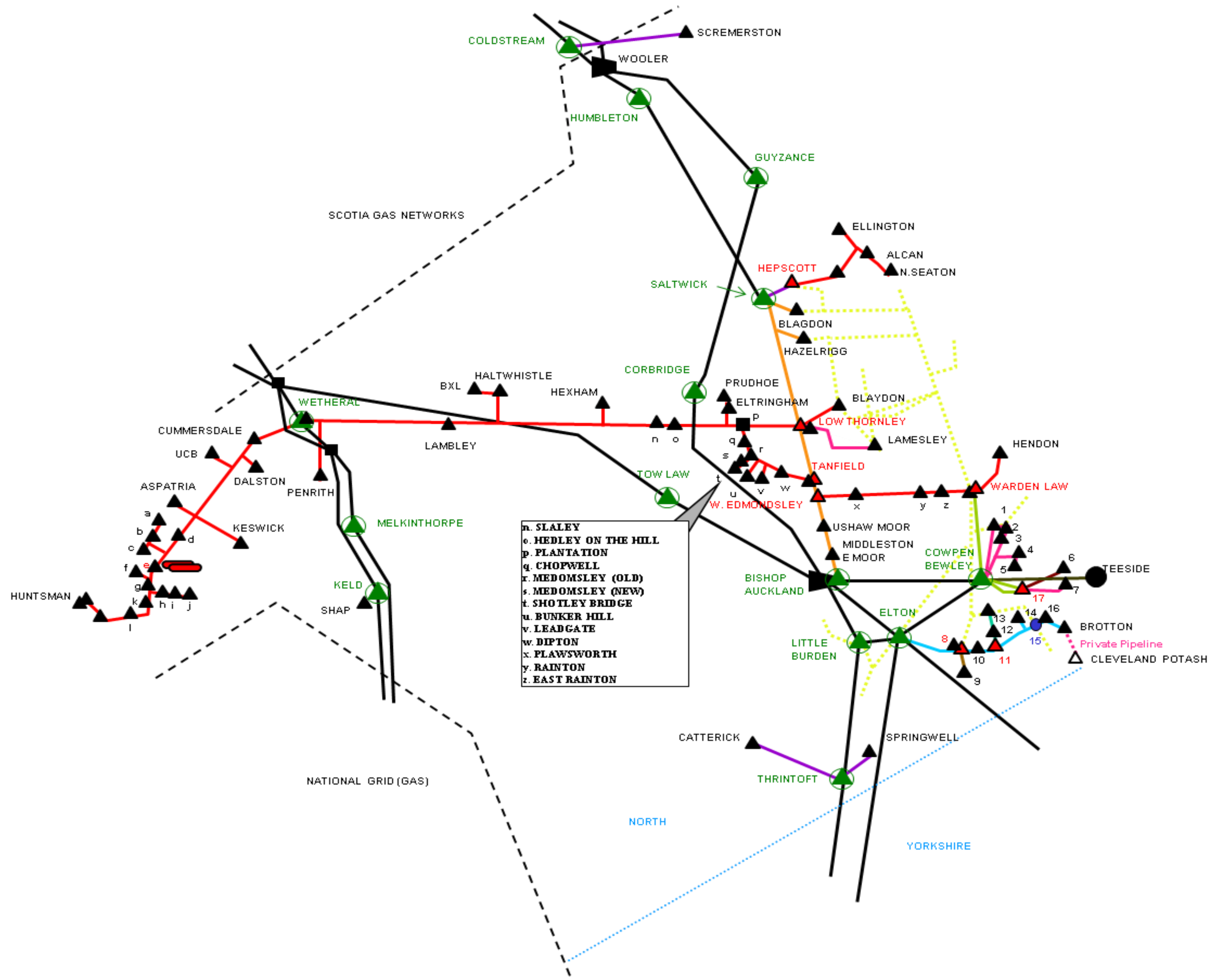
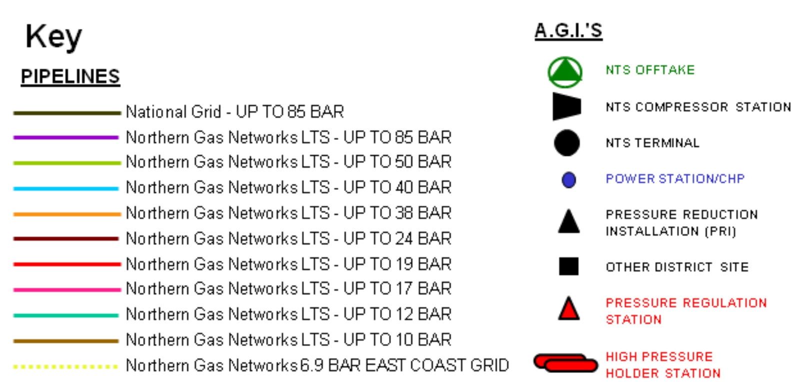


