Northern Ireland Gas Capacity Statement

2022/23 – 2031/32

GNI (UK) Ltd.

mutualenergy

Contents

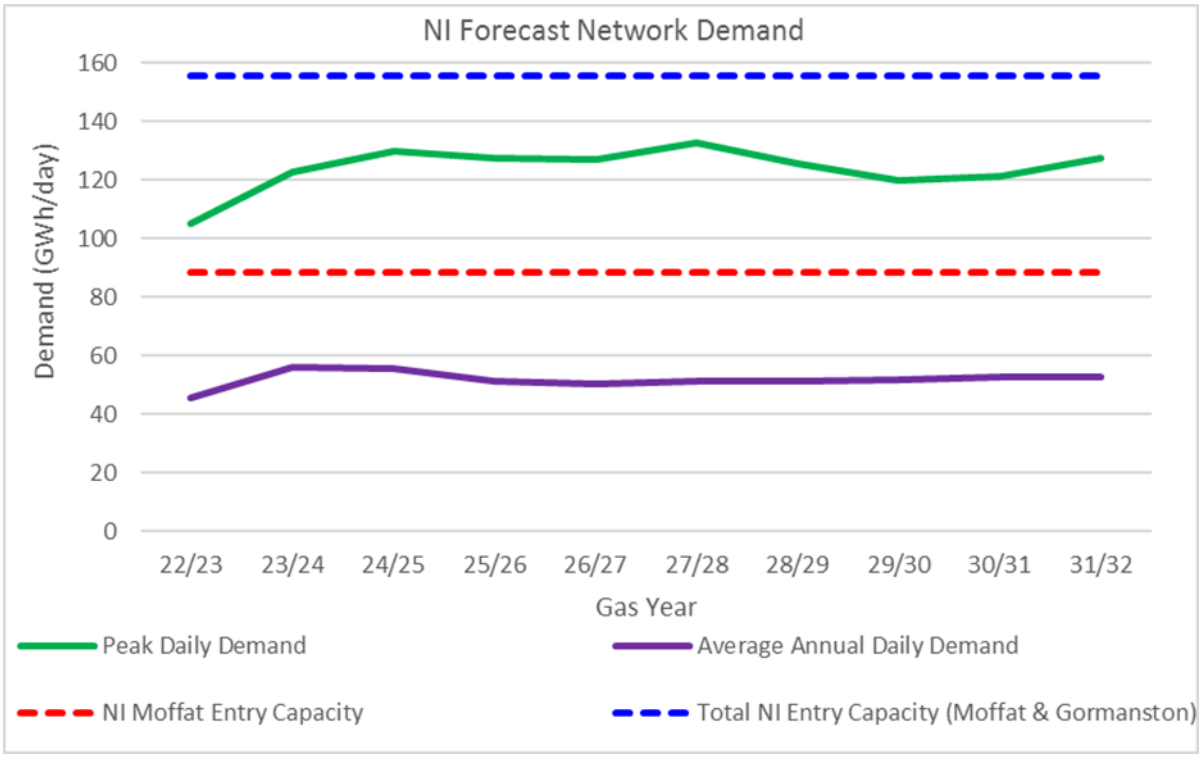
1 Executive Summary

The Northern Ireland Gas Capacity Statement provides an assessment of the ability of the NI gas transmission system to provide for supply and demand over a number of potential scenarios across the next ten years up to 2031/32, based on forecasts supplied by power sector and distribution users of the network.

In addition to existing users of the gas transmission network, the forecast demands considered in this 2022/23 Statement include the EP Kilroot connection (to facilitate the new gas-fired power station planned for operation in 2023) and demand outside of NI serviced through the NI Network, including SGN at Stranraer in Scotland and Gas Networks Ireland at Haynestown, Co. Louth.

Key Messages

The graph below depicts peak and average forecast demand against present network entry capacity thresholds and may helpfully illustrate certain key observations.



- The ten-year forecast indicates strong anticipated growth (of 15%) in annual gas consumption in NI and 15.8% forecast growth in total annual gas consumption on the NI Network overall (to include the demands of Stranraer and Haynestown).
    - Strong growth of 21.7% in annual consumption by distribution, driven by new connections, is combined with a 10.1% increase in annual consumption by the power sector as a result of the addition of new gas fired generation units in NI.

- In addition to the overall 10.1% increase in power sector annual consumption, is a larger 22.6% increase in power sectors potential peak day requirements and therefore electricity generation's reliance on gas network capacity.

Following the commissioning of EP Kilroot OCGT's in 2023, supply from both NI Entry Points will be required as the forecast peak day demand will exceed the capacity available at the NI Moffat Entry Point.

The use of the NI Gas Transmission system is changing and the flexibility previously available to users, by way of pressures and offtake profiles, is reducing as the system edges closer to reaching capacity. The peak day demand for the Severe Winter Peak scenario in 2027/28 is 132.833GWh/d; in this scenario, with the offtake profiles being modelled against the entry supply profile and contractual Twynholm pressures, pressures in excess of 39barg could not be maintained. This demand is less than the total NI Network Entry Capacity of 154.778GWh/d yet would likely lead to a System Constraint declaration, hence highlighting that capacity which can be delivered to Exit Points under suitable system pressures is not equivalent to the Entry Capacity available.

Gas-fired power generation is relied on by the electricity system as a flexible, back-up for renewable generation. With the forecast increase in the use of gas-fired power generation and the electricity system's reliance on a relatively simple gas transmission network, it has become clear that there is a strong need for an integrated, whole system approach to the energy systems in NI. Peak daily demand is increasing, partly because of increased distribution connections, but more significantly due to an increased reliance on natural gas in the wider energy transition, as a back up to the increasing penetration of renewable energy (e.g. when wind availability is low). In a first attempt to address the need for a whole system approach, the gas TSO's have engaged with the System Operator for Northern Ireland (SONI) to analyse the NI gas network for scenarios of high demand for gas-fired generation from the power sector.

As SONI have a holistic view of how the NI power stations will be dispatched in aggregate, the TSO's believe the most credible scenario within the NIGCS is that presented by SONI. Full details of this network analysis scenario can be found within Section 6.

It is clear that Moffat will become congested in the next gas year 2023/24 and nominations will be required at the South North Entry point. If there are insufficient pressures available in Scotland (i.e if pressures in the SWSOS are lower than the historic pressures presented in Section 5.4 of this report), a proportion of the 89GWh nominated at Moffat, that could historically have been flowed at Moffat, will be required to flow at Gormanston where higher pressures (than in SWSOS) will be available. In

the SONI scenario, should the historic pressures of +70barg not be available at Twynholm and if the inlet pressure is limited to the TA maximum pressure cap, it will not be possible to maintain suitable system pressures without Carrickfergus operating in free flow mode (i.e. allowing gas to flow in both directions across the AGI) and the NI Gas Network will be facing a System Constraint declaration. GNI are currently engaged with UR to explore the option of free flow at Carrickfergus.

