Northern Gas Networks

Northern Gas Networks

Long term development statement

2022

we are the network

Foreword

Welcome to our 2022 Long Term Development Statement which contains essential information on the process for planning the development of the gas distribution system, including demand and supply forecasts, system reinforcement projects and associated investment. We publish the report at the end of our 2022 planning process for our two Local Distribution Zones, North East and Northern. The main body of the document provides an overview of the key topics, with further details contained in the report appendices.

At the time of publishing this report we are halfway through our second year of our RIIO-GD2 2021-26 price control period and working hard to meet our license requirements and outperform our targets. The past year has seen many challenges for our industry and the communities that we serve. 2021 saw the UK experience record breaking temperatures in some areas, putting increased pressure on the electricity grid as fans and cooling units were utilised by many. Severe storms tested communities and the energy networks during the last winter. The events demonstrated how interconnected our energy systems are and highlighted the importance of continued investment in a whole systems approach and cross sector working.

Furthermore, wholesale gas prices started to increase in the latter part of 2021 and reached record levels in 2022. At the time of forecasting our future gas demand the price impact was not in our base dataset and it is unlikely we'll see the true impact until this forthcoming winter closes out and we have more data to work with.

The drive to meet net zero has accelerated globally and the part we must play in transitioning to green energy is ever more apparent and crucial.

Paul Bolton

Head of Programme Management

Version & Circulation

Version Number: Final 2022

This document, and any updates to this document will be circulated electronically and uploaded to our website.

Disclaimer

The Long-Term Development Statement 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.

This document is not intended to have any legal force or to imply any legal obligations regarding capacity planning, future investment and resulting capacity.

Background & Context

The Long-Term Development Statement is the product of an annual cycle of planning and analysis. The statement sets out our assessment of future supply and demand for natural gas on our network. It also outlines proposals for investment in our local transmission and distribution systems. Interested parties may use this information to gain an understanding of how we expect gas demand to evolve on our networks over the next 10 years. This will help them plan accordingly when considering connection opportunities.

We are required to publish this annual statement in accordance with Standard Special Condition D3 of our Gas Transporters Licence and Section 4.1 of the Uniform Network Code Transportation Principal Document.

Northern Gas Networks (NGN) 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 below map summarises the extent of NGN's two Local Distribution Zones (LDZs):

LDZ	No.	Location
Northern (NO)	1	Northern
	2	Tees
North East (NE)	3	Eastern
	4	Central
	5	West Riding

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Chapter 1

ENA - Gas in our Future Energy

Chapter 1 - ENA Gas in our Future Energy Systems

In November 2020, The Prime Minister's Ten Point Plan for a Green Industrial Revolution set out a new direction for Britain's gas networks in a Net Zero future, building on much of the work already undertaken through Energy Networks Association's Gas Goes Green programme, setting out the role Britain's gas networks can play in delivering hydrogen and biomethane to homes, businesses and communities across the country.

Tackling climate change means we need to decarbonise the gas that plays a critical role in our everyday lives. That's why Britain's gas network companies are now playing a leading role, to ensure that we, as a country, can get the job done, by undertaking the work needed to replace that natural gas with hydrogen and biomethane through Gas Goes Green, which completed its second full year this year in April 2022.

The programme brings together the engineering expertise of Britain's five gas network companies with the wider energy industry, policymakers, and academics, to tackle the technical challenges associated with a shifting our energy system away from natural gas so that it can allow us all to reap the benefits of a world-leading zero carbon gas grid delivering hydrogen and biomethane. That work has, so far, focussed on the planning and research steps necessary to build the world's first zero carbon gas grid, culminating in major research publications such as Britain's Hydrogen Network Plan (January 2021), which set out a national, detailed green print for the roll out of hydrogen in the UK.

With the swift progress of the gas networks; flagship H21, HyDeploy and H100 hydrogen innovation projects, the focus of industry, policymakers and, increasingly, the public, has now turned to demonstrating the real-world outcomes of hydrogen trials in a scalable format. The Government's Hydrogen Strategy confirmed that a decision on heat decarbonisation will be made 2026, with hydrogen neighbourhood, village and town trials announced in the Prime Minister's Ten Point Plan providing the information required for that.

Gas networks have also been focusing on providing BEIS with the evidence required to inform their 2023 hydrogen blending decision, as outlined in the Prime Minister's Ten Point Plan. In January 2022 Britain's Hydrogen Blending Delivery Plan was published, setting out the key actions required to make hydrogen blending a success.

Gas distribution networks are front and centre of that work, utilising their world-leading expertise of running one of the world's most extensive national gas grids to developing the hydrogen evidence and skills base that's required for them to provide the solutions the country needs to tackle climate change.

At the start of the new regulatory period RIIO-2 in April 2021 Britain's network companies introduced the Energy Network Innovation Process providing full governance details of the end-to-end industry led process for reporting, collaboration, and dissemination of Ofgem funded NIA projects in GB.

This new process will include reporting against an Innovation Measurement Framework (IMF) Energy Networks will report on a range of innovation outcomes, including collaboration and partnerships, the speed at which successful innovation is transitioned into BAU and the benefits innovation has delivered for network customers.

RIIO-2 has also introduced a Strategic Innovation Fund (SIF) to support the transition to net zero. This fund supports large-scale transformational research and development projects and will be available to Gas Distribution (GD), Gas Transmission (GT), Electricity Transmission (ET) and the Electricity System Operator (ESO) in the first instance.

In September 2022, ENA jointly held its first Energy Innovation Summit in Glasgow with BEIS, Ofgem, UKRI and Innovate UK. Sector colleagues used the first major in person event following Covid to reconnect in person, and share updates on key innovation projects and discuss new projects that need to be taken forward to help Britain decarbonise.

You can find out more information about individual projects at the Smarter Networks Portal, https://www.smarternetworks.org/

James Earl

Director, Gas

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Chapter 2
Demand

we are the network

Chapter 2 - Demand

2.1 Demand Forecasts Overview

This chapter outlines the ten-year gas demand forecast for each Local Distribution Zone (LDZ) within NGN, including both the annual and 1 in 20 Peak day gas demands. It also includes discussion on how current forecasts relate to previously published forecasts. Further information is provided in Appendix 2.

Demand forecasts are prepared as part of an exchange of information that is intended to inform respective capacity planning processes between the Gas Distribution Networks and National Grid Gas. These forecasts are compliant with the demand forecasting requirements of Section H of the Uniform Network Code (UNC) Offtake Arrangements Document.

2.2 Demand Forecasts

2.2.1 Annual Demand

This section provides an outline of our latest annual gas demand forecasts up to and including gas year 2031/32 along with the key underlying assumptions. A more detailed view can be found in Appendix 2.

Annual demand forecasts are produced without the knowledge of future weather conditions. Consequently, we use past data (historical averages) to estimate what future temperature would be under seasonal normal conditions. To compare demand data between years, we adjust our estimates to account for the variance of actual weather and seasonal normal temperature. This adjustment is called 'weather corrected demand'.

The annual demand forecasts are based on analysis of how historic weather corrected demand is influenced by non-weather factors such as the economy, environmental and efficiency initiatives and how the most influential factors are likely to change in the future. Evidence suggests that the most influential factor that determines gas demand annually, after weather, is its price. The largest single components of customer bills are gas and electricity wholesale prices. The wholesale gas prices rose steeply through 2021 and has continued through 2022. The prices are expected to stay high for at least another year. The day ahead gas price has seen a peak of 450p/th in December 2021, and over 500p/th in Q1 2022. The price is extremely high due to global shortfalls, and the ongoing conflict in Ukraine.

This has led to lower storage levels than typical for the time of year and causing concern that supplies will remain restricted through the winter period.

Our demand forecasting process takes place in the first quarter of each year, therefore at the time of producing our annual and peak outlook for the next ten years the Covid-19 pandemic was still present and the effects on demand were largely unknown. The data which provides the basis of our analysis was typical of a 'normal' year. We assumed that gas prices would continue to steadily increase therefore, on a Network basis, annual gas demand was forecast to increase by 0.19% over the next 10 years with an average calendar year increase of 0.02%. 2022 is the first year over the past decade that NGN has forecast an increase in overall annual gas demand. However, the forecast rate of increase is due to small growth in the North East LDZ, but is primarily a flat profile due to an uncertain economic outlook and relatively high increases in UK gas prices. The economic outlook is even more uncertain since we produced our forecasts at the beginning of the year.

Contributary factors to the decline in gas demand are thermal efficiency improvements across businesses and residential housing, combined with the switch to renewable heat. It is difficult to separate the impact of efficiency improvements from the impact of gas price changes and the effect that a changing number of network supply points has on annual demand. Historic demand, economic data and economic forecasts suggest an increase over the whole forecast period of 0.5% for our North East LDZ and decline of 0.15% for our Northern LDZ.

Load Band	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
0-73 MWh	40.9	40.8	40.9	40.8	40.7	40.6	40.7	40.6	40.6	40.5
73-732 MWh	5.4	5.4	5.4	5.4	5.5	5.5	5.5	5.5	5.5	5.5
732-5860 MWh	4.3	4.3	4.3	4.3	4.4	4.4	4.4	4.4	4.4	4.4
Small User	50.5	50.4	50.6	50.5	50.5	50.5	50.6	50.5	50.6	50.5
Firm> 5860 MWh	20.8	20.9	20.9	20.9	21.0	21.0	21.0	21.1	21.1	21.1
NGN Consumption	71.4	71.3	71.6	71.5	71.5	71.5	71.6	71.6	71.6	71.6
NGN Shrinkage	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2
NGN Demand	71.7	71.6	71.9	71.8	71.8	71.7	71.8	71.8	71.9	71.8

Table 2.2.1 NGN's forecast annual demand by load category & calendar year (in TWh)
Note: Figures may not sum exactly due to rounding.

The chart below illustrates the actual annual throughput and our most recent forecasts through to the end of our RIIO GD2 price control[1] period.

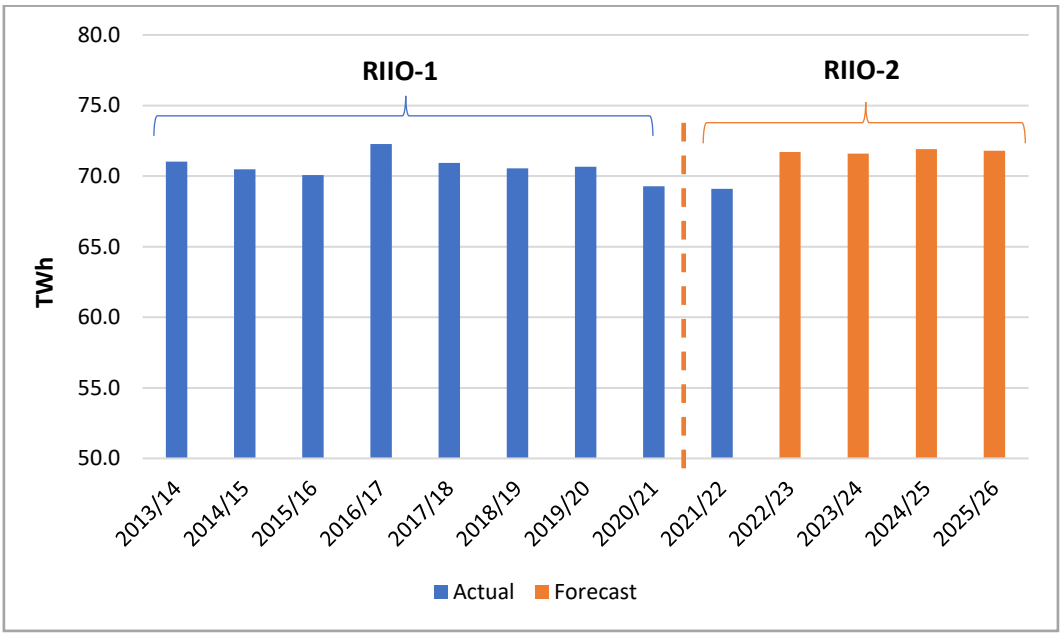


Figure 2.2.2 RIIO GD1 historic annual demand and forecast RIIO GD2 annual demand

[1] RIIO GD2 Price Control https://www.ofgem.gov.uk/publications/riio-2-final-determinations-transmission-and-gas-distribution-network-companies-and-electricity-system-operator

2.2.2 Forecast Accuracy

Table 2.2.3 below provides a comparison of actual and weather corrected throughput during the 2021 calendar year with the forecast demands presented in our 2021 plan. Annual forecast demands are presented in the format of consumption load bands/categories, consistent with the basis of system design and operation.

Load Band	Actual 2021	Weather Corrected 2021	Forecast for 2021	Weather Corrected v Forecast (%)
0-73 MWh	39.08	39.29	40.52	-3.0
73 – 732 MWh	5.09	5.14	5.80	-11.5
>732 MWh	24.63	24.68	25.57	-3.5
Network Shrinkage	0.31	0.31	0.30	1.7
NGN Network Total	69.11	69.41	72.19	-3.9

Table 2.2.3 Comparison of actual and weather corrected throughput in 2021 calendar year (TWh)
Note: Figures may not sum exactly due to rounding.