Figure 5A – North LDZ schematic



A5.2 North East LDZ Schematic

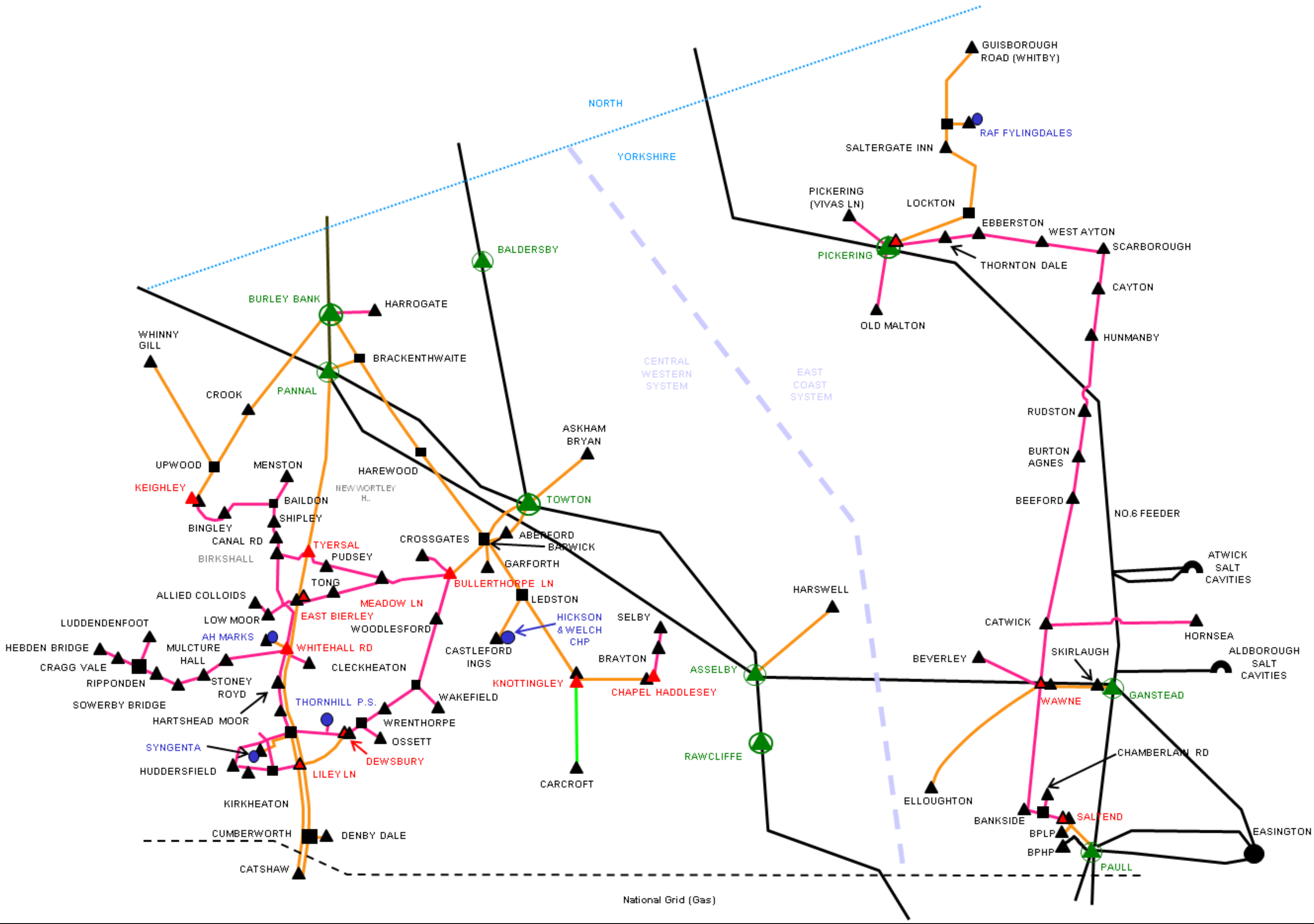
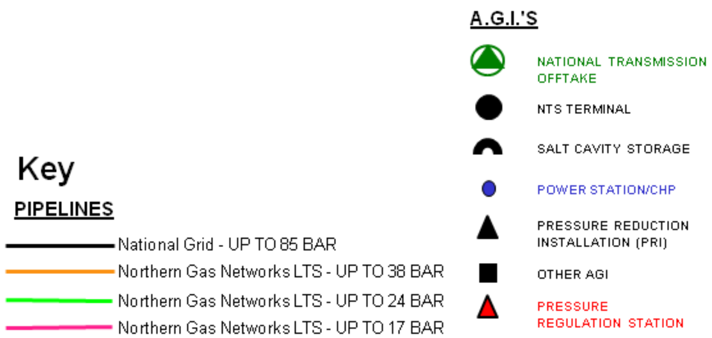