To enable this and hence ensure NI gets the maximum physical benefit from the existing infrastructure and contractual arrangements, the TSO's recommend having commercial arrangements in place that enables the TSO's to direct flow in this manner or introduce market reforms such that the market signals the most effective and efficient behaviour at entry and exit points. The TSO's are engaged with UR in a Capacity Management Workstream, part of which involves working with SONI to determine the frequency of high demand scenarios, to better inform the outcomes of the workstream.

The modelling and forecasts within this report are based on data gathered up to the end of March 2022. The TSO's recognise that the full impact of potential reduced gas consumption in recent months related to current high energy prices may not be fully captured within this report.

NI Energy Strategy

The NI gas network plays a hugely significant role in NI's energy supply mix; reliably, safely and efficiently providing over 16TWh through gas year 2020/21, which is forecast to be sustained. The flexibility offered by the substantial usable energy storage capability inherent in the network (typically upwards of 10 GWh per day) is of real value in meeting diurnal and seasonal variability in energy demand and supporting intermittency in renewable electricity generation supply. The ever-increasing access to a gas connection across the region creates choice for households (estimated at 550,000 by 2022) to a cleaner source of energy and is important for industrial and economic development, connecting people and opportunities through infrastructure.

The new NI Energy Strategy 'Path to Net Zero'[1], published in December 2021, provides further clarity on the future role of the gas transmission network in delivering future energy requirements. The TSO's welcome the publication of the NI Energy Strategy and look forward to engaging with stakeholders to collaborate on the important contribution the gas network can continue to make in delivering a clean energy system, balancing decarbonisation and sustainability with security of supply and costs to consumers. It is the TSO's intention to include specific scenarios to

[1] https://www.economy-ni.gov.uk/publications/energy-strategy-path-net-zero-energy

assess the impacts of biomethane injection on the NI gas system in next year's Gas Capacity Statement.

2 Introduction

Overview

2.1 The aim of the Northern Ireland Gas Capacity Statement ("**NIGCS**") is to provide an assessment of the ability of the Northern Ireland ("**NI**") transmission network to meet forecast demands on the network over a ten-year period, based on certain scenarios and assumptions.

2.2 The NI Transmission System Operators ("**TSOs**") are obliged, via the NI Network Gas Transmission Code and their respective Gas Conveyance Licences, to produce a capacity report based upon network analysis of relevant supply and demand scenarios.

2.3 The NI TSO's are;

- GNI (UK) Limited ("**GNI (UK)**");
- Mutual Energy ("**MEL**"), on behalf of its relevant subsidiaries;
    - Premier Transmission Ltd. ("**PTL**");
    - Belfast Gas Transmission Limited ("**BGTL**"); and
    - West Transmission Limited ("**WTL**")[2]

Report Structure

2.4 This document hereafter is set out as follows:

Section 3: Provides an overview of the existing NI transmission network and future infrastructure projects that are currently being considered.

Section 4: Provides information on historic and forecast NI gas demand.

Section 5: Sets out the scenarios that have been modelled.

Section 6: Sets out the modelling results.

Section 7: Provides commentary on a range of relevant matters.

Appendix 1 – Northern Ireland Demand Forecast

Appendix 2 – Summary of System Modelling Assumptions

Appendix 3 – Detailed Modelling Results

Appendix 4 – Maps

[2] WTL is not a TSO (Transmission System Operator) but it is referred to as a TSO in this document for simplicity.

Appendix 5 – Technical Note 2: SONI Sensitivity Analysis Modelling Results

3 Northern Ireland Network Overview

3.1 The NI gas transmission system (the "**NI Network**"), for commercial and regulatory purposes, begins at Moffat in Scotland, at the point which connects the GNI (UK) network to National Grid's National Transmission System ("**NG NTS**") in Great Britain ("**GB**"). This connection allows for the seamless importation of gas from GB to NI. From the connection with the NG NTS at Moffat, the GNI (UK) owned Scottish Onshore System ("**SWSOS**") consists of a compressor station at Beattock, which is connected to Brighouse Bay by two pipelines, all capable of operating at 85 barg.

3.2 A second compressor station at Brighouse Bay compresses the gas into the two sub-sea interconnectors through which Gas Networks Ireland ("**GNI**") transport gas to the Republic of Ireland ("**ROI**"), which can operate at pressures in excess of 140 barg if required. This pressurised gas feeds Gormanston Phase 2 Above Ground Installation ("**AGI**"), to which the NI Network also extends via the South-North Pipeline ("**SNP**").

3.3 Before reaching the Brighouse Bay compressor station, an offtake station at Twynholm supplies gas to NI via the Scotland to Northern Ireland Pipeline ("**SNIP**"). The SNIP pipeline has a Maximum Operating Pressure ("**MOP**") of 75 barg. While there is no compressor station dedicated to the SNIP alone, PTL has the contractual ability to request and pay for elevated Twynholm inlet pressures above the contractual guaranteed supply pressure to Twynholm inlet of 56 barg – see Table 5-1 for maximum pressures available.

3.4 The SNIP (600 mm nominal diameter) was completed in 1996 and connects to the SWSOS at Twynholm in Scotland and has a MOP of 75 barg. The pipeline is 135 km long and runs towards the coast near Stranraer and crosses the Irish Sea to terminate at Ballylumford Power Station, Islandmagee. The SNIP is owned and operated by PTL.