On a Network basis, the weather corrected annual throughput in 2021 was 69.41 TWh. This shows an increase of 0.2% from 2020.

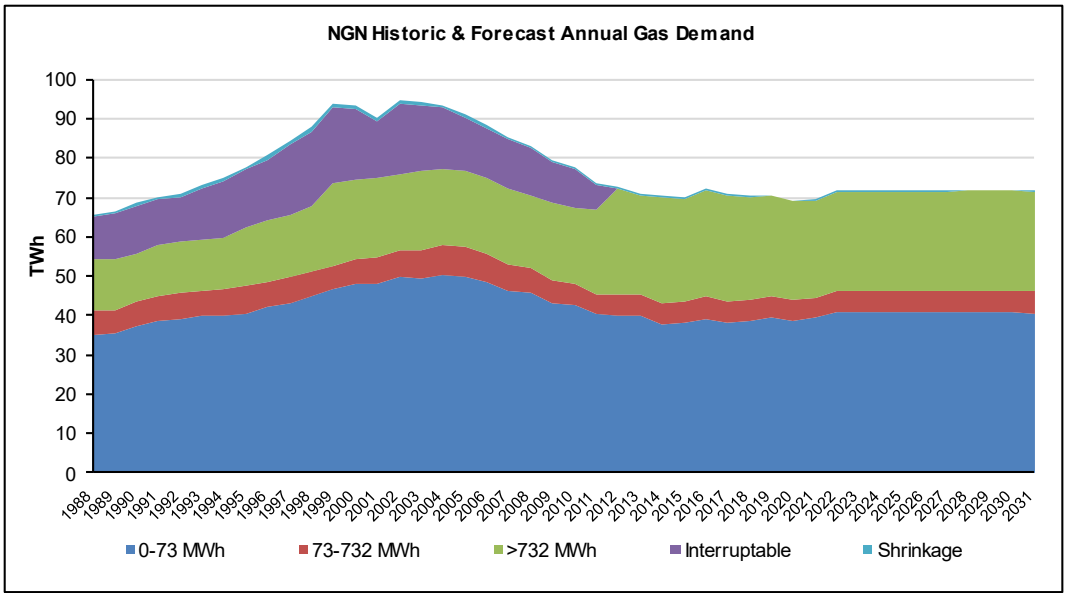


Figure 2.2.4 Historical Weather Corrected Throughput & Forecast Annual Gas Demand by Load Band

The chart above shows weather corrected and forecast gas demand by load band through to 2031. The most significant change in this chart is the change in the Interruptible load in 2011. Following a modification in UNC Interruption Arrangements (Mod 90), which came into effect 01 October 2011, interruptible contracts were only made available at specific supply points where NGN had identified an area in which interruption was necessary. This change to the Interruption process resulted in a significant reduction in Interruptible Load.

2.2.3 Peak Forecast Demand

NGN is required to forecast 1 in 20 Peak day demand on an annual basis. We maintain and operate our network to be able to satisfy this level of demand, as defined in Uniform Network Code section W2.6.4(c):

1 in 20 Peak day demand - 1 in 20 peak day demand is the level of daily 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.

Peak demand is calculated using an established industry methodology[2] and is based on determining the weather-demand relationship for each loadband in each LDZ. Smaller loadbands, which tend to represent households and smaller businesses, are much more weather sensitive than larger loadbands. This is because they tend to use most of their gas for space heating rather than industrial processes which aren't linked to weather.

Evidence continues to suggest that overall demand in NGN's network has become less sensitive to weather. However, during extreme cold weather there is an observable 'cold weather upturn' in demand. One possible explanation for this upturn is, the increased number of people that decide to stay at home when it snows due to school closures.

The forecast 1 in 20 peak day demand in the 2022/23 gas year is 1% lower than the forecast made in 2021. Overall, peak demand is forecast to increase by 0.41% over the 10-year period within our Northern LDZ and 0.49% in our North East LDZ.

This compares with a decline of 0.01% and 0.26% respectively, for these LDZs in the 2021 forecast. As we move into the winter of 2022/23, we are yet to fully understand the impact that the large increase in the gas price will have on our network demand.

Current working practices mean that a larger proportion of the population will be working from home. As temperatures decrease, we are likely to see a flatter 'within day' profile rather than the usual morning and evening peaks we see when large numbers of people are working in offices during the day.

Business closures and changes to operating hours will also impact on demand, but the extent of which will be understood more as we progress through the winter months.

Early analysis of the Annual Quantity (AQ) nominations carried out by the Demand Estimation Sub Committee suggest that domestic and small supplier point demand is increasing, and industrial, commercial and large supply point demand is decreasing. Preliminary analysis suggests the overall change in AQ is marginal. More will be understood about this as we move into the colder months.

[2] Further information can be found here: https://www.nationalgrid.com/gas-transmission/document/132516/download

The following table summarises our 1 in 20 peak day forecasts for the period 2022/23 to 2031/32. These are the forecasts for each gas year covering the period 1st October to 30th September.

1 in 20 Peak day Demand (GWh)										
LDZ	**2022/23**	**2023/24**	**2024/25**	**2025/26**	**2026/27**	**2027/28**	**2028/29**	**2029/30**	**2030/31**	**2031/32**
North	219	221	220	220	220	220	220	220	220	220
North East	263	264	264	264	264	264	264	264	264	264
Total	482	485	485	484	485	484	484	484	484	484

Table 2.2.5 Forecast 1 in 20 Peak day Firm Demands by LDZ from the 2022 Demand Statements (GWh)

Note: *Figures may not sum exactly due to rounding*

The chart below illustrates the historic peak day demands from RIIO GD1, and the RIIO GD2 forecasts. Prior to GD1 the highest demand in recent years was seen in the winter of 2010/11.

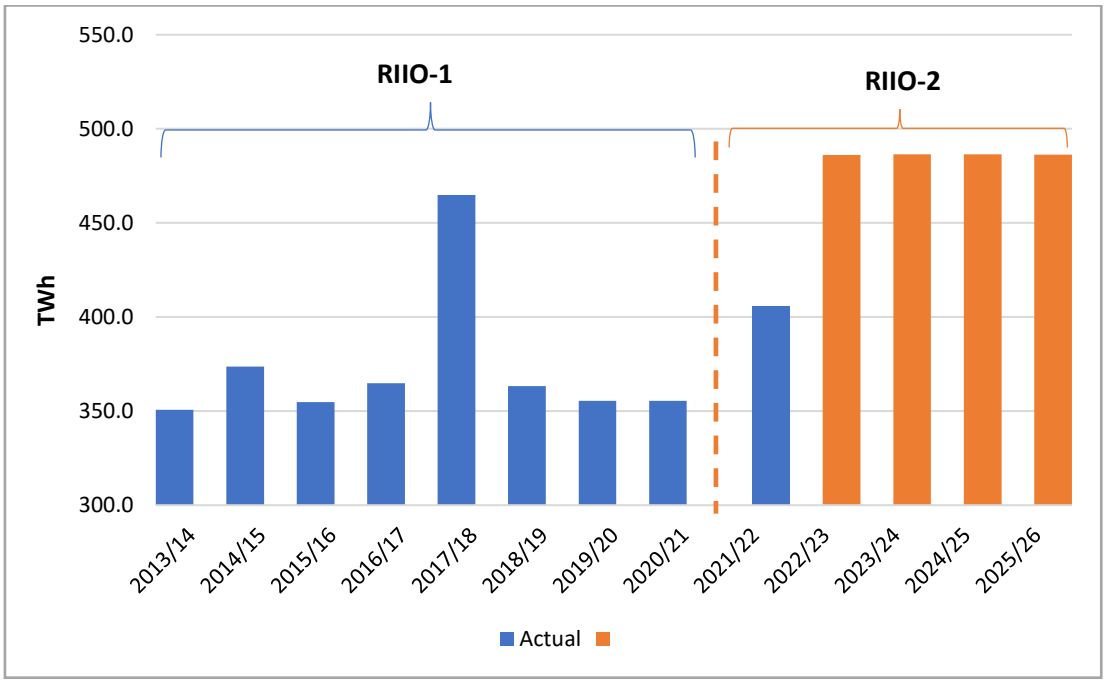
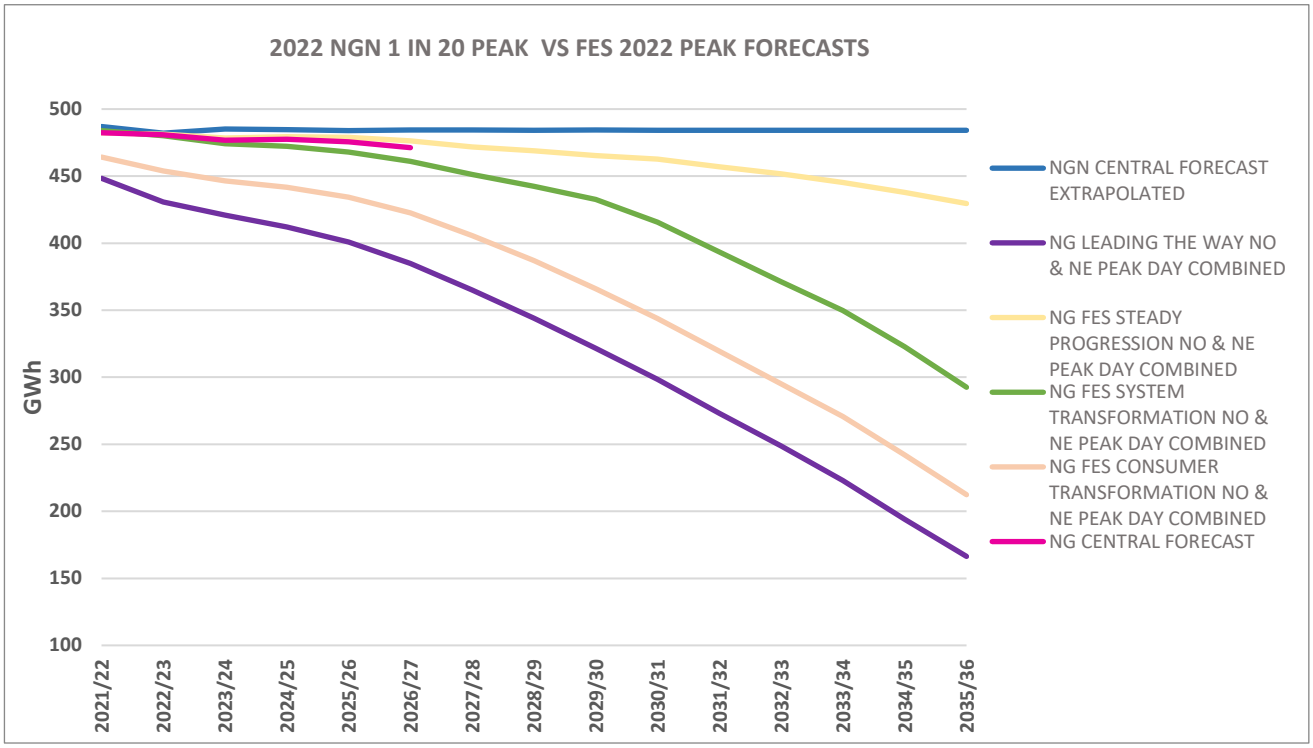


Figure 2.2.6 Historic Peak day Demand Actuals and RIIO GD2 forecasts (GWh)

National Grid ESO carry out Future Energy Scenarios (FES) for both transmission and distribution networks. The FES outline four different pathways for the future of energy over the next 30 years. Each scenario considers how much energy we might need and where it could come from.

Below you can see where our forecast of peak day demand sits closely to the 4 FES scenarios produced by National Grid and their 5-year central forecast;



As you can see there is a great deal of variance across the scenarios and the direction of travel is dependent on factors such as policy surrounding the decarbonisation of heat, the state of the economy, societies willingness to change and advancements in technology. More information can be found https://www.nationalgrideso.com/future-energy/future-energy-scenarios/

Impact assessment will be undertaken and form part of the NGN 2022 forecasts and FES 2022.