Figure 5A – North East LDZ schematic



Appendix Six - Connections to our System

A6.1 Introduction

Within the space of a few years, the gas industry in Britain has evolved from a situation where one company provided all new connections, to one where many alternative connection services are now available on a competitive basis.

Indeed, whilst Northern Gas Networks continues to offer connection services in line with our Gas Act obligations, customers and developers have the option to choose other parties to build their facilities, have the connection vested in or adopted by the host gas transporter (depending upon circumstances), pass assets to a chosen system operator, transporter, or retain ownership of them.

The following are the generic classes of connection.

- Entry Connections: connections to delivery facilities processing gas from gas producing fields or, potentially in the future, LNG vaporisation (i.e. importation) facilities, for the purpose of delivering gas into the NGN system. Biomethane is a fully renewable source of energy and NGN is fully committed to maximising the entry of biomethane into our gas network
- Exit Connections: connections that allow gas to be offtaken from our system to premises (a 'Supply Point') or to Connected System Exit Points' (CSEPs). There are several types of connected system including:
    - A pipeline system operated by another gas transporter;
    - Any other non-NGN pipeline transporting gas to premises consuming more than 2,196MWh per annum; and
    - Storage Connections: connections to storage facilities for the purpose of temporarily offtaking gas from our system and delivering it back at a later date.

Please note that storage may both deliver gas to the system and offtake gas from the system and therefore specific arrangements pertaining to both Entry and Exit Connections will apply. In addition to new pipes being termed connections, any requirement to increase the quantity of gas delivered or offtaken is also treated as a new connection.

We have received a number of enquiries to enter biomethane into our pipeline system and anticipate that several of these facilities will be connected during the 10 year planning period. These sites use a variety of feedstocks for this process such as crops, sewage, livestock and supermarket wastes and range in entry capacity from 250 – 1,200 cubic metres per hour.

It should be noted that any third parties wishing to connect to our system, or requiring increased flow, should contact us as early as possible to ensure that requirements can be met on time, particularly if system reinforcement is required as outlined in A6.7.

A6.2 Additional Information Specific to System Entry and Storage Connections

We require a Network Entry Agreement or Storage Connection Agreement as appropriate, with the respective operator of all delivery and storage facilities to establish, among other things, the gas quality specification, the physical location of the delivery point and the standards to be used for both gas quality and the measurement of flow.

A6.2.1 Network Entry Quality Specification

For any new entry connection to our system, the connecting party should notify us as soon as possible as to the likely gas composition. We will then determine whether the gas can be accepted, taking into account our existing statutory and contractual obligations.
The ability of Northern Gas Networks to accept gas supplies into the system is affected by, among other things, the composition of the new gas, the location of the system entry point, volumes entered, pressure ranges and the quality and volumes of gas already being transported within the system.