3.5 A map of GNI (UK), GNI and MEL infrastructure in Scotland and Ireland is shown in Figure 3-1.

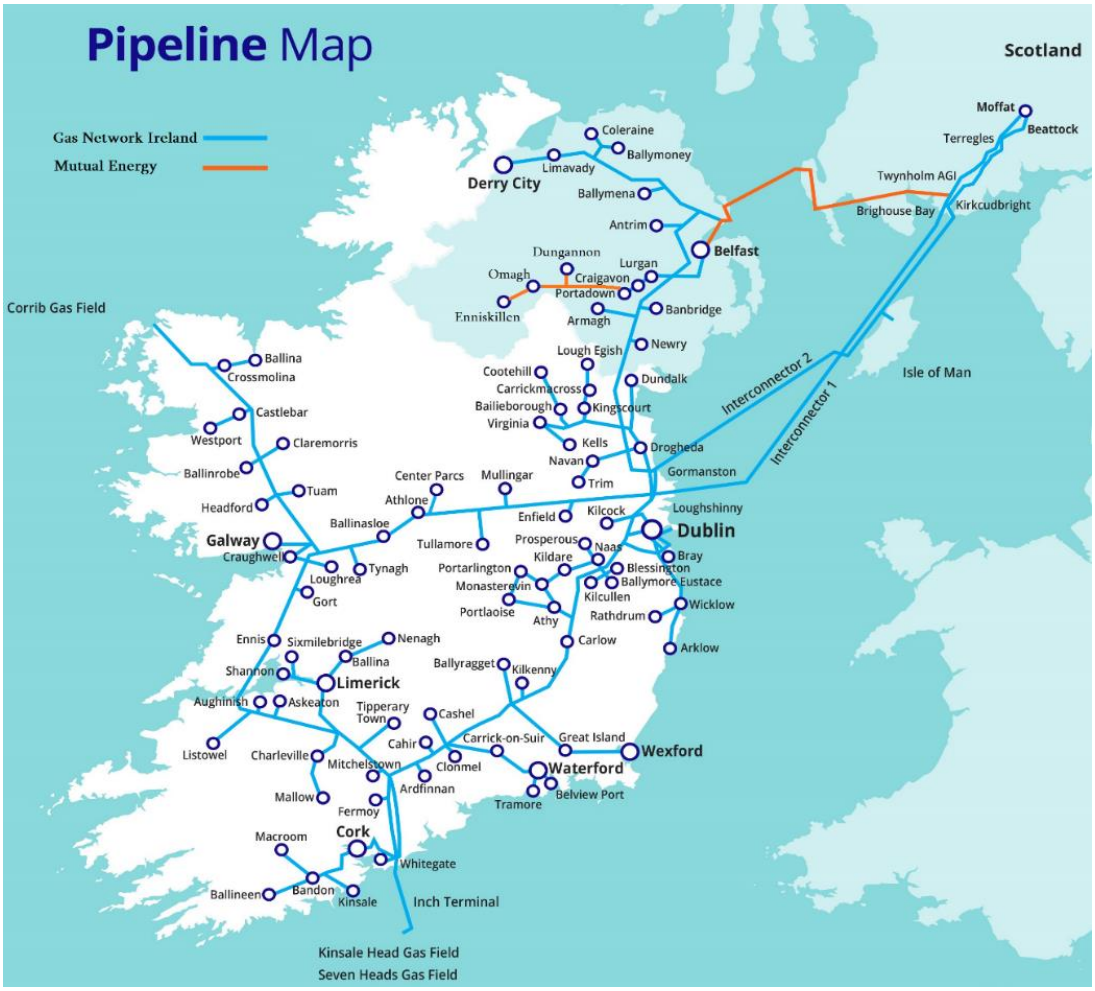


Figure 3-1: Northern Ireland Transmission Network Map (GNI (UK)/MEL infrastructure in Scotland and GNI infrastructure in the Republic of Ireland are also shown).

3.6 The Belfast Gas Transmission Pipeline ("**BGTP**") comprises a further 35 km of 600 mm pipeline with a MOP of 75 barg and runs from Ballylumford via Carrickfergus to Belfast, where it supplies the Phoenix Natural Gas ("**PNGL**") distribution network. The BGTP is owned and operated by BGTL.

3.7 The North-West Pipeline ("**NWP**") (450 mm nominal diameter) connects to the BGTP at Carrickfergus and extends a further 112 km from there to Coolkeeragh power station. The NWP is owned and operated by GNI (UK). The Firmus Energy distribution network connects several towns to the NWP.

3.8 The SNP (450 mm nominal diameter), built in 2006, connects to the NWP at Ballyalbanagh, Co. Antrim and extends 156 km to Gormanston, Co. Meath in ROI. The SNP supplies, through the Firmus Energy (Distribution) Limited ("**FeDL**") distribution network, the towns in the corridor from Newry to Belfast as well as an offtake supplying the PNGL distribution network. The pipeline facilitates supplies into the NI Network

via GNI's Interconnector 2 ("**IC2**")[3] by booking capacity and placing nominations at the South North IP Entry Point and through the ROI transmission system.

3.9 In 2015, following an open competitive process, conveyance licences were awarded for the 'Gas to the West' ("**GTTW**") network extension, to MEL (through its subsidiary WTL) for the transmission element and to SGN Natural Gas ("**SGNNG**") for the distribution element. This system is known as the West Transmission Pipeline System ("**WTPS**").

3.10 The construction of the circa. 200 km of gas pipelines (78 km being transmission pipeline) as part of the GTTW Project commenced in October 2017 and was completed and commissioned by 2019 (the Strabane connection commenced operation before then, in 2017). It is estimated that this project will, in future, connect up to 40,000 new business and domestic consumers to natural gas in the West and North-West.