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Chapter 3
Supply and storage

we are the network

Chapter 3 - Supply & Storage

3.1 Supply

Gas is predominantly brought into our network through offtakes connected to the National Transmission System (NTS). Offtakes are above ground installations (AGIs) that connect the NTS to NGN's Local Transmission System (LTS). NGN's offtakes can operate to an inlet pressure of up to 85bar. From the offtake, gas then passes through the Local Transmission System, into the Distribution System and then onward to consumers

We develop the network to meet our customers' requirements. National Grid Transmission (NGT) will also develop the NTS in line with supply and demand forecasts, provided by us and used in conjunction with their own demand forecasts of network demand. The NGT Ten Year Statement can be found on their website[3]

The amount of gas NGN requires to satisfy its 1 in 20 peak day demand commitment is secured from National Grid on an annual basis via an offtake capacity booking process. This process involves our network modelling team using the 1 in 20 forecasts at the Local Distribution Zone (LDZ) level to derive a booking quantity at each of our offtakes to satisfy demand at the local level. NGN then request a daily energy quantity and a volume of storage for each of the offtakes. We also indicate the peak hourly flow and associated minimum inlet pressure required. Following discussion between the two parties, National Grid will allocate the capacity and our Control Room will operate the system accordingly.

Over the course of RIIO GD1 we have been reducing our capacity bookings to 1 in 20 peak day forecast levels. Historically, capacity was held at levels that were in excess of current demand levels, mainly due to demand levels being higher in the past. In order to reduce our customer bills and free-up capacity on the National Transmission System for other users, we have made significant changes to reduce our bookings at each of our offtakes. The offtake capacity incentive in place in RIIO GD1 has been replaced with a new licence obligation for the gas transporter licence holders to comply with an enhanced obligations framework in relation to the exit capacity booking process. We now comply with the Exit Capacity Planning Guidance which is available here: Exit Capacity Planning Guidance. The Exit Capacity regime as we know it was under review and we are supporting and encouraging positive regime changes which will allow us to run an even more efficient network for our customers. More information on the final workgroup report can be found on the Joint Office website[4].

3.2 Distributed Network Entry

We have 19 biomethane connections to our network, 2 of which are new sites which we commissioned in 2022. These developments have the potential to contribute significantly to increased security of supply and the transition to a low carbon economy. We are actively involved the Entry Customer Forum and the Entry Technical Workgroup to address the technical, regulatory, legislative and commercial challenges and opportunities that these developments present over this time. Through our commitment to support increased injection to our network, NGN will play a direct role in the UK achieving its legally binding commitments to reduce greenhouse gas emissions to net zero of the level in 1990 by 2050 as set out under the terms of the Climate Change (Net Zero UK Carbon Account) Act.

[3] https://www.nationalgrid.com/uk/gas-transmission/insight-and-innovation/gas-ten-year-statement-gtys
[4] https://www.gasgovernance.co.uk/0705

The demand for biomethane connections during our busiest connection periods in regulatory years 2015/16 and 2019/20 was heavily influenced by the Government's environmental programme, known as the Non-Domestic Renewable Heat Incentive (RHI). This has now been replaced by the Green Gas Support Scheme (GGSS), which launched in autumn 2021. NGN are still receiving healthy numbers of initial biomethane enquiries and requests for detailed analysis relating to available injection capacity in areas of our network and we hope to see some of these projects move forward to connection reservation, build and commission.

3.3 Storage in the Network

3.3.1 Linepack

The compressibility of natural gas allows the use of linepack to compensate for fluctuations of gas demand. Linepack refers to the volume of gas that can be 'stored' in the gas pipeline during periods of low demand when the pressure in the system is lower. When demand increases this stored gas can be released to ensure supply to consumers. Linepack is of strategic importance to NGN in the absence of physical storage vessels such as gas holders.

4

Chapter 4

Investment in the Distribution Networks

we are the network

Chapter 4 - Investment in the Distribution Networks

The Local Transmission System is designed to transport gas across our network and store it for the purposes of satisfying the 1 in 20 peak day forecast demands. The system is developed, based on demand and supply forecasts, to ensure that this capability is maintained. This routinely involves significant investment projects to improve efficiency, system design and replace ageing equipment.

The following are major projects currently in the 2022 plan:

Northern LDZ

- Bishop Auckland - Offtake condition upgrade / WBH Heater Control Upgrade– 2022/23
- Blaydon – Pressure Reduction Installation preheating upgrade - 2022/23
- Coldstream – Metering Upgrade – 2023/24
- Corbridge – Pressure Reduction Installation preheating upgrade - 2022/24
- Cowpen Bewley – Offtake condition upgrade & Metering Upgrade – 2023/24
- Elton – Offtake Condition Upgrade – 2022/23
- Penrith - Reinforcement and capacity upgrade - 2021/22
- Guyzance – Metering & Boiler upgrade – 2022/24
- Keld – Boiler upgrade – 2022/23
- Tow Law – Metering upgrade WBH Heater control cabinet upgrades – 2023/24
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North East LDZ

- Meadow Lane - Physical Security Upgrade - 2022/23
- Saltend – Pressure Reduction Installation preheating upgrade - 2021/22
- Rawcliffe - Offtake capacity upgrade - 2022/23
- Pickering - Offtake condition upgrade - 2023/24
- Saltersgate – Pressure Reduction Installation preheating upgrade – 2022/23
- Mulcture Hall – PRI condition upgrade – 2022/24
- Chapel Haddlesey – PRI condition upgrade – 2022/23
- Burley Bank – Metering upgrade – 2021/22
- Ganstead – Boiler Replacement / Heat Exchanger – 2022/23
- Hartshead Moor – Boiler upgrade – 2022/22
- Keighley – Boiler upgrade – 2022/23
- Transpennine electrification Phase 1 – Diversion or plant protection (Ravensthorpe) – 2022/23
- Transpennine electrification Phase 2 – Diversion (Heaton Junction) – 2022/24
- Transpennine electrification Phase 3 – Diversion (Ridge Road) – 2022/24
- Transpennine electrification Phase 4 – Diversion (Austhorpe) – 2022/25

4.1 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 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 (Tier 1: 8 inches and below) within 30 metres of occupied buildings before April 2032, and the progressive decommissioning of larger iron pipes based on their risk and condition.

Mains Workload (km)	21/22	22/23	23/24	24/25	25/26	TOTAL	ALLOWED
Tier 1	437.4	437.4	437.4	437.4	437.4	2186.8	2144.3
Tier 2a	3.2	2.2	2.0	2.0	2.0	11.5	11.5
Tier 2b	19.1	20.7	20.7	20.7	20.7	102.0	102.0
Tier 3	5.3	4.4	4.4	4.4	4.4	22.7	22.7
Iron Mains	464.9	464.7	464.5	464.5	464.5	2323.1	2280.6
Steel	75.1	72.6	72.6	72.6	72.6	365.4	361.1
Other	14.0	8.4	8.4	8.4	8.4	47.5	47.5
Diversions	11.1	11.4	11.4	11.4	11.4	56.6	56.6
Total	565.2	557.0	556.8	556.8	556.8	2792.7	2745.9

This year we have delivered a total of 565.2km of mains abandonment.

The **Tier 1 Mains** target is 2,144.3km over RIIO-2, or 428.9km per annum. Over RIIO-2 we plan on delivering 2,186.8km, or 437.4km per annum. This is an increase of 8.5km each year, 42.5km over the 5 years. This will allow us to recover the Covid-19 related shortfall of workload seen in the final year of RIIO-1 by the end of the Repex programme in 2032. This increased workload will be funded under the Tier 1 Mains volume driver.

Tier 2a Mains are also subject to a volume driver as the workload is very difficult to predict. We now expect to deliver 11.5km over RIIO-2, an increase of 1.5km, with most of this increase delivered in the first two years of the price control.

We are slightly behind the planned run rate for **Tier 2b Mains**, and slightly ahead of the run rate for **Tier 3 Mains.** We expect to deliver the allowed workload for both by the end of RIIO-2.

We expect to deliver slightly more **Steel mains** workload over the price control. This is predominantly in the <2” steel category, which is replaced mainly when we find it whilst replacing Tier 1 iron mains. As Tier 1 mains volumes increase as described above, we expect this workload to increase as well.

Other Mains and Diversions work is difficult to predict, as the former includes poor performing PE and Asbestos which we replace when it’s found, and the latter is third party driven. We expect to deliver the allowed workload over RIIO-2.

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Chapter 5
Innovation

we are the network

Chapter 5 - Innovation

5.1 Gas in Our Future Energy Systems

In March 2020, the gas networks set out their latest vision for network innovation projects and priorities. The latest Gas Networks Innovation Strategy has built on the inaugural version from 2018[5], reviewing progress and setting future priorities. This bi-annual process has just resumed with a new updated collaborative innovation strategy scheduled to be published in March 2022.

Network innovation projects are essential to provide critical evidence and understanding to support the energy systems transition and ensure that impact on customers in vulnerable situations is clearly understood help deliver increased efficiency and value for money, and develop the new technologies and approaches needed for decarbonisation. The gas networks coordinate to share learning and ensure that projects are delivering industry goals. You can find out more information about individual projects at the Smarter Networks Portal, https://smarter.energynetworks.org/.

We work closely with colleagues from the electricity networks and the wider energy industry to deliver innovation. The Gas Network Innovation Strategy was published alongside an equivalent Electricity Network Innovation Strategy, and the 2020 strategies feature enhanced analysis of cross vector challenges and opportunities. Input from wider industry is crucial in shaping our innovation strategies. We consult widely during their development and encourage third parties to participate directly in innovation projects and present new ideas to network operators. You can find out more or submit your proposals via https://www.nicollaborationportal.org/.

In addition to the strategy documents, we have worked in partnership with the ENA and electricity DNO's to produce the Energy Networks Innovation Process (ENIP[6]). As part of the Ofgem requirement for RIIO-2 price control, this industry-led reporting and collaboration process was put in place. This process will be followed by all Energy Networks, formally in place and operational for RIIO-2 on 1 April 2021 and will be reviewed at least every two years. This document contains the full details of the end-to-end industry led process for reporting, collaboration, and dissemination of Ofgem funded NIA projects in GB. This process has been presented to Ofgem and external stakeholders, and feedback from these groups have been incorporated.

Details of other innovation projects currently underway can be found at

https://www.northerngasnetworks.co.uk/wp-content/uploads/2021/07/NGN_Innovation-Report-2020_21_FINAL.pdf

The RIIO-T2 and RIIO-GD2 price controls, which apply from April 2021, include a new mechanism called the **Strategic Innovation Fund (SIF)** detailed in section 5.4.

[5] https://www.energynetworks.org/gas/futures/gas-network-innovation-strategy.html

[6] https://smarter.energynetworks.org/enip/

5.2 Gas Network Innovation Competition (NIC)

The Gas Network Innovation Competition (NIC) was an annual opportunity for gas transmission and distribution network companies to compete for funding for the development of new technologies, operating and commercial arrangements.

The Gas NIC allowed for up to £20 million of funding per year for innovative projects which help all network operators understand how to provide environmental benefits, reduce costs, and maintain security of supply as Great Britain (GB) moves to a low carbon economy.

Funding was awarded to the following companies:

- Cadent
- National Grid Gas (Transmission)
- Northern Gas Networks
- SGN

The Gas NIC was closed to new proposals with the ending of the RIIO-T1 and RIIO-GD1 price controls in March 2021. The RIIO-T2 and RIIO-GD2 price controls, which apply from April 2021, include a new mechanism called the **Strategic Innovation Fund (SIF)** detailed in section 5.4.

You can see all publications relating to the Gas NIC and its qualifying projects in the link below.

Gas Network Innovation Competition (RIIO-1)

H21 (2017)

The final presentation and launch of the work undertaken in H21 Phase 1 was launched at the "Gas Goes Green" virtual mini summit hosted by the Energy Networks Association on the 20 May 2021. The results were also delivered virtually to Gas Industry experts, our regulators at Ofgem and the HSE in February 2021. The launch also provided other industry leaders the opportunity to present on the work they are doing to ensure hydrogen can deliver a safe and reliable energy supply to Britain's homes in a net zero future. All of the reports from H21 Phase 1 are available through request, with the H21 Phase 1 Technical Summary Report available on the H21 website. The final close out report was submitted to Ofgem in October 2021 and the project has now been formally closed.

https://h21.green/projects/h21-nic-phase-1/

H21 Phase 2 (2019)

H21 Phase 2 is reviewing the existing natural operational procedures and assessing their suitability with 100% hydrogen. The project is further broken down into 4 key areas that will be reported against below.

Phase 2a - Appraisal of Network Operations

By the end of 2020 our project partners at HSE Science and Research Centre had conducted an in-depth appraisal of NGN's 300+ distribution procedures that related to operations on the 0-7barg network. This research allowed a test plan to be developed focusing on the key areas requiring further evidence and potentially changes undertaking operations on a converted hydrogen system.

Detailed engineering designs were undertaken early in 2020 and construction of a 0-7barg hydrogen test network known as the 'microgrid' started in October 2020 and was completed in June 2021 at DNV's Spadeadam research centre in Cumbria despite all the difficulties winter and the covid pandemic presented. Operational testing at the microgrid started immediately following completion of the build and is scheduled to complete in

October 2022. The test programme has included demonstrations under live hydrogen conditions at all network pressures including those associated with finding and accessing leaks, live under pressure connections and isolations, purging pipelines and routine maintenance of pressure regulation equipment.