In assessing the acceptability of any proposed new gas supply, we will take account of the following.

a) Our ability to continue to meet statutory obligations (including, but not limited to, the Gas Safety (Management) Regulations 1996 (GS(M)R)).

b) The implications of the proposed gas composition on system running costs.

c) Our ability to continue to meet our contractual obligations.

For indicative purposes, the specification set out below is usually acceptable for most locations and encompasses, but is not limited to, the statutory requirements set out in the GS(M)R.

1. Hydrogen Sulphide
    - Not more than 5mg/m3

2. Total Sulphur
    - Not more than 50mg/m3

3. Hydrogen
    - Not more than 0.1% (molar)

4. Oxygen
    - Not more than 0.001% (molar)

5. Hydrocarbon Dewpoint
    - Not more than -2°C at any pressure up to 85barg

6. Water Dewpoint
    - Not more than -10°C at 85barg

7. Wobbe Number (real gross dry)
    - The Wobbe Number shall be in the range 47.20 to 51.41MJ/m3

8. Incomplete Combustion Factor (ICF)
    - Not more than 0.48

9. Soot Index (SI)
    - Not more than 0.60

10. Gross Calorific Value (real gross dry)
    - The Gross Calorific Value (real gross dry) shall be in the range 36.9 to 42.3MJ/m3, in compliance with the Wobbe Number, ICF and SI limits described above. Subject to gas entry location and volumes, we may set a target for the Calorific Value within this range.

11. Inerts

- Not more than 7.0% (molar) subject to Carbon Dioxide: not more than 2.0% (molar)

12. Contaminants
    - The gas shall not contain solid, liquid or gaseous material that may interfere with the integrity or operation of pipes or any gas appliance within the meaning of regulation 2(1) of the Gas Safety (Installation and Use) Regulations 1998 that a consumer could reasonably be expected to operate.

13. Organohalides
    - Not more than 1.5 mg/m3

14. Radioactivity
    - Not more than 5 Becquerel/g

15. Odour
    - Gas delivered shall have no odour that might contravene the statutory obligation not to transmit or distribute any gas at a pressure below 7 barg, which does not possess a distinctive and characteristic odour.

16. Pressure
    - The delivery pressure shall be the pressure required to deliver natural gas at the Delivery Point into our Entry Facility at any time, taking into account the back pressure of our System at the Delivery Point as the same shall vary from time to time.

    - The entry pressure shall not exceed the Maximum Operating Pressure at the Delivery Point.

17. Delivery Temperature
    - Between 1°C and 38°C

Note that the Incomplete Combustion Factor (ICF) and Soot Index (SI) have the meanings assigned to them in Schedule 3 of the GS(M)R. In addition, where limits on gas quality parameters are equal to those stated in GS(M)R (Hydrogen Sulphide, Total Sulphur, Hydrogen, Wobbe Number, Soot Index and Incomplete Combustion Factor), we may require an operational tolerance to be included within an agreement to ensure compliance with the GS(M)R.

Due to continuous changes being made to the system, any undertaking made by us on gas quality prior to signing an agreement will normally only be indicative. We are working with the Government and Ofgem in assessing the compatibility of existing specifications (both statutory and contractual) with the longer term needs of the UK in respect of additional gas supplies, and the European Association for the Streamlining of Energy Exchange (EASEE-gas) in the development of a Gas Quality harmonisation Common Business Practice. The outcomes of these projects could ultimately result in changes to our network entry quality specifications in the future.

A6.3 Additional Information Specific to System Exit Connections

Any person can contact NGN to request a connection, whether a shipper, operator, developer or consumer. However, gas can only be offtaken where the Supply Point so created has been confirmed by a shipper, in accordance with the Network Code.

A6.4 National Transmission System (NTS) Connections

For information regarding NTS Connections visit http://www.nationalgrid.com/uk/Gas/connections

A6.5 Distribution Network Connections

Gas will normally be made available for offtake to consumers at a pressure that is compatible with a regulated metering pressure of 21mbarg.