3.11 Figure 3-2 shows a map of the NI Network from Moffat in Scotland to Gormanston in the ROI.

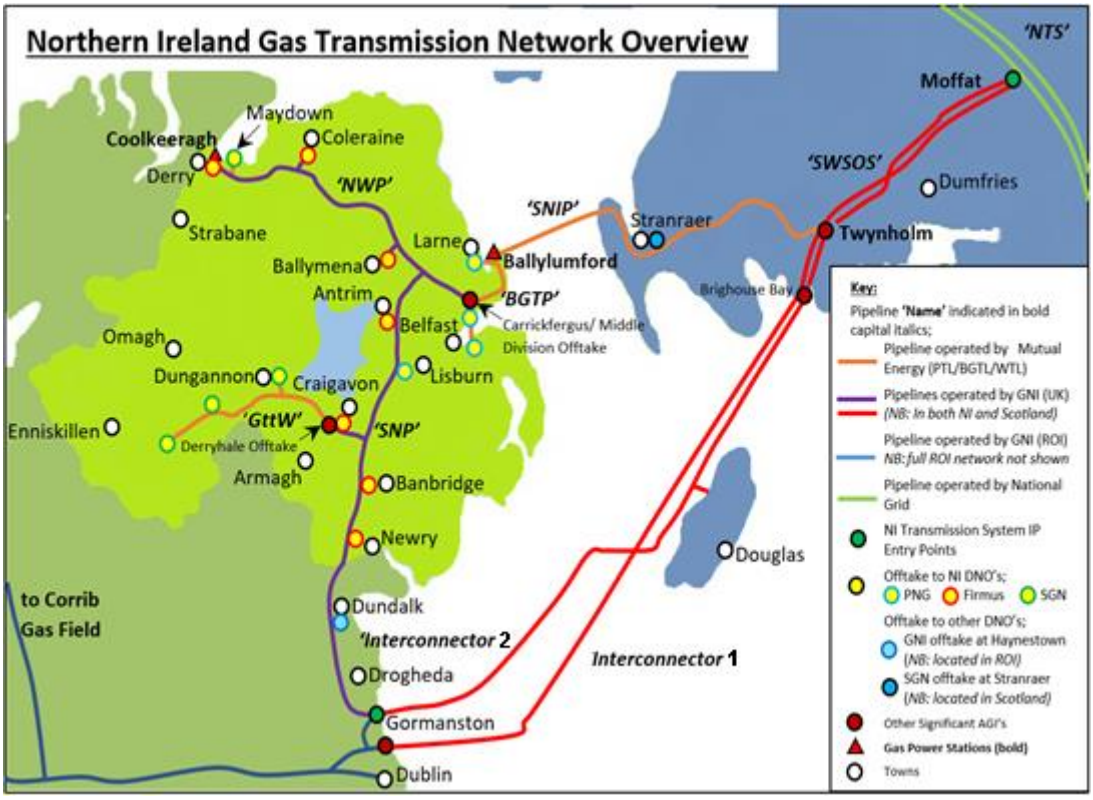


Figure 3-2: NI Transmission Network Map

[3] IC2 is a 195km sub-sea pipeline that runs from Brighouse Bay compressor station in southwest Scotland to Gormanston, Co. Meath, Ireland.

Northern Ireland Distribution System

3.12 Three Distribution Network Operators ("**DNO's**") currently operate within NI.

3.13 PNGL own and operate the distribution network in the Greater Belfast (including Larne) and 'East Down' area. They were awarded their conveyance licence in September 1996 and presently have over 241,597 connections[4] A map of the PNGL licensed area is shown in Figure A4-1 in Appendix 4 – Maps.

3.14 FeDL own and operate the distribution network in the area commonly referred to as the 'Ten Towns'. FeDL was awarded their conveyance licence in March 2005 and have over 62,333 connections[4]. A map of their licence area is shown in Figure A4-2 in Appendix 4 – Maps.

3.15 SGNNG own and operate the distribution network in the main conurbations in the west of NI. SGNNG was awarded their conveyance licence in February 2015 and have over 2,546 connections[4]. A map of their licence area is shown in Figure A4-3 in Appendix 4 – Maps.

3.16 Figure 3-3 below illustrates an overview of their respective Gas Supply Areas.

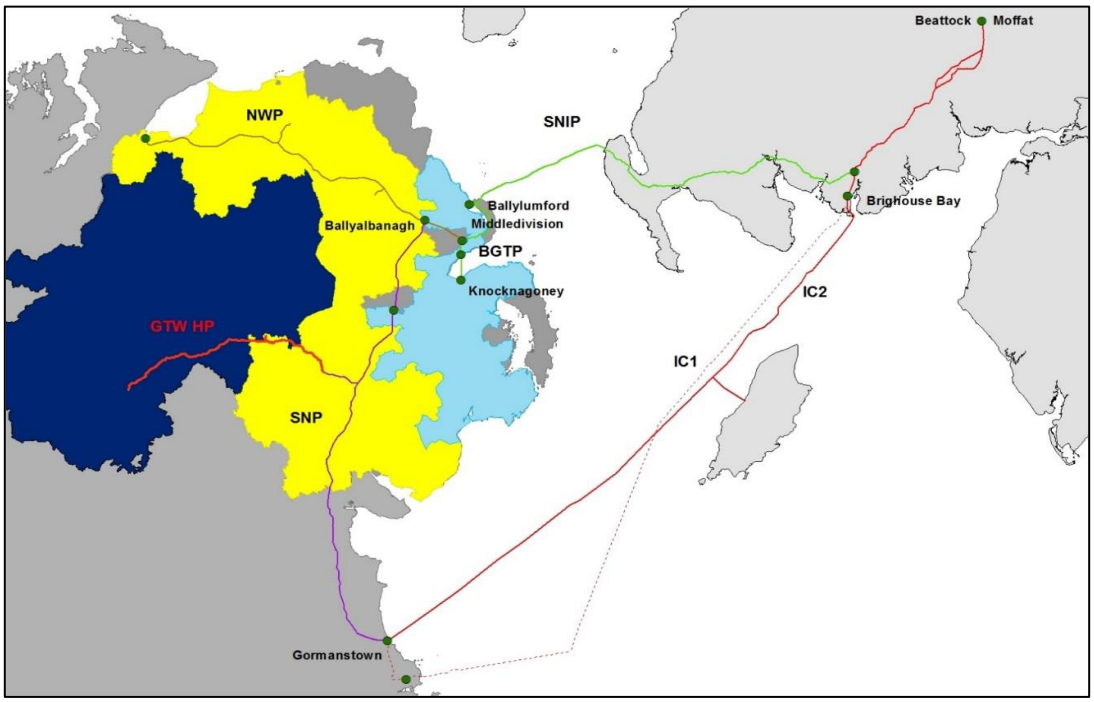


Figure 3-3: NI Distribution Gas Supplies area overview, PNGL area in light blue, FeDL areas in yellow and SGN area in navy.

[4] Utility Regulator Quarterly Retail Energy Market Monitoring Report, Quarter 1 January to March 2022

Haynestown and Stranraer

3.17 SGN operate a distribution network supplying the town of Stranraer in Scotland, which is supplied via the SNIP, and GNI operate a distribution network supplying the Dundalk area in ROI, which is supplied via the SNP. Hence, these loads are to be considered within the scope of this document in assessing the capacity of the NI transmission network to supply their demand.

3.18 To cater for supplying such demand, these two offtakes have reserved capacity in the NI Network (i.e. capacity not available to NI Shippers), as described below;

3.18.1 an offtake on the SNIP at Stranraer in Scotland, already in commercial operation but which from Gas Year 2021/22 shall have arrangements under the 'Stranraer Interoperator Agreement' between PTL and Scotland Gas Networks such that it shall have reserved capacity of 0.931 GWh/day (equating to 0.084 mscm/d) at Moffat and at the 'Stranraer Exit Point', and;

3.18.2 an offtake on the SNP near Haynestown in ROI (to supply a spur of the ROI System), which commenced operation on 19 February 2021 under a 'Use of System Agreement' between GNI (UK) and GNI such that it shall have reserved capacity of 6.6 GWh/day (equating to 0.597 mscm/d) at Gormanston and at the 'ROI System Exit Point'.