We anticipate the completion and publication of all technical reports by the end of 2022 these will enable industry to take the journey towards hydrogen conversion further forward. The findings and recommendations will be critical in allowing the gas distribution networks to develop safe operating and emergency response procedures that in turn will roll out into future training ready for live public hydrogen trials and beyond.

Phase 2b – Unoccupied Network Trials

Construction of the unoccupied test site at Southbank in Middlesbrough commenced in July 2021 following a detailed design and development of a stringent safety management system undertaken in partnership with NGN and DNV. The site comprises public streets of former now demolished housing where the existing iron low pressure network was left in place. This presented an opportunity to convert the network to 100% hydrogen in a typical public setting as would be the case when networks start to be converted to customers. The build phase was successfully completed in Nov 2021 and testing kicked off in Jan 2022 following a period of testing and commissioning of the new infrastructure over the Christmas period. The testing programme focused on procedures relative to older metallic networks while similar in nature to the Phase 2a testing, those tests were focused in the main on procedures adopted on a PE network. The test programme continued until August 22 and the team are currently analysing results and writing up technical reports that will be published at the end of 2022.

This site was the 1st time an actual network had been repurposed from natural gas to hydrogen in the UK and furthermore hydrogen that was odourised locally on site. The trial network not only served the purposes for testing by also supplying hydrogen to heat and provide hot water to the welfare facilities and offices on site. Furthermore, it allowed 3rd party suppliers of network tooling and equipment to utilise their equipment such as flow stop for the 1st time on a live hydrogen network.

Phase 2c – Combined Quantitative Risk Assessment (QRA)

The combined network and downstream Quantitative Risk Assessment work concluded in September 2022, and we are currently socialising the results with the other GB distribution networks and stakeholders with a public launch planned for early in 2023. This critical piece of work will determine any safety mitigation controls that will be adopted to ensure operating a hydrogen system is at least as safe as today's exemplary natural gas system. The work allowed advancements to be made to the CONIFER model adapted for hydrogen in H21 Phase 1 to be further improved in Phase 2 and also include for risks downstream of the emergency control valve to be assessed in a consistent manner. The work has shown that with relatively simple, non-disruptive and cost-effective controls the safety of hydrogen utilisation can be assured in line with the timescales for net zero.

Phase 2d – Social Sciences Research

This year the final stage of the project was delivered. This stage repeated the Phase 1 Qualitative Research via a UK wide survey that explored customer perceptions of hydrogen before introducing participants to the hydrogen animation and interactive display content that was produced throughout Phase 2 to see if the content is successful in changing people's perceptions of hydrogen. The report of the research is currently being finalised and is expected to be released towards the end of 2022.

Hydrogen Home

The Hydrogen Homes were formally opened by the UK Energy Minister in July 2021 and first opened to visitors in August 2021. During its first year the Homes welcomed 1757 guests, as well as hosting 254 visits, 24 media visits and 32 educational visits with visitors from around the UK and internationally with guests from Australia, Canada and Japan. Additionally, several dedicated events were held such as Manufacturer Days, where visitors have the chance to speak to representatives from the appliance manufacturers, IGEM events and general public open days.
The Homes have and continue to generate a lot of interest with appointments to visit the Homes being regularly booked up 3 months in advance of actual visits.

Hydrogen Village Trial (HVT)

After successful award of funding for Phase 2 of the HVT, our business is currently undertaking a detailed design for the conversion of circa 2000 Natural Gas consumers to hydrogen from 2025. The proposal is centred around Redcar and Cleveland and includes the nearby conurbations of Warrenby, Kirkleatham and Coatham.

The Prime Minister's Ten Point Plan set out key milestones for a pioneering programme of trials. Government is supporting industry to undertake the detailed design of converting 2000 consumers to hydrogen, known as the Hydrogen Village Trial (HVT). The trial will provide crucial evidence to inform decisions on the role of hydrogen in heat decarbonisation in 2026. BEIS are now bringing forward the necessary legislative changes to facilitate the village trial (a grid conversion trial). Currently in Phase 2 (detailed design) of a planned 5 phases through to 2027, NGN are creating proposals for a community surrounding Redcar and Cleveland to be the favoured trial location.

This year the team have been designing and developing trial project proposals and forming successful partnerships with local authorities, energy companies, organisations and communities which will be essential to enable the project to go ahead. In our Outline Designs, the project team will include clear evidence of our early engagement with stakeholders in the Redcar area, and demonstrate how we are responding to initial feedback, and our plans for consultation and engagement in developing the proposals.

Town Pilot

As part of the UK Government's 10 point plan the Networks have started engaging with BEIS to map out the process for delivering one or more hydrogen Town Pilots.

The process will include several initial stages including preparing proposals for suitable town size locations of between 10,000- and 20,000-meter points, and outline design and detail design for the chosen locations by 2025.

East Coast Hydrogen

East Coast Hydrogen is a 15-year programme that will be carried out in multiple discrete phases to decarbonise industrial processes and domestic heating in the East Coast region. East Coast Hydrogen is a project that NGN is carrying out in collaboration with National Grid Gas Transmission and Cadent Gas.

The last 12 months have seen the completion of the East Coast Hydrogen feasibility study and the launch of the feasibility report in November 2021. This report confirmed that East Coast Hydrogen has the potential to decarbonise up to 39,000 industrial and commercial sites, up to 4.4 million homes, and avoid up to 20MtCO2 per year in direct emissions.

In the summer of this year Phase 2 of this project commenced. In Phase 2 the networks will focus on developing their Pre-FEED studies, from which key themes will be identified and presented in a single, aligned public facing Delivery Plan. The report will be launched at the end of the Phase 2 programme, in summer 2023.

The key steps in this year's Pre-Feed study are to collect data on how the potential future demand for hydrogen and the production and storge of hydrogen may evolve. It will then consider the options for creating a future hydrogen transportation network of both new and repurposed natural gas pipelines that will link the producers and consumers of hydrogen. The engineering, environmental, operational and commercial challenges will be reviewed, and a delivery plan developed to take the project to the next stage.

HyDeploy

The project is now complete. We successfully blended up to 20% hydrogen into the Keele University campus, which included 100 residential properties and over 30 facility buildings. This project has been a significant milestone in the journey towards rolling out blending across the UK.

Gas safety checks were carried out in the homes and buildings in the trial area. Laboratory tests were carried out on a range of gas appliances, as well as extensive research on the effect of hydrogen on the different materials found in the gas network and the appliances.

Hydrogen produces no carbon dioxide when used, making it a viable alternative for heating homes and businesses to achieve the Government's target of Net Zero carbon emissions by 2050, unlike natural gas, which is responsible for over 30% of carbon emissions.

The success of the trial at Keele University has paved the way for a larger pilot project at Winlaton, with HyDeploy Phase 2.

The results of the first phase of a ground-breaking green energy project, that could help Britain dramatically cut its carbon emissions and open the door to a low-carbon hydrogen economy. The recently published reports can be found using the link below.

https://hydeploy.co.uk/about/news/first-uk-trial-of-hydrogen-blended-gas-hailed-a-success/

HyDeploy Phase 2 – Winlaton Trial

The Winlaton Trial is now complete. On the 4th of August 2021 the project successfully started blending up to 20% hydrogen into the public network at the village of Winlaton, which comprised 668 residential properties, a church, a primary school and several small businesses – the first community to receive a hydrogen blend via a public network without having to make any changes to their homes or the way they use their heating and cooking appliances. The project has been a significant milestone in the journey towards rolling out blending across the UK. The trial ran for 11 months and was completed on the 30th of June 2022. The trial provided further learning to support the roll out of blending. This is critical if we want to meet the Government's 2023 milestone of working with industry to complete testing necessary to allow up to 20% blending of hydrogen into the gas distribution grid for all homes on the gas grid, as set out in their 10-point plan[6].

The Winlaton trial has supplied more vital evidence to support the safety of blending into the gas network across the UK. This stage of the project has demonstrated that hydrogen can be used safely in the public gas network and the evidence from this trial will be used to help the UK Government form policies about the role of hydrogen in blending for the future of gas in our networks. If blended gas was distributed to homes and businesses across the country, it could prevent 6 million tonnes of carbon dioxide being released to the atmosphere every year. That's the same as taking 2.5 million cars off the roads so the project is hugely important.

https://hydeploy.co.uk/winlaton/

HyDeploy Phase 2 – Enabling Government Policy

The UK Government has committed to sanctioning the use of hydrogen blending across the gas distribution network, if a positive economic and safety case can be made by the end of 2023. HyDeploy is working to complete the safety evidence needed to allow the UK Government to make this decision.

5.3 Network Innovation Allowance (NIA)

As part of the RIIO GD1 price control period, Ofgem introduced the Network Innovation Allowance, and it will continue to be provided in the RIIO-2 price controls. The NIA is received by each network licensee for the purpose of funding innovative projects. The eligibility of the Network Innovation Allowance changed at the start of RIIO-2 and for a project to be eligible it must satisfy several areas of governance, demonstrating the fulfilment of the six requirements set out below:

- Facilitate energy system transition and/or benefit consumers in vulnerable situations
- Potential to deliver a net benefit to consumers
- Involve research, development or demonstration
- Develop new learning
- Be innovative
- Not lead to unnecessary duplication

Here are just a few recent NIA projects that makes up NGN's innovation portfolio:

H2Go Domestic Hydrogen Detector

As hydrogen becomes an ever more viable future fuel for domestic heating and cooking, a new project is looking to develop a domestic hydrogen detector. This NIA project will provide a critical piece of evidence to support the energy system transition. We are working with DefProc Engineering who are developing the sensor technology, and with the Health and Safety Executive Science Division, who are testing the device at their Buxton laboratories. The creation of a prototype domestic hydrogen detection device is similar in style and size to existing, ceiling mounted, indoor smoke and CO detectors. The battery powered device includes a piezo speaker for audio alarm and an LED for visual alarm and to indicate proper functioning. The device uses an available MOS sensor combined with temperature and relative humidity sensor to determine the H2 volume in air.

Legacy Stubs

The current HSE mandate is to abandon all metallic Tier 1 and Tier 2 stubs to remove the risk of potentially dangerous gas escapes. Currently ESEAL 1 and 2 is implemented on the NGN gas distribution area to deal with stubs as and when they become available during other main laying and renewing activities. There is currently no method for dealing with legacy stubs that are still in the ground prior to the advent of ESEAL 1 and 2 other than full cut out. NGN also carry out full tee piece cut out operations on existing stubs. This requires large excavation which are potentially deep. They are also costly, give rise to hazards which need to be managed and require road traffic management. This project seeks to develop a solution to enable the seal or abandonment of Tier 1 and Tier 2 metallic stubs up to and including the final transition joint prior to the parent main connection.

[6] https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution

H21 Wider Impacts

In order to utilise the existing distribution gas network to transport hydrogen, the effects of the changes in characteristics of hydrogen from natural gas need to be reviewed and the resultant effect on the network assessed. The velocity, density and dynamic and kinematic viscosity of hydrogen through the gas distribution network will be different to natural gas, these changes may have an adverse effect on the network and so the impacts need to be reviewed. This project will utilise computational fluid dynamics modelling to determine the potential impact on conversion to hydrogen across a range of criteria, such as particulate pickup, MEG saturation, noise and vibration through pressure regulation, slamshut operation and filter differential pressures.

H21 Legacy PE Assessment

This project is to determine the suitability of the existing PE network for 100% hydrogen conversion, addressing the knowledge gap of existing operational assets. While testing has concluded current specification PE pipework is suitable for 100% hydrogen conversion, no research has been conducted on PE subjected to prolonged exposure to natural gas under pressure, adversely effecting material properties over time, in some instances up to 50 years. This project will expand the evidence generation programme of PE assessment to include permeation testing, slit defect leakage rate, stress cracking susceptibility, fracture toughness and leak tightness of house fittings for pre-1976 specification PE.

H21 SR/25 and ATEX Equipment Assessment

To date the impact on conversion on hazardous area classification and electrical connection compliance / suitability has been limited to use of assets under natural gas conditions. A review and supplement to existing standard has given the opportunity to further the quantification of feasibility for conversion of existing infrastructure to use for 100% hydrogen through assessment of existing configurations, hazardous areas and E&I equipment. This will include a full survey across a sample of installations of electrical and instrumentation equipment in accordance with relevant standard and identification of any electrical equipment of classification IIB (not inclusive of IIB+H2) and below within current hazardous areas and hazardous areas under assumed hydrogen conditions, this is to be benchmarked against existing audit records for each site.

5.4 Strategic Innovation Fund (SIF)

The Strategic Innovation Fund (SIF) is a funding mechanism for the Electricity System Operator, Electricity Transmission, Gas Transmission and Gas Distribution sectors.

The SIF aims to find and fund ambitious, innovative projects with the potential to accelerate the transition to net zero. These projects should help shape the future of the gas and electricity networks and succeed commercially where possible.