A6.6 Self Lay Pipes or Systems

In accordance with Section 10(6) of the Gas Act, and subject to the principles set out in the published Licence Condition 4B Statement and the terms and conditions of the contract between us and the customer in respect of the proposed connection, where a party wishes to lay their own service pipe to premises expected to consume 2,196MWh per annum or less, ownership of the pipe will vest in us once the connection to the our system has been made.

Where the connection is for a pipe laid to premises expected to consume more than 2,196MWh per annum or the connection is to a pipe in our system which is not a relevant main, self-laid pipes do not automatically vest in us. However, subject to the principles set out in the published Licence Condition 4B Statement and the relevant contractual terms and conditions, we may take ownership of pipes to such premises.

Parties considering laying a pipe that will either vest in us or is intended to come into our ownership should refer to the published Licence Condition 4B Statement and make contact with the appropriate office prior to the planning phase of any project.

A6.7 Reasonable Demands for Capacity

Operating under the Gas Act 1986 (as amended 1995), we have an obligation to develop and maintain an efficient and economical pipeline system and, subject to that, to comply with any reasonable request to connect premises, provided that it is economic to do so.

In many instances, specific system reinforcement may be required to maintain system pressures for the winter period after connecting a new supply or demand. Details of how we charge for reinforcement and the basis on which contributions may be required can be found in the published Licence Condition 4B Statement. Please note that dependent on scale, reinforcement projects may have significant planning, resource and construction lead-times and that as much notice as possible should be given. In particular, we will typically require three to four years' notice of any project requiring the construction of high pressure pipelines or plant, although in certain circumstances, project lead-times may exceed this period.

Glossary

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

Composite Weather Variable (CWV)
A single measure of weather for each LDZ, incorporating the effects of both temperature and wind speed. A separate composite weather variable is defined for each LDZ.

Distribution Network (DN)
An administrative unit responsible for the operation and maintenance of the local transmission system (LTS) and <7barg distribution networks within a defined geographical boundary.

Diurnal Storage
Gas stored for the purpose of meeting, among other things, within day variations in demand. Gas can be stored in special installations, such as gasholders, or in the form of linepack within transmission, i.e. >7barg, pipeline systems.

Formula Year
A twelve-month period commencing 1st April, predominantly used for regulatory and financial purposes.

Gas Supply Year
A twelve-month period commencing 1st October, also referred to as a Gas Year.

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

Interruptible Service
A service that offered financial incentives to customers but under which we can interrupt the flow of gas to the supply point. This ceased in October 2011.

Kilowatt hour (kWh)
A unit of energy used by the gas industry. Approximately equal to 0.0341 therms. One megawatt hour (mWh) equals 10^3 kWh, one gigawatt hour (GWh) equals 10^6 kWh, and one terawatt hour (TWh) equals 10^9 kWh.

Linepack
The volume of gas within the National or Local Transmission System at any time.

Load Duration Curve (1 in 50 Severe)
The 1 in 50, or 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 offtakes. Consists of LTS and distribution system pipelines.

Local Transmission System (LTS)
A pipeline system operating at >7barg that transports gas from one or more offtakes to distribution systems. Some large users may take their gas direct from the LTS.

LP Gasholder
A vessel used to store gas for the purposes of providing diurnal storage.

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

Non-Daily Metered (NDM)
A meter that is read monthly or at longer intervals. For the purposes of daily balancing, the consumption is apportioned, using an agreed formula, and for supply points consuming more than 73.2MWh pa, reconciled individually when the meter is read.

Odorisation
The process by which the distinctive odour is added to gas supplies to make it easier to detect leaks. We provide odorisation at our offtakes.

Offtake Capacity Statement (OCS)
The Offtake Capacity Statements are received by NGN in September of each year from National Grid specifying assured pressures and the amount of capacity available at each offtake.

Own Use Gas (OUG)
Gas used by us to operate the transportation system. Includes gas used for compressor fuel, heating and venting.

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.