Additional Gas-Fired Power Generation

3.19 EP UK Investments ("**EPUKI**") acquired AES' NI assets (namely Kilroot and Ballylumford power stations) in June 2019. Kilroot power station is being connected to the NI gas transmission system in 2022 and the current coal units are to be retired. EP Kilroot were previously awarded capacity in the T-4 auction for two Open Cycle Gas Turbines, each with 350MWe output (aggregate derated capacity of 557MWe). The Single Electricity Market ("**SEM**") 2024/2025 T-4 Capacity Auctions have confirmed the award of 216.22MWe new gas-fired power generation (de-rated) capacity to Kilroot. This capacity is in addition to the previously award 557MWe (de-rated) capacity awarded to Kilroot in the previous T-4 auction. It is expected that this additional capacity will be met by converting the new Kilroot Open Cycle Gas Turbine ("OCGT") to Combined Cycle Gas Turbine ("CCGT"), with the addition of a Steam Turbine resulting in a 2+1 CCGT configuration. Although this has not been modelled within this year's NIGCS, Kilroot as CCGT in normal operation should place less stress on the gas transmission system due to the nature of operation and efficiencies compared to OCGT. The TSO's are engaged with SONI to undertake further network analysis regarding the potential future dispatch scenarios of the three NI power stations, including scenarios following the completion of the second N/S tie line in 2025/26, with different levels of electricity export through the electrical interconnectors.

Potential Additional Gas Connections

3.20 Islandmagee Energy Limited ("**IMEL**"), a subsidiary of InfraStrata plc, hold the development rights to an Underground Gas Storage project located in Islandmagee, Co. Antrim. A mandatory Marine Licence (which required approval of the Minister for the Department for Agriculture, Environment and Rural Affairs ("**DAERA**")) was awarded in October 2021 but is currently subject to a judicial review. Confirmation of the potential operational commencement date is presently not available.

4 Northern Ireland Gas Demand

Historic Annual Demand

4.1 Figure 4-1 and Table 4-1 below show the historic annual NI Network total demand and the breakdown of such between the Distribution (including Haynestown and Stranraer) and Power generation sectors, from Gas Year 2012/13 to 2021/22.[5] A gas year begins on 1st October and ends 30th September each year.

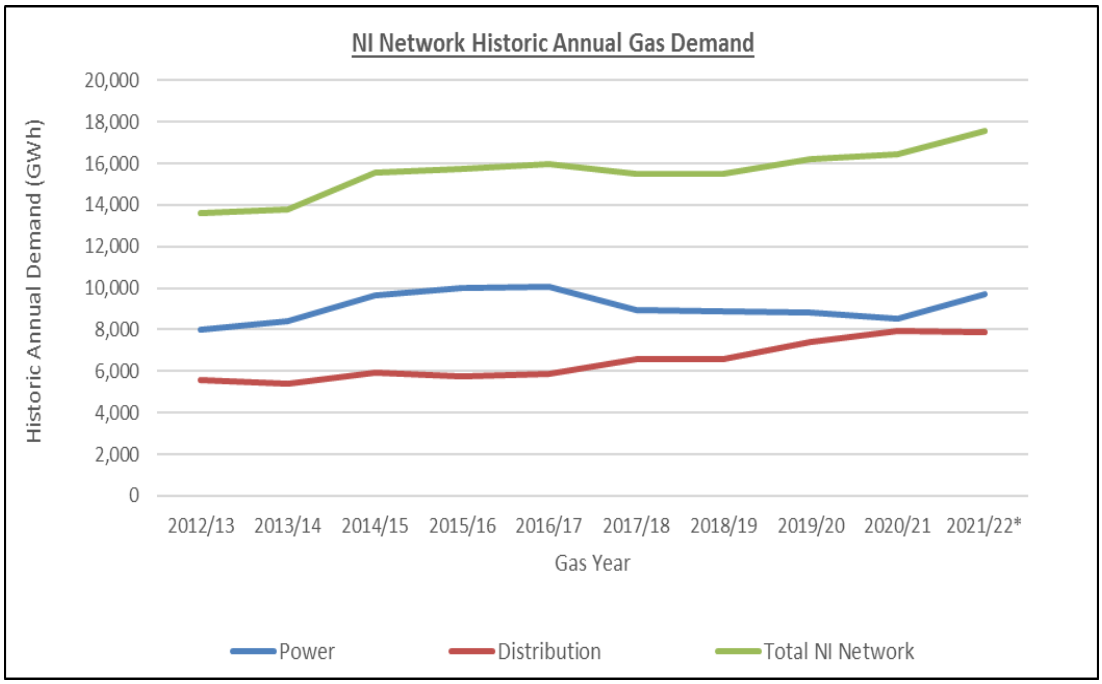


Figure 4-1: Historic NI Annual Demand - Energy (GWh/year)

Table 4-1: Historic NI Annual Demand - Energy (GWh/year)

	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22[6]
Power	7,986	8,390	9,646	10,011	10,082	8,925	8,894	8,801	8,504	9,688
Distribution	5,603	5,377	5,935	5,732	5,870	6,568	6,589	7,388	7,950	7,883
Total NI Network	13,589	13,767	15,581	15,743	15,952	15,493	15,483	16,189	16,454	17,571

[5] Note, gas year 2021/22 includes a combination of actual demand to end of March 2022 and forecasts for April to September 2022.

Power Sector

4.2 Figure 4-2 and Table 4-2 below illustrates the changing proportions of electricity generation sources in NI through the period 2014 to 2021.[6]