The fund is expected to invest £450 million in energy network innovation from 2021-2026, with the option to extend and increase as necessary.

The SIF is delivered in partnership with Innovate UK, part of UK Research and Innovation (UKRI). Our objective for the SIF is to help transform the UK into the ‘Silicon Valley’ of energy, making the UK the best place for high potential businesses to grow and scale in the energy market.

Using Innovate UK's expertise and extensive business and academic networks, the SIF programme will tap into the best of UK and international innovation whilst also aligning with other public innovation funding, delivering measurable benefits to network users and consumers.

Working with our stakeholders, we have identified four Innovation Challenge areas. These are:

- Whole system integration
- Data and digitalisation
- Heat
- Zero emission transport

The first SIF Innovation Challenges opened to applications on 31 August 2021 and Ofgem invited project proposals from licensees[7]. The application window will close on 17th November 2021. We are working with our stakeholders to explore opportunities for SIF proposals across the four key themes, supported by UKRI and EIC (Energy Innovation Centre).

You can read more about the fund on the UKRI website and Ofgem's Strategic Innovation Fund (SIF) website.

[7] https://www.ofgem.gov.uk/publications/strategic-innovation-fund-innovation-challenges

Appendix 1

Process methodology

A1

Appendix 1 - Process Methodology

A1.1.2 Daily Demand / Weather Modelling

Temperature explains most of the variation in daily LDZ demand, but a better fit can be obtained by including other variables. Within each model the Composite Weather Variable (CWV) which is the gas industry's data item that provides a measure of daily weather in each Local Distribution Zone (LDZ). It is calculated in UK Link using various data items, including weather variables such as temperature, wind speed and a set of parameters designed to provide a strong linear relationship to LDZ gas demand.

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 conditions to see underlying trends. The Seasonal Normal value of the Composite Weather Variable (SNCWV) is therefore a key parameter used in various calculations. CWV and SNCWV are key building blocks in the production of demand models, profiles, peak load factors and the Non-Daily Metered allocation formulae.

For stability across the many industry processes impacted, the Demand Estimation Sub Committee[7] (DESC) review the CWV and SNCWV, as a minimum, every 5 years. New CWV and SNCWV figures came into effect on the 1st October 2020. The calculation now includes a 'solar effect' variable which provides substantial improvement in demand estimation, particularly for the colder months.

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 dating back to 1st October 1960. This determines the peak day and severe winter demand estimates. The model estimates what demand would be if historical weather from 1960 were to repeat today and generates a statistical distribution of the results which can be used to determine 1 in 20-year peak day demand. That is the level of demand you would statistically expect to occur once in every 20 years.

A1.1.4 High Pressure Tier Planning

Although the development of the GDN's Local Transmission System (LTS) is largely demand led, LTS capacity planning processes are not dissimilar to those utilised for the development of the National Transmission System (NTS). GDNs 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
- Constructing new supplies (offtakes from the NTS), regulators and control systems

[8] http://www.gasgovernance.co.uk/desc

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 for NGN this is in the form of linepack.

A1.1.5 Below 7 barg planning

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.

A1.1.6 Investment Procedures and Project Management

All investment projects must comply with The Investment Planning Policy, 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 most 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 cost whilst not undermining the project objectives or the safety and 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 post project and post investment review to ensure compliance and capture lessons learned

NGN have four frameworks in place to help deliver our Capital Investment Programme which were all competitively tendered through the OJEU process. These framework agreements ensure we build lasting relationships with our partners to deliver quality at the most efficient cost for our customers. Our design framework is due to expire early next year and we are in the process of re-tendering this. Our three delivery frameworks were re-tendered during 2021 and went live in May 2022, the Major Framework consists of six framework partners and work is awarded via mini competition, the two Minor Frameworks consist of four framework partners each, two assigned in the North and two in the South, and work is shared between them and prices negotiated. The frameworks have been designed to suit the work type, complexity, and volume to

deliver the most economical value. All four frameworks are based on the NEC forms of contract which are renowned and approved worldwide as a project management contract, focussing particularly on cost and programme.

All projects are completed in line with the Capital Projects Integrated Management System (IMS) which covers the 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 makes use of professional consultants and specialist contractors, all of whom are appointed subject to competitive tender.

Performance of the Contractors is monitored using Key Performance Indicators (KPI's) to ensure that the standards of Health & Safety, Environmental Performance, Quality, Commercial Performance and Programme management are all of the required level. Within the new framework, these figures will be used to incentivise high levels of performance, whilst still providing a tool to ensure consistent levels of performance.

Where Third Party funded schemes are raised, these are sanctioned, awarded, and managed in exactly the same way with a focus on value, programme and quality, however the Project Manager role may be sourced from the Professional Services Framework (as opposed to an NGN employee) on an ad-hoc basis to ensure that the Capex workload is delivered without compromise.

Appendix 2

Gas Demand Forecasts

A2

Appendix 2 - Gas Demand Forecasts

A2.1 Annual Demand

Annual demand forecasts are developed without knowledge of future weather conditions. Consequently, we calculate a Seasonal Normal Temperature (SNT) based on past averages. To compare throughput between years, actual demand data is adjusted to account for the variance of actual weather and SNT. This is known as weather corrected demand.

The network code states that the calculated methodology used to derive seasonal normal values must be reviewed periodically. The 'seasonal normal composite weather variables' (SNCWV) have been reviewed and the new figures went live on the 1st October 2020. These figures now include solar effect. Seasonal normal values reflect the general upturn, in warm weather, that has been experienced over the past decade.

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.

Over the next ten years annual gas demand is forecast to decline by 0.15% in the Northern LDZ and an increase of 0.50% in the North East LDZ. As discussed in section 2.2, the forecast rate of change has an overall flat profile, and with an uncertain economic outlook and high forecast increases in UK gas prices; amongst other factors which are outlined overleaf. The following tables show the LDZ specific forecasts:

Northern LDZ

Load Band	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
0-73 MWh	18.7	18.6	18.7	18.6	18.6	18.5	18.6	18.5	18.5	18.5
73-732 MWh	2.4	2.4	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
732-5860 MWh	1.9	1.9	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
> 5860 MWh	10.4	10.4	10.4	10.4	10.4	10.4	10.5	10.5	10.5	10.5
LDZ Shrinkage	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
LDZ Demand	33.6	33.5	33.6	33.6	33.6	33.5	33.6	33.6	33.6	33.5

Table A2.1A Forecast Annual Demand by Load Category & Calendar Year for North LDZ from 2022 Demand Statements
Note: Figures may not sum exactly due to rounding.

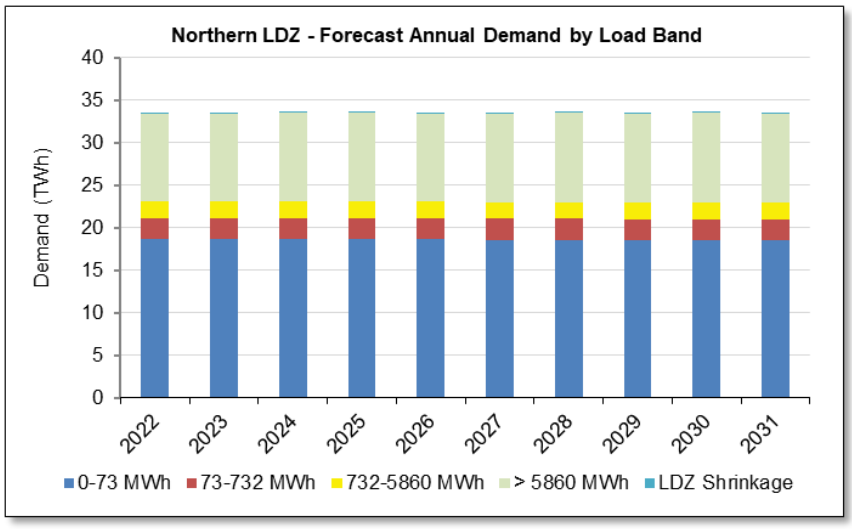


Figure A2.1A Northern LDZ - Forecast Annual Demand by Load Band

North East LDZ

Load Band	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
0-73 MWh	22.2	22.1	22.2	22.2	22.1	22.1	22.1	22.1	22.1	22.0
73-732 MWh	2.9	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
732-5860 MWh	2.3	2.3	2.4	2.4	2.4	2.4	2.4	2.5	2.5	2.5
> 5860 MWh	10.5	10.5	10.5	10.5	10.5	10.5	10.6	10.6	10.6	10.6
LDZ Shrinkage	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
LDZ Demand	38.1	38.1	38.2	38.2	38.2	38.2	38.3	38.3	38.3	38.3

Table A2.1B Forecast Annual Demand by Load Category & Calendar Year for North East LDZ from 2022 Demand Statements (TWh)

Note: Figures may not sum exactly due to rounding.

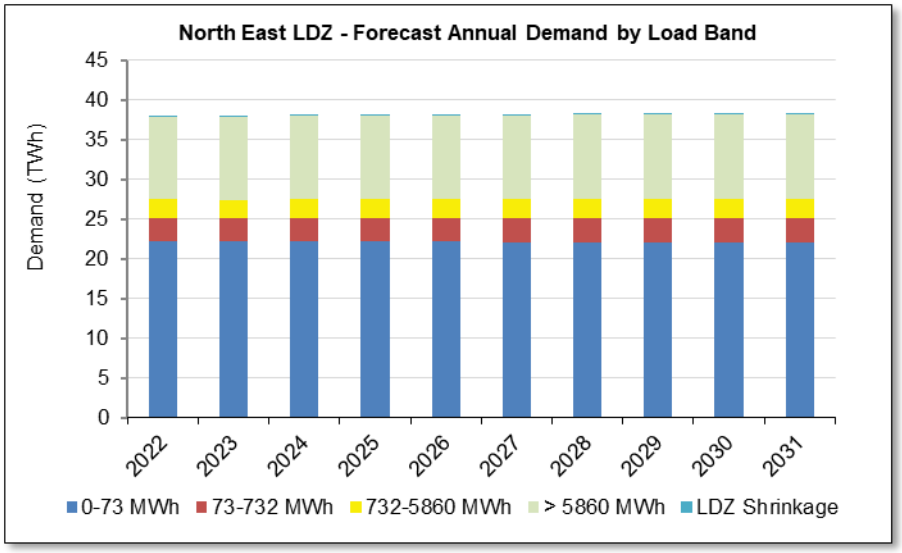


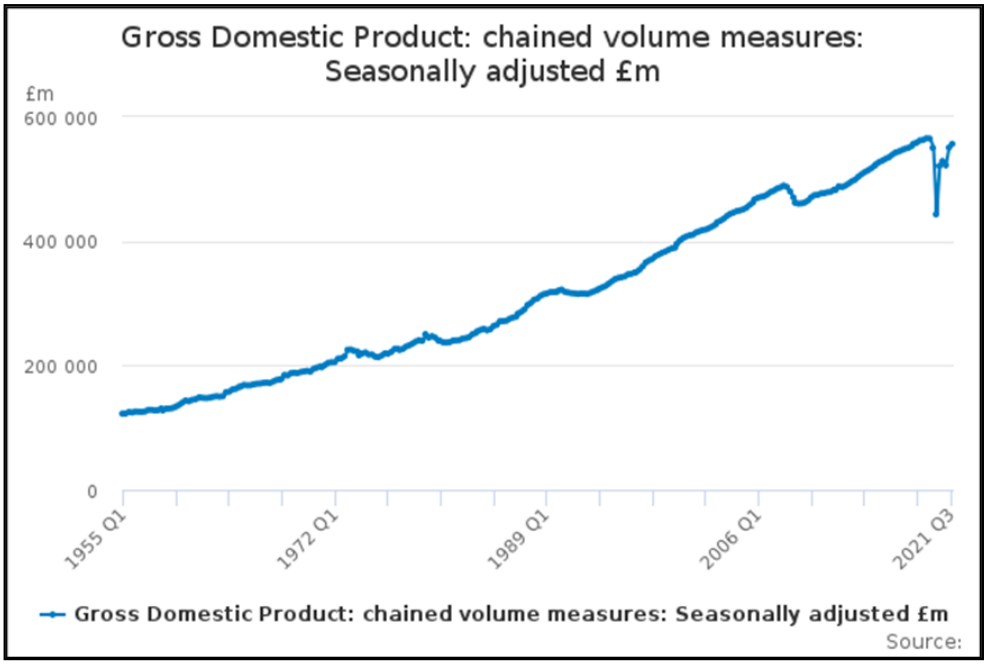
Figure A2.1B North East LDZ - Forecast Annual Demand by Load Band

A2.2 Key Assumptions in developing the 2022 NGN Demand Forecasts

This section provides an overview of the key econometric assumptions used to inform our 2022 demand forecasts. The commentary underpins the forecasts made back in the first quarter of this year, in which the Covid-19 pandemics full impact on the economy is yet to be seen. The base date for our 2022 forecast models captures the recent spike in gas prices, the long term effects are still unknown as gas prices have continued to increase, and there is uncertainty to when they will start to reduce.