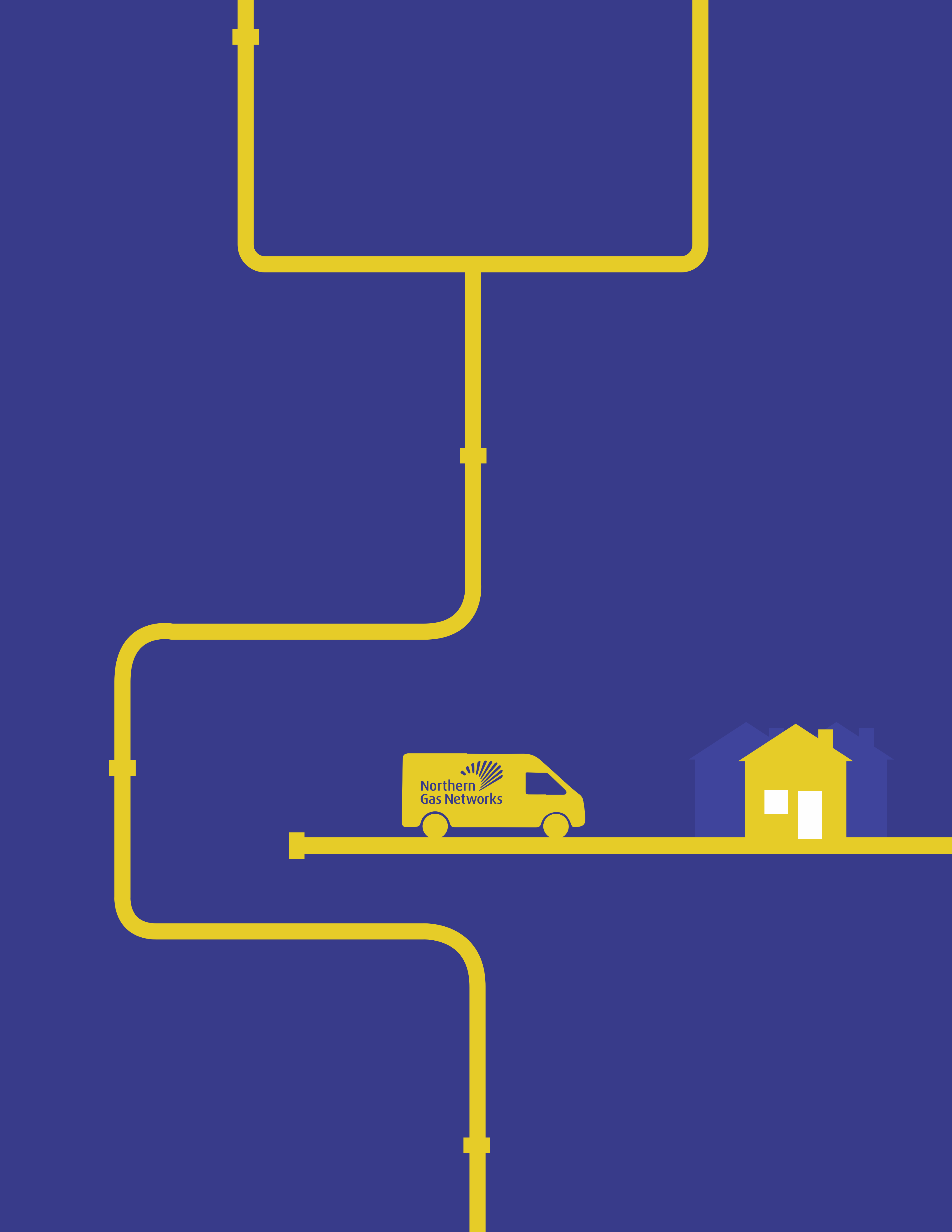
Seasonal Normal Composite Weather Variable (SNCWV)
The seasonal normal value of the CWV for a LDZ on a day is the smoothed average of the values of the applicable CWV for that day in a significant number of previous years.

Shrinkage
Gas that is input to the system but is not delivered to consumers or injected into storage.
It is either Own Use Gas or Unaccounted for Gas.

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

Unaccounted for Gas (UAG)
Gas lost during transportation. Includes leakage, theft and losses due to the method of calculating the Calorific Value.

Uniform Network Code (UNC)
The document that defines the contractual relationship between System Users.
The Uniform Network Code has replaced the Network Code and, as well as existing arrangements, covers the arrangements between all gas transporters.


Northern
Gas Networks