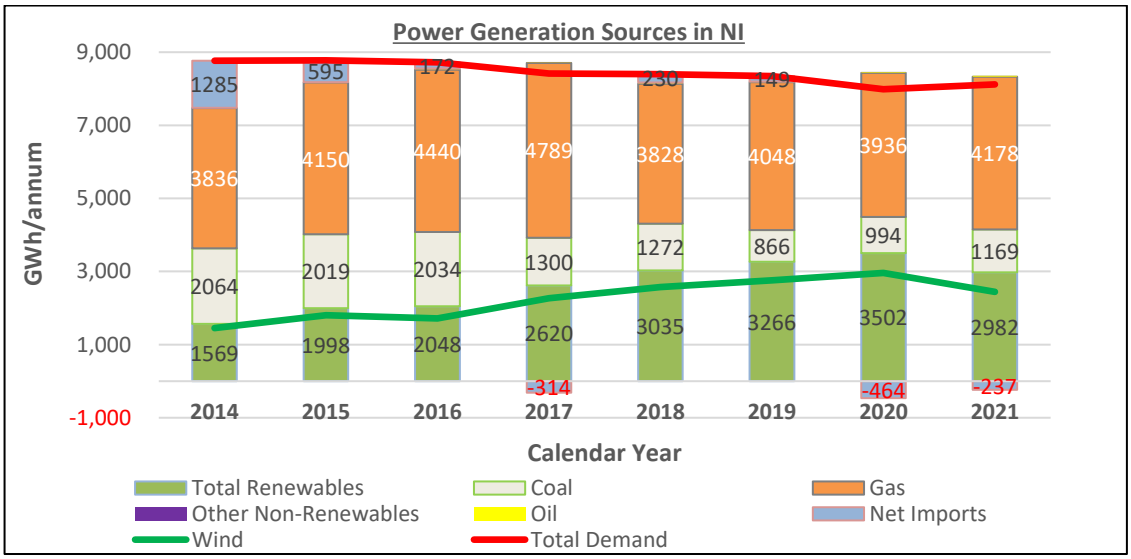


Figure 4-2: Historic NI Annual Electricity Demand and Generation 2014 to 2021

Table 4-2: Historic NI Annual Electricity Demand and Generation 2014 to 2021

	2014	2015	2016	2017	2018	2019	2020	2021
Total NI Demand (GWh/year) [7]	8766	8777	8725	8413	8403	8316	7987	8120
Total Renewable (%) [8]	17.9%	22.8%	23.5%	31.1%	36.1%	38.9%	43.8%	36.7%
Wind (%) [9]	*16.6%*	*20.5%*	*19.7%*	*27%*	*30.7%*	*33.2%*	*37.1%*	*30%*
Gas Fired (%)	43.8%	47.3%	50.9%	56.9%	45.6%	48.7%	49.3%	51.5%
Other Generation (%) [10]	23.7%	23.2%	23.7%	15.7%	15.6%	10.6%	12.7%	14.7%
Net Imports (%) [11]	14.7%	6.8%	2.0%	-3.7%	2.7%	1.8%	-5.8%	-2.9%

[6] Data source: 'System & Renewable Summary Report (Spreadsheet)' available; https://www.soni.ltd.uk/how-the-grid-works/renewables/. All generation figures/proportions stated in this dataset represent net exported energy from generation sources, using metered data provided by SONI.

[7] 'Total demand' is equivalent to 'gross generation' consumed in NI and therefore is greater than total final (net) use / consumption (i.e. it includes losses used by the energy sector / network itself).

[8] 'Total Renewable' generation includes Wind, Solar, Biomass, Biogas, Landfill gas, Hydro and renewable Combined Heat and Power ("**CHP**").

[9] 'Wind' generation figures do not include potential wind generation which was 'curtailed' or 'constrained'.

[10] 'Other Generation' includes Coal, Oil and other non-renewables such as Distribution System Operator Combined Heat and Power ("CHP") and Diesel.

[11] Negative 'Net Imports' indicate net exported energy.

4.3 General trends in electricity generation of significant impact are (i) the increasing penetration of renewable generation; (ii) gas-fired generation increasingly displacing other non-renewable generation (such as coal and oil-fired units etc.), and; (iii) decreasing total generation (indicative of final energy consumption reductions), which is largely attributable to improving energy efficiency measures.

4.4 It is worth noting the reduction in wind generation from 2020 to 2021 which can be explained by a circa 23% reduction in wind availability across the year, along with the increase in demand from 2020 to 2021, resulting in less wind availability to meet a larger demand.

4.5 System Operator for Northern Ireland ("**SONI**") has now confirmed the ability to operate the system at up to 75% System Non-Synchronous Penetration ("**SNSP**") (which includes wind, solar, etc.), following completion of a successful trial in 2022 with an ambition to operate at up to 95% SNSP by 2030.[12] Renewable generation is considered 'priority dispatch' and so gas-fired generation is needed to balance variability in renewable output, which reduces the annual volume of gas needed for power generation.

4.6 In addition to emerging macro trends in the broader electricity market, gas-fired power generation is influenced by numerous factors, including swings in commodity prices (coal, gas and carbon, etc.), plant maintenance and interjurisdiction energy flows, which can either be to the ROI (although still within SEM), via the North South Interconnector, or to GB, via the Moyle Interconnector.

4.7 The SEM allows (subject to physical and technical constraints) the most efficient generation on the island of Ireland to meet all-island electricity demand. However, the continued lack of the second North South Interconnector (also known as the Tyrone to Cavan Interconnector) affects the efficient operation of the SEM and so can result in dispatchable (e.g. gas-fired) power generation needing to run when it otherwise may not be required.[13] Similarly, it can act as a constraint to generation in NI meeting all-island needs.

4.8 The United Kingdom's ("**UK**") Withdrawal from the European Union ("**EU**") (commonly referred to as 'Brexit') has resulted in the SEM becoming de-coupled from the GB wholesale electricity market (and so the Internal Energy Market ("I**EM**") of the EU). This has resulted in less efficient trading (and so power flows) on the interconnectors between SEM and GB, including the Moyle Interconnector, which has knock on impacts to requirements for local power generation (typically requiring

[12] https://www.soni.ltd.uk/newsroom/press-releases/ni-grid-carrying-world-le/index.xml

[13] Dispatchable generation is sources of electricity that can be used on demand and dispatched at the request of SONI, according to market needs. Does not include non-dispatchable generation (e.g. wind and solar).

dispatchable – often gas-fired – power generation to run when it may otherwise not have been required).

Distribution Sector

4.9 As shown in Figure 4-1, demand from the distribution sector has continued on a general upwards trend, reflecting increasing market penetration of natural gas within the domestic and Industrial and Commercial ("**I&C**") sector.

4.10 Figure 4-3 below shows the increasing number of connections to the NI distribution networks in the previous five gas years, with a 28.9% increase in connections in domestic and small I&C consumers (<73,200 kWh/annum).[14]