Gross Domestic Product (GDP) and Gross Value Added (GVA)

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 GDP, which is a key indicator of the state of the whole economy. Therefore, it is an important driver for gas demand. A significant decline in GDP occurred during 2008/9 set against a long period of growth from 1992. However, there has been steady and sustained recovery in GDP since that time. The economic figures produced by the Office of National Statistics (ONS) show the impact to the economy during 2021 (see graph below). The uncertainties created by the trading conditions after the UK left the EU and supply chain disruptions during the pandemic may impact the economy, but the finalising of a trade deals worldwide could improve the UK economy in the medium to long term. The preliminary figures from the ONS show that annual GDP growth for 2021 is around 6.5%. This is a dramatic increase from the outturn figure for 2020 of -9.8%.



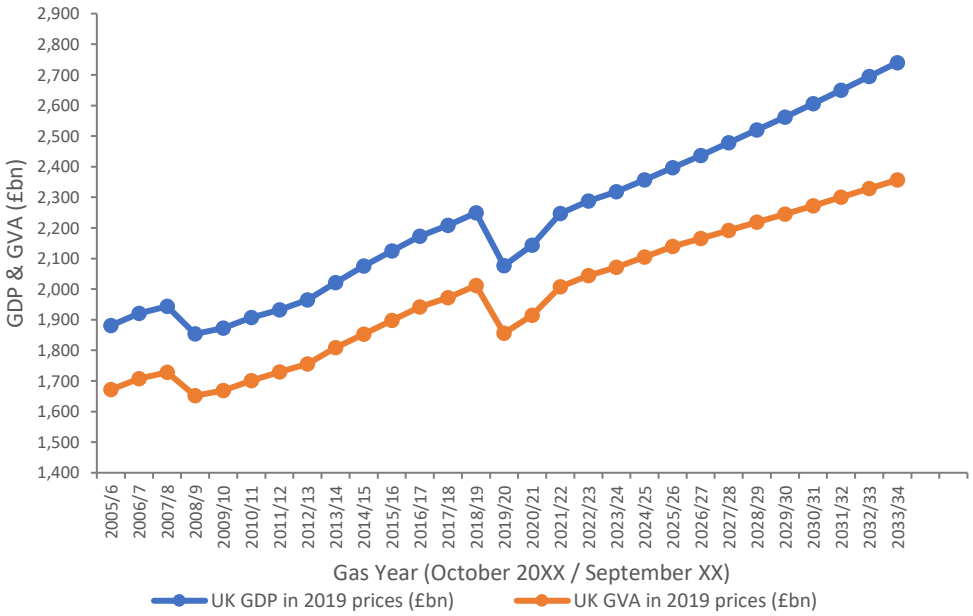


Figure A2.2.1A – UK GDP & GVA in 2019 prices (£bn)

The level of growth is expected to recover over time with a growth rate of 6% in 2022, 2.1% in 2023 and 1.3% in 2024. The forecasts for 2025 and 2026 are 1.6% and 1.7% respectively. The Office for Budget Responsibility (OBR) published the range of forecasts of potential GDP paths in October 2021 which is shown below.

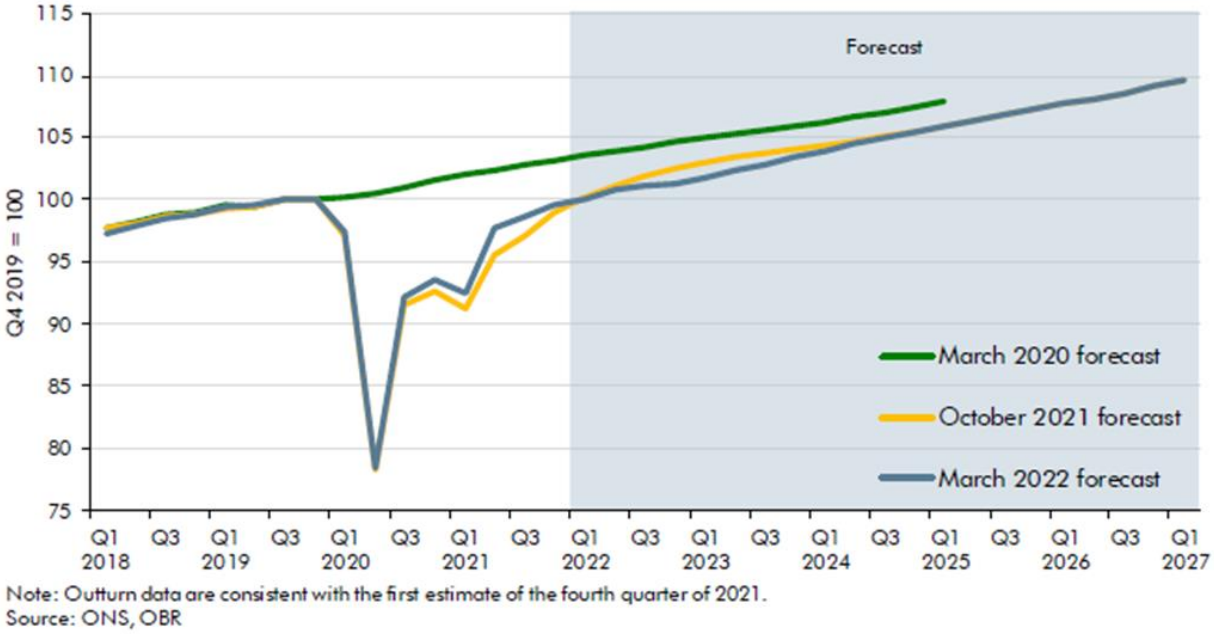


Figure A2.2.1B – UK Real GDP Growth Fan Chart

GVA growth in both LDZs has been below the average growth for the UK in the period 2004/5 to 2016/17, with the impact of the recession being present at the same time in both LDZs as the UK but of lower impact in 2008 particularly in NE LDZ. With regard to the Northern LDZ there was in fact minimal growth in 2012 but recovering after that date, although growth has been low in recent years.

The North of England region covered by NGN's LDZs has historically had a lower GVA per capita than the UK average, as shown below;

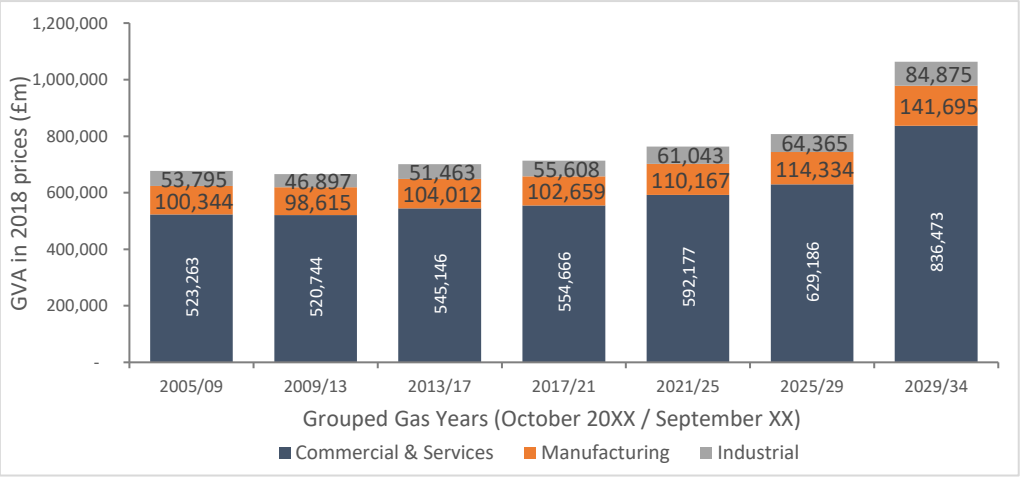


Figure A2.2.1C – GVA in 2018 prices (£m) in the NGN regions

Gas & Energy Prices

Analysis shows that gas prices and demand are inversely related; an increase in price leads to a demand reduction. All prices in all markets have shown significant rises - from 2002 for households and from 1999 in the non-domestic market. This is a direct result of the pass through of the wholesale gas price rises, which has in turn been driven by rising oil prices. There was a significant turnaround in 2015 and 2016 with the 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 initial refusal of OPEC to cut back production. New oil exports from Iran did have an impact on the market and potentially increased the surplus. OPEC producers however cut back production in 2017 and self-imposed output limits have been encouraged lead by Saudi Arabia and Russia. This led to a steady recovery in oil prices, significantly during 2017 and into 2018. It is forecast that US shale oil will continue to be developed along with new conventional US oil production despite the low oil price. The reasoning behind this is that shale costs are expected to fall with further innovation and the shale technology is being utilised on conventional reservoirs.

There is extreme uncertainty regarding the oil price. The damage to the world economy from the pandemic could easily result in slow oil demand recovery, most likely at levels below those before the pandemic. Furthermore, in a bid to improve the environment and to generate new jobs green sources of energy will receive greater support than before the pandemic. Any escalation in tensions in oil producing regions are always a risk factor, the latest being the political unrest in Belarus, Kazakhstan and the Ukraine/Russia border.

Any assertions made by commentators regarding the delinking of gas prices from oil, may currently appear to have been a reasonable assumption given the surge in wholesale gas prices at levels way beyond those seen in the oil market. According to the International Energy Agency (IEA)

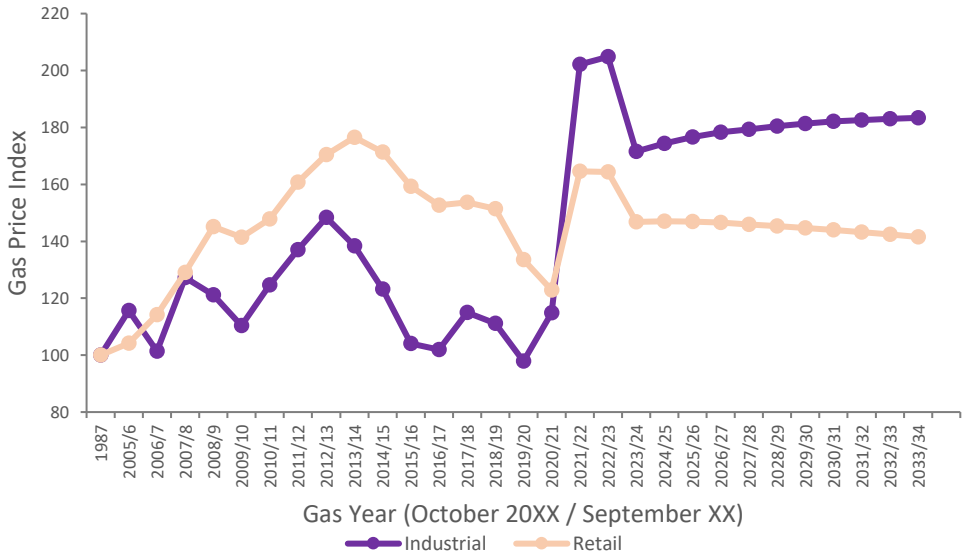


Figure A2. 2.1D– Retail & Industrial gas price index (1987 = 100; base figure)

Wholesale Price

Our 2022 forecasting process will capture data related to the recent price spikes and seek to understand any associated effects on gas supply and demand. At the time of producing our 2022

forecasts There has been some significant fluctuation in the wholesale gas price (as represented by the UK NBP price at 2019 prices) over time but the general trend has until recently been upwards. Following the steep decline in oil prices between 2014 and 2015 the wholesale price fell in 2016, but then increased again in 2017 and 2018. The price then fell sharply and only partially recovered during 2019 followed by another dip and rise during 2020, then a steep rise through 2021. The price is currently extremely high due to global shortfalls. The forecast provided is based on an assessment of the forecasts of wholesale price used by National Grid and DBEIS for their energy demand forecasts, but adjusted to account for the current high levels, but assuming that the price will return to historical average levels by 2023/4.

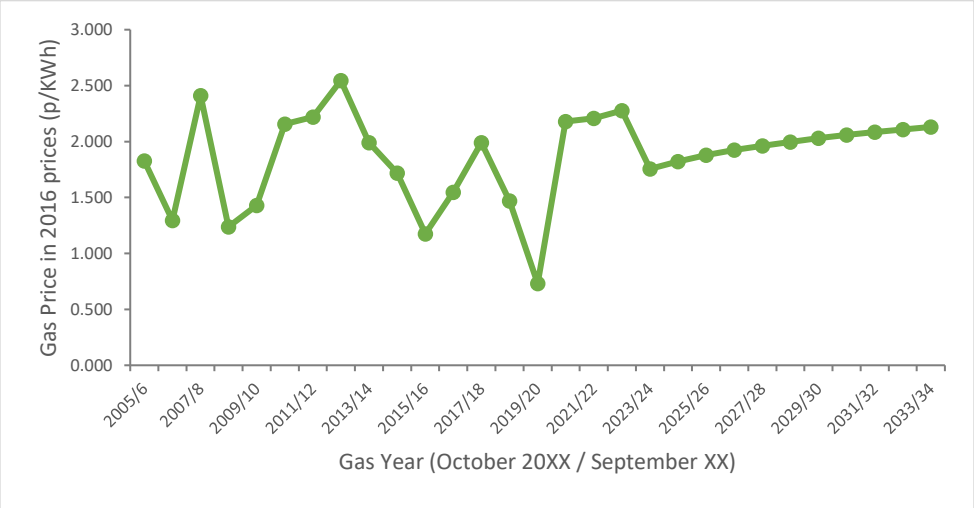


Figure A2.2.1E – Wholesale gas price in 2019 prices (p/KWH)

Retail Price – Domestic

Following the dip in the real price of domestic gas prices in 2017 there was a rise in 2018 as a result of the impact of the sustained wholesale price rise which has an impact on a proportion of the costs incurred by domestic suppliers. Prices rose slightly in 2019 despite the increase in competition from smaller suppliers, ongoing developments to make switching supplier easier and quicker and the Government's introduction of a price cap mechanism. This price cap lead to a fall in prices during 2020, but then a rise in prices for 2021. The combination of a price cap and rising wholesale prices has resulted in a significant number of small supplier failures however which has lead to a loss of some of the cheaper tariffs on offer. We have assumed that the major suppliers will as a minimum control prices at or below the price cap and that the price cap will remain in place reflecting the full changes in the wholesale price. The cost associated with smart metering and the development of smart grids is assumed to be accounted for within the price cap.

Retail Price – Industrial

There has until 2014/15 been a steady rise in the real price of industrial gas prices for many years but with significant fluctuations in line with the fluctuation in wholesale prices. This fluctuation is particularly felt by those customers with large annual consumption as the wholesale price is a much greater proportion of their charges from their supplier. The oil price started high in 2020 but dipped significantly during the year before rising again towards the end of 2020. The impact on industrial gas prices was a significant decline in all non-domestic prices for 2020. In the first three quarters of 2021, the prices for small and medium non-domestic customers fell, but it rose significantly for large customers.

Forecast price rises are expected to reflect the changes in wholesale gas prices with no additional premium to the current price to accommodate the development of smart grids, smart metering and other green initiatives. There remains no premium as it is now assumed that smart technology will be incorporated into industrial applications as part of the normal development process for any industrial user to reduce energy costs.

Efficiency

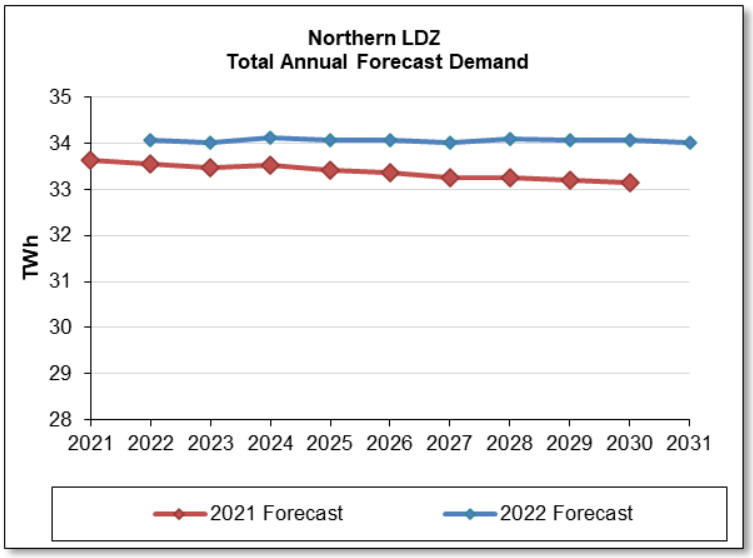
Gas demand, when corrected to seasonal normal weather conditions, has been declining in recent years, although there are some instances of growth in some sectors in some parts of the country, possibly driven by historical falling gas prices and the improving economy. There is also evidence that average consumption per customer is falling steadily. 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. This is further complicated by the impact of the penetration of renewables into households that were using gas as their primary source of heating and now have renewable alternatives when they are available and then use gas heating as a top-up. Therefore there remains the possibility that gas demand at peak could be the same as previously seen at those properties before the installation of renewable heat sources.

There has been a steady and substantial programme of gas fired domestic boiler replacement for a very long period now and the high levels of efficiency achieved with these new boilers is a significant contributory factor in the decline in gas demand. However the increases in efficiency may in some circumstances have been used to provide higher comfort levels, especially in winter. There has also been a sustained 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 major suppliers are however in many instances refusing to offer top-up loft insulation as the benefits are not sufficient to cover the cost.

The BEIS statistics as at the end of 2020 show that there are only 772,000 homes with solid wall insulation which equates to 9.1% of the total properties that do not have a cavity wall.

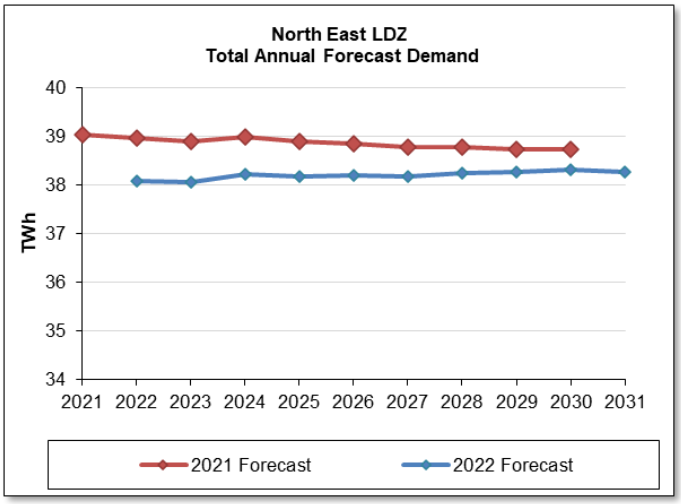
A2.3 Forecast Comparisons

The following charts provide a comparison of the current forecasts with those published in the 2021 Demand Statements (DS).



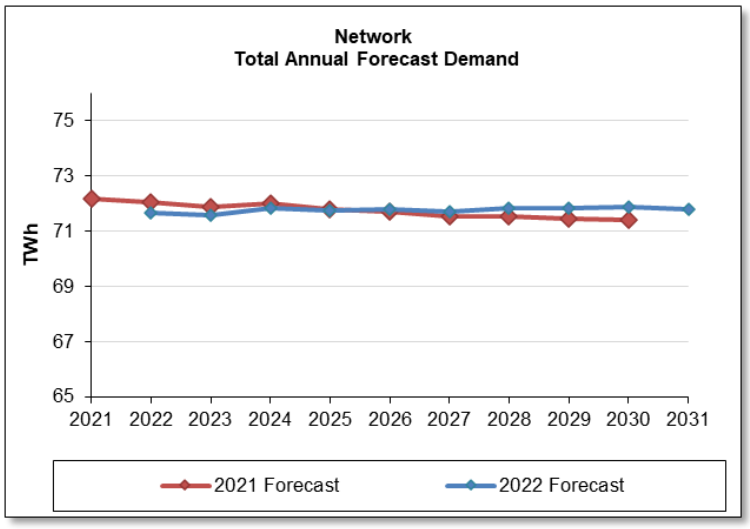
Forecast (TWh)			
Year	2021 DS	2022 DS	% Difference
2022	33.06	33.57	1.55
2023	32.97	33.53	1.70
2024	33.02	33.63	1.84
2025	32.91	33.58	2.01
2026	32.86	33.57	2.17
2027	32.77	33.53	2.32
2028	32.76	33.59	2.53
2029	32.69	33.56	2.67
2030	32.66	33.57	2.79
2031		33.52	

Figure 2.3A – Northern LDZ Total Annual Forecast Demand



Forecast (TWh)			
Year	2021 DS	2022 DS	% Difference
2022	38.98	38.09	-2.28
2023	38.90	38.07	-2.13
2024	39.00	38.22	-1.99
2025	38.90	38.18	-1.84
2026	38.86	38.20	-1.69
2027	38.78	38.18	-1.55
2028	38.79	38.26	-1.36
2029	38.74	38.27	-1.22
2030	38.75	38.32	-1.10
2031		38.28	

Figure 2.3B – North East LDZ Total Annual Forecast Demand



Forecast (TWh)			
Year	2021 DS	2022 DS	% Difference
2022	72.03	71.66	-0.52
2023	71.86	71.60	-0.37
2024	72.02	71.85	-0.23
2025	71.81	71.76	-0.07
2026	71.72	71.78	0.08
2027	71.55	71.71	0.23
2028	71.55	71.85	0.42
2029	71.43	71.83	0.56
2030	71.40	71.89	0.68
2031		71.80	

Figure 2.3C – Network Total Annual Forecast Demand

Appendix 3

Actual Flows 2021

A3

Appendix 3 – Actual Flows 2022

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 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 2021 calendar year, with the forecast demands presented in the 2021 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.

The 2021/22 winter severity, based on the 61 winters starting from October 1960, was deemed to be average cold for the 6 month period from October to March and average cold for the 3 month period from December to February. This was the 22nd warmest October to March in the last 61 years.

Northern LDZ 2021	Actual Demand	Weather Corrected Demand	Forecast Demand	Corrected v Forecast (%)
0 to 73.2 MWh	17.72	18.07	18.29	-1.2
73.2 to 732 MWh	2.28	2.33	2.56	-9.1
>732 MWh	11.90	11.96	12.14	-1.5
Shrinkage	0.14	0.14	0.14	2.3
Total LDZ	32.05	32.51	33.14	-1.9

Table A3.1A Northern LDZ Throughput 2021 **Note:** Figures may not sum exactly due to rounding.

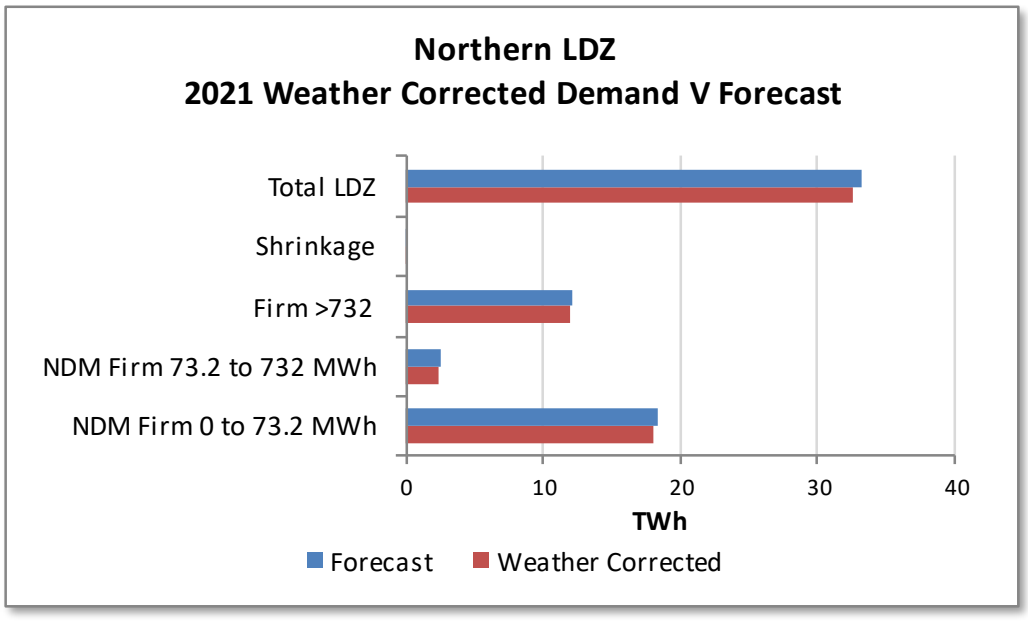


Chart A3.1B 2021 Northern LDZ Weather Corrected Demand V Forecast

In the Northern LDZ, the forecasts for each of the loadbands, were higher than the actual throughput. Overall the total LDZ weather corrected throughput was 1.9% lower than forecast.

North East LDZ 2021	Actual Demand	Weather Corrected Demand	Forecast Demand	Corrected v Forecast (%)
0 to 73.2 MWh	21.36	21.22	22.23	-4.6
73.2 to 732 MWh	2.81	2.81	3.24	-13.3
>732 MWh	12.73	12.72	13.42	-5.3
Shrinkage	0.16	0.16	0.16	1.1
Total LDZ	37.06	36.90	39.05	-5.5

Table A3.1C North East LDZ Throughput 2021 **Note:** Figures may not sum exactly due to rounding.