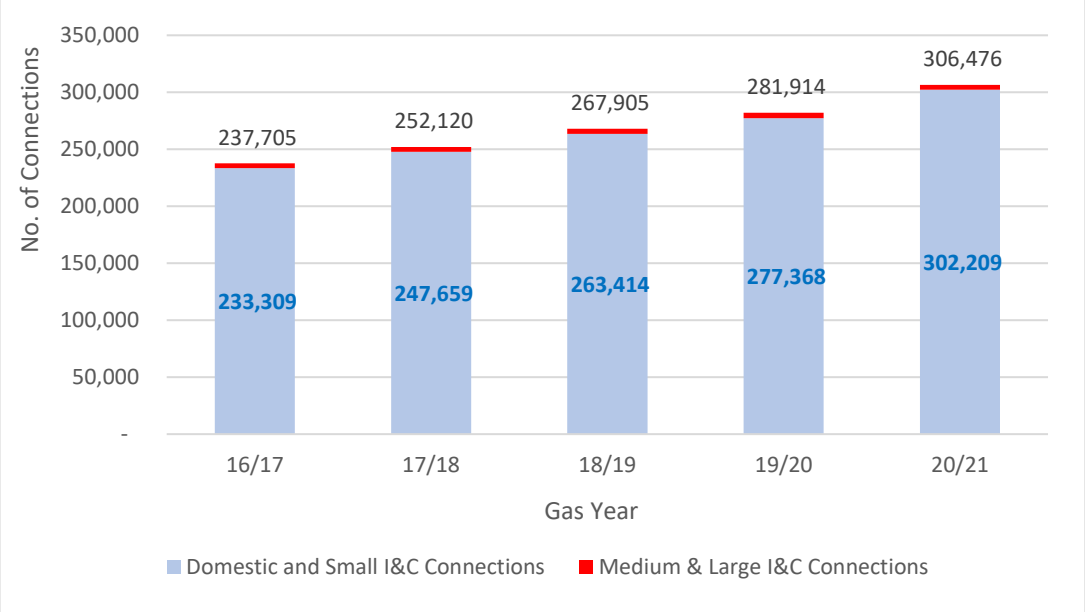


Figure 4-3: Total Number of NI Distribution Network Connections

4.11 Figure 4-4 below illustrates that, while domestic and small I&C consumers represent greater than 98% of all NI distribution network connections, medium & large I&C consumers drive roughly half of distribution consumption.[15]

[14] Utility Regulator Quarterly Retail Energy Market Monitoring Report, Quarter 1 January to March 2022
[15] Utility Regulator Quarterly Retail Energy Market Monitoring Report, Quarter 1 January to March 2022

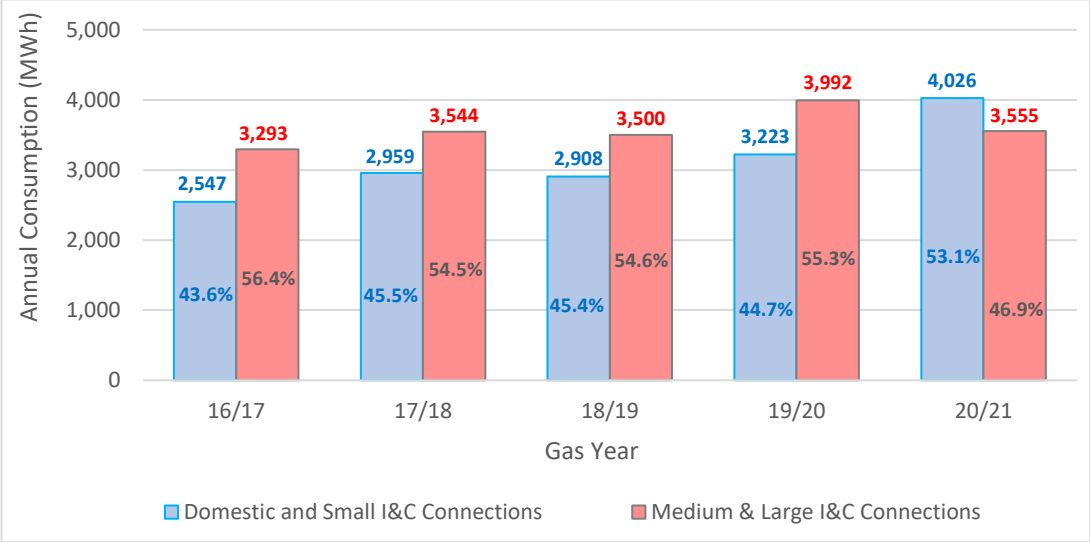


Figure 4-4: Distribution Consumer Sectoral Consumption Proportions

NI Intra-Year Gas Demand

4.12 Figure 4-5 below illustrates day to day variability in distribution, power and total NI Network demand across the period June 2021 to May 2022.

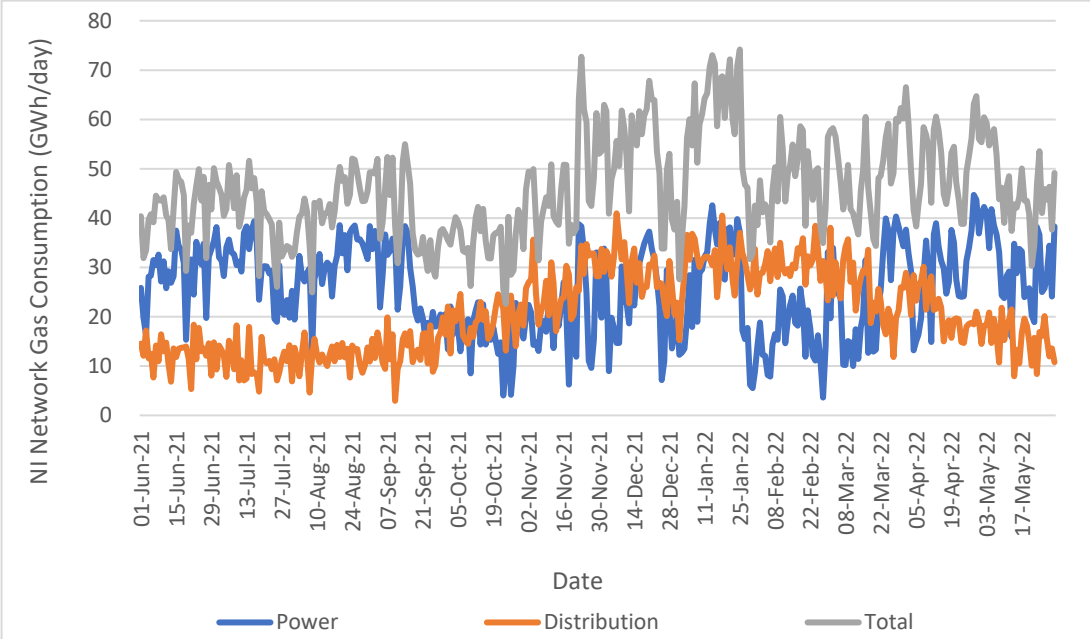


Figure 4-5: NI Network Demand June 2021 to May 2022 – Daily Variability

4.13 Figure 4-6 below shows the same dataset ranked by total NI Network demand and the proportions of such demand from the power and distribution sectors.

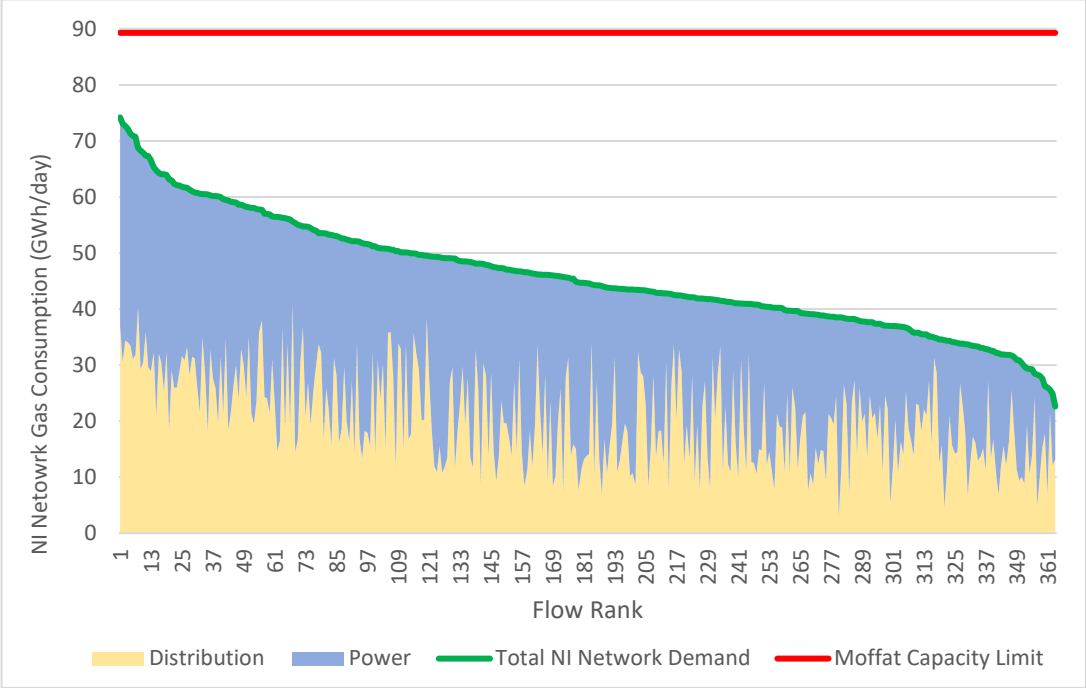


Figure 4-6: NI Network Demand June 2021 to May 2022 – Load Duration Curve

4.14 The developments discussed above in the power and distribution sectors both contribute to increasing variability in NI gas demand across a given year. Figure 4-7 below illustrates the quarterly variability in consumption requirements of domestic and small I&C consumers (the primary driver of their consumption is for heating requirements which is highly temperature sensitive) in comparison to medium & large I&C consumers,[16] whose consumption is more stable for year-round output, but is influenced by wider economic conditions to a greater extent than domestic consumers (as has been noticeably the case during to the COVID-19 pandemic).

[16] Utility Regulator Quarterly Retail Energy Market Monitoring Report, Quarter 1 January to March 2022

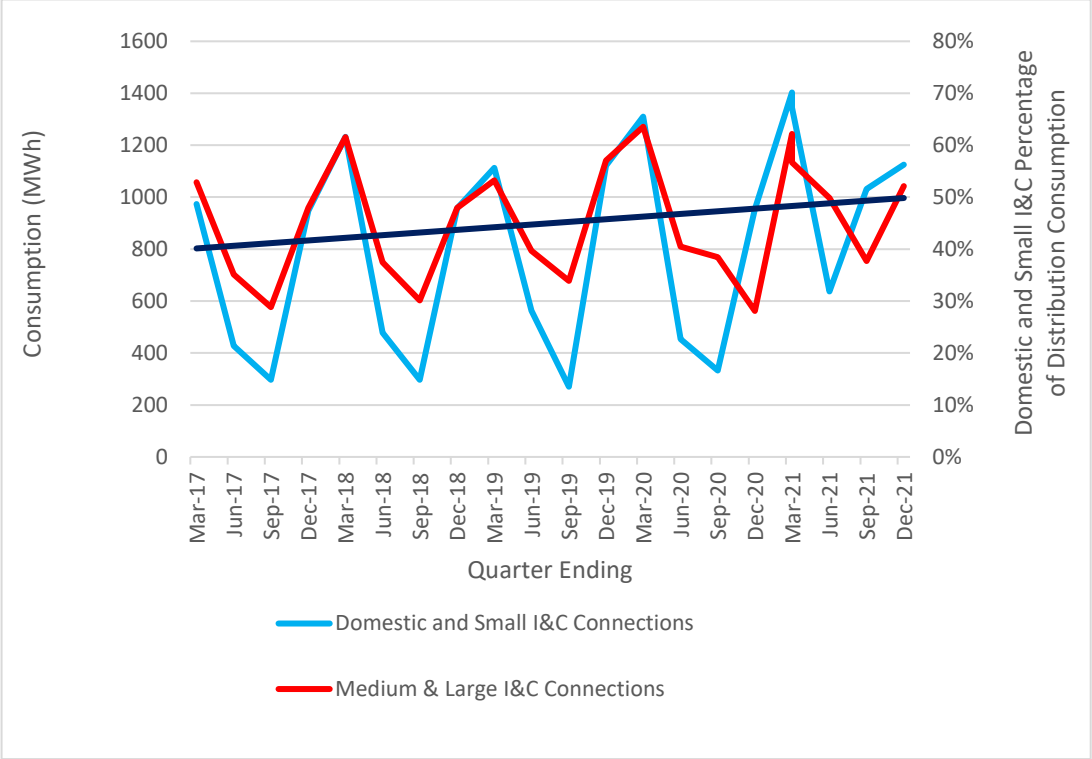


Figure 4-7: Distribution Consumer Sectoral Consumption Proportions

4.15 This results in increased peak capacity requirements, but a reduced 'load factor' (being a decimal description of average utilisation relative to peak consumption) of distribution demand. It is important to note that demand from such domestic and small I&C consumers is considered 'firm' (which means capacity for peak requirements must be provided for), in comparison to some larger medium & large I&C demand, which may be considered 'interruptible'.

Historic Peak Demand

4.16 The historic peak day demand for each of the last ten gas years is summarised by sector in Table 4-3 and Figure 4-8 below.

Table 4-3: Historic Actual Peak Day Demand (GWh/day)

Historic Actual Peak Day Demands (GWh/day)				
Year	**Peak Flow Power**	**Peak Flow Distribution**	**Potential Coincidental Total NI Network Peak Flow**	**Actual Realised NI Network Peak Flow**
2012/13	45.77	28.00	73.77	70.43
2013/14	46.02	27.29	73.31	66.21
2014/15	53.55	31.30	84.85	71.10
2015/16	44.24	35.26	79.50	77.00
2016/17	44.21	35.15	79.36	73.29
2017/18	43.59	40.76	84.35	68.25
2018/19	40.66	35.52	76.18	71.06
2019/20	40.32	37.51	77.83	70.52
2020/21	39.35	41.78	81.13	77.82
2021/22 ^	44.69	40.95	85.64	74.18

^ to 31 May 2022 NI Network Historic Actual Peak Day Demands