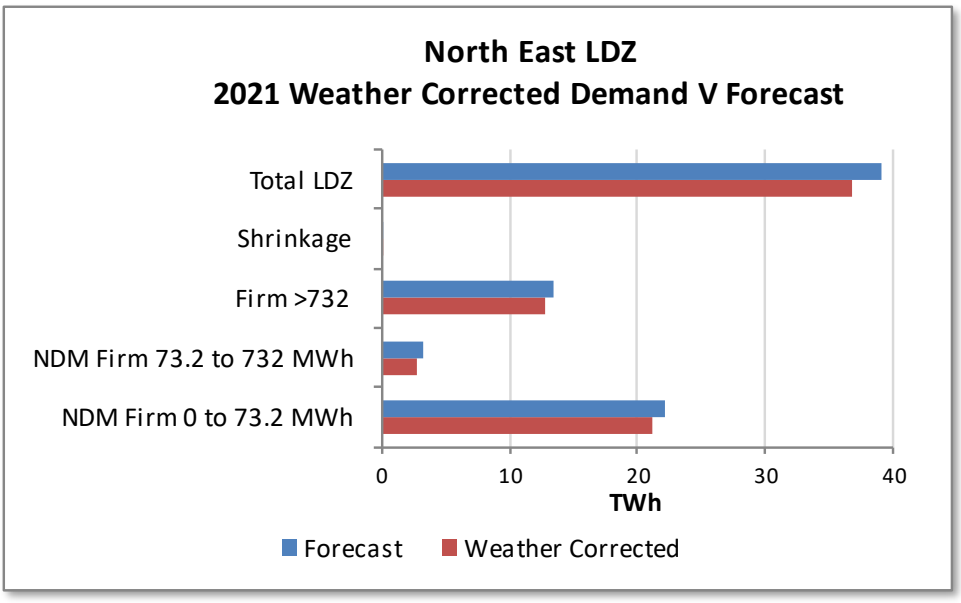


Chart A3.1D 2021 North East LDZ Weather Corrected Demand V Forecast

Similarly, the North East LDZ forecasts were overstated for all load bands. At LDZ level, the weather corrected throughput was 5.5% lower than forecast.

A3.2 Peak Flows

The maximum demand day for Northern LDZ during winter 2021/22 was 6th January 2022, when the network demand was 14.75 mcm, equating to **74.5%** of the expected 1 in 20 peak day for winter 2021/22. This was 7.6% lower than the highest demand day in 2020/21 of 16.45 mcm.

The maximum demand day for North East LDZ during winter 2021/22 was 6th January 2022, when the network demand was 17.56 mcm, equating to **73.4%** of the expected 1 in 20 peak day for winter 2021/22. This was 10.1% lower than the highest demand day in 2020/21 of 20.00 mcm.

Our 2022 forecasts suggest that over the next ten years, the 1 in 20 Peak day forecast demand will increase by 0.41% in the Northern LDZ and 0.49% in the North East LDZ in line with annual forecasts, as shown by the charts below.

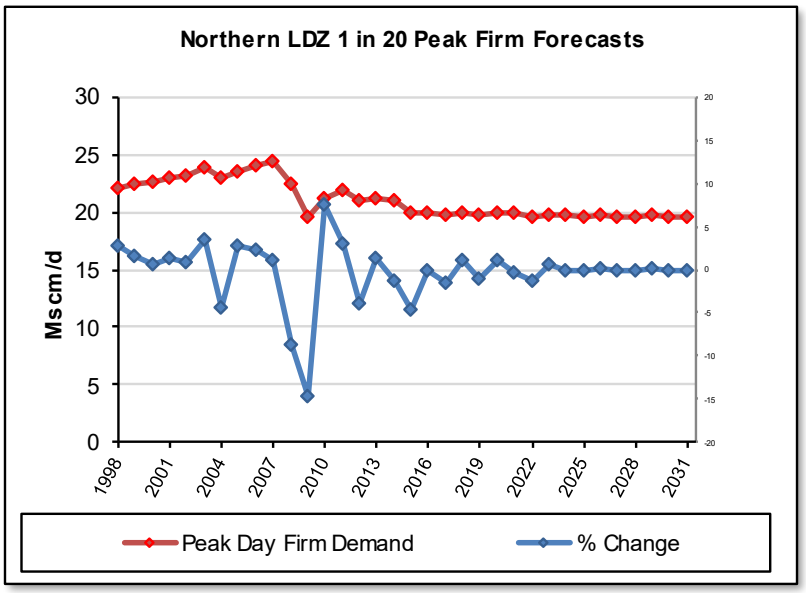


Figure 3.2a Historical Throughput & Forecast Peak day Firm Demand for Northern LDZ

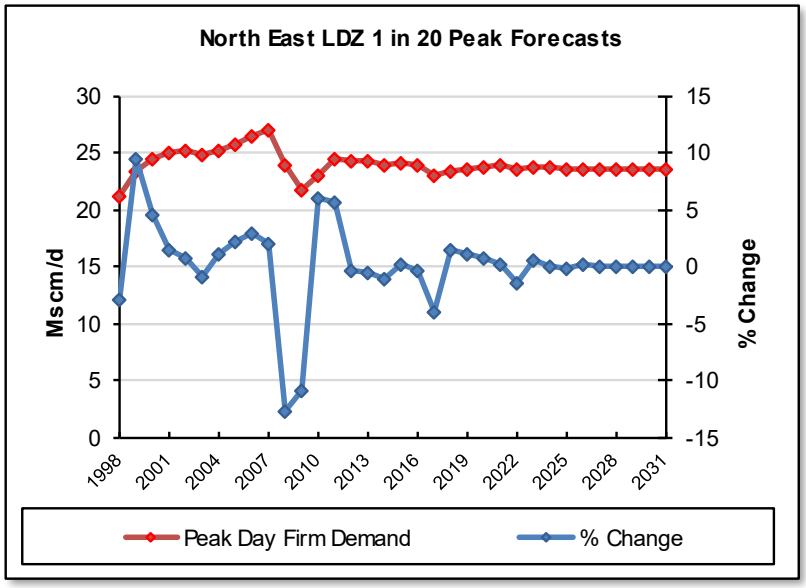
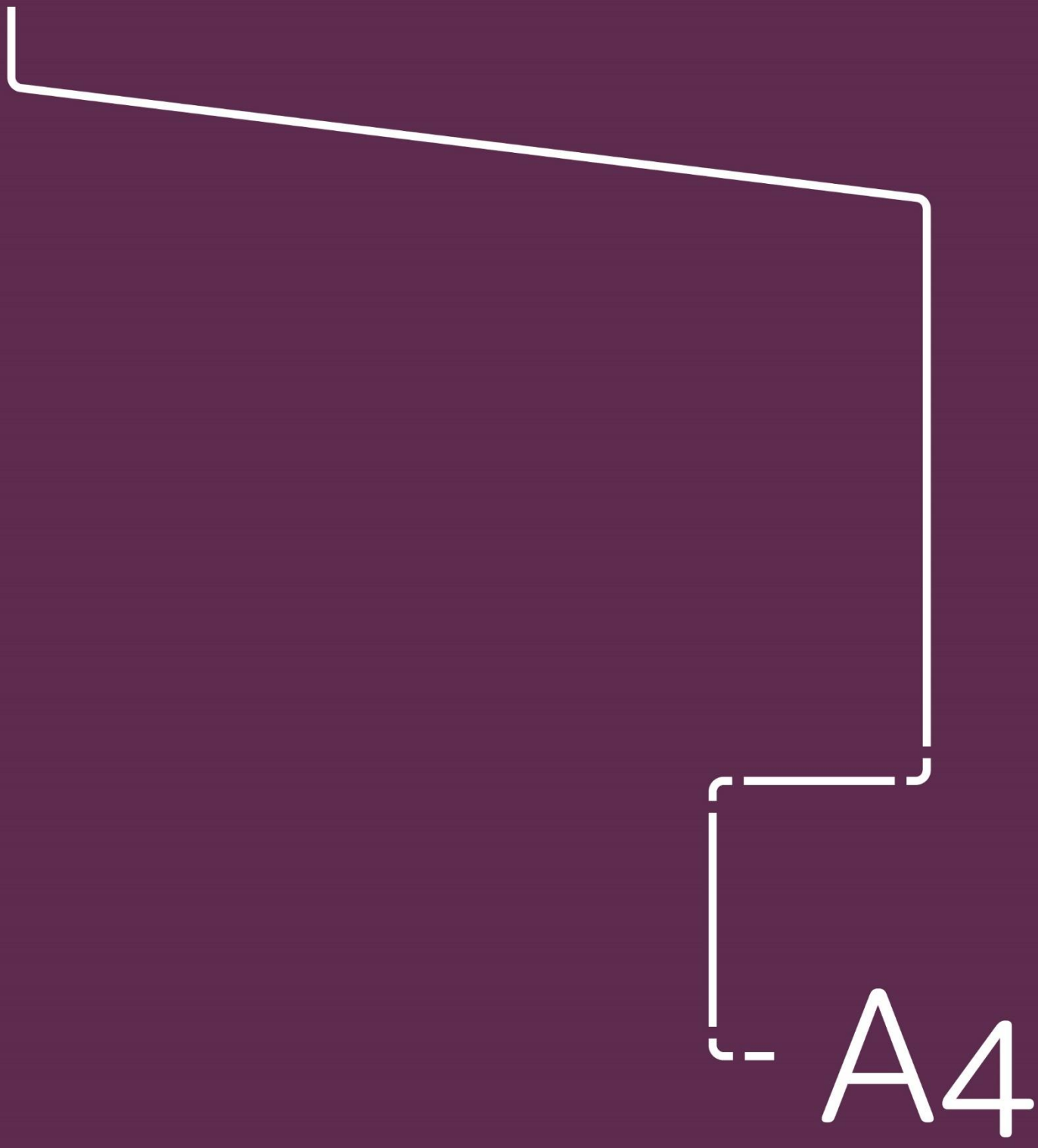


Figure 3.2b Historical Throughput & Forecast Peak day firm Demand for North East LDZ

Appendix 4

Connections to our system



Appendix 4 – Connections to our System

A4.1 Connection Services

Within the space of a few years, the gas industry in the UK 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 off taken 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
- Storage Connections: connections to storage facilities for the purpose of temporarily off taking 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, 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 off taken is also treated as a new connection.

A4.2 Connections to the Local Transmission System

LTS Planning have received 10 HP gas connection enquiries in the year 2022. There have been no new physical HP connections.

A4.3 Electricity Flexible Generation

For the third year running NGN have seen reduced numbers of quotation enquiries for large load connections- 11 year to date (Sept 21 – Aug 22). We expect that flexible generation enquiries will start to reduce in numbers over the coming years and throughout GD2 due to the areas of the UK that require flexible generation already being covered and the increasing focus on carbon emissions. The Covid-19 pandemic has inevitably also had an effect on the overall numbers of projects.

We currently have 19 live issued quotes with customers and expect a number of these to be accepted and progress to a connection.

There are 13 flexible power generation sites currently connected, with another 6 accepted sites anticipated to progress across RIIO-GD2.

We expect the numbers of hydrogen and CNG Fuelling stations to significantly increase across RIIO-GD2. We currently have 1 connected CNG site, 1 accepted CNG Fuelling station projects and a number of innovative hydrogen projects.

It should be noted that any 3rd party wishing to connect to our network, or requiring increased flow must contact NGN as early as possible via the correct process to ensure that their requirements can be met.

A4.4 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.

A4.4.1 Network Entry Quality Specification

For any new entry connection to our system, the connecting party should notify us as soon as possible as to their 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 NGN 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 schedule 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. https://www.legislation.gov.uk/uksi/1996/551/schedule/3/made

A4.5 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 taken off the system where the Supply Point created has been confirmed by a shipper, in accordance with the Uniform Network Code.

More information regarding NGN connections can be found here https://www.northerngasnetworks.co.uk/gas-connections/

A4.6 National Transmission System (NTS) Connections

For information regarding NTS Connections visit https://www.nationalgrid.com/uk/gas-transmission/connections

A4.7 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.

A4.8 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 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 pipe 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 our Connections Methodology Statement and contact our connections team on 0800 040 7766 and (option 2) or email gasconnections@northerngas.co.uk

A4.9 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. 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

Of terms

Glossary of Terms

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.

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.

Linepack
The volume of compressed 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.

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)

Gas distribution networks review their total consumption in an LDZ vs the total consumption of the daily metered (DM) sites within a particular LDZ. The remaining consumption is then allocated as non-daily metered (NDM) consumption, which is then divided between the shippers, who supply gas to that LDZ, by applying an agreed formula.

It should also be noted, that following the implementation of project nexus in 2017, all meter points regardless of the supply class or registered demand volumes are reconciled when a valid meter read is submitted by the consumer.

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 an 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

Shrinkage refers to the gas which is lost from the transportation network. Shrinkage is a combination of Leakage, Own Use Gas and Theft of 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.

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we are the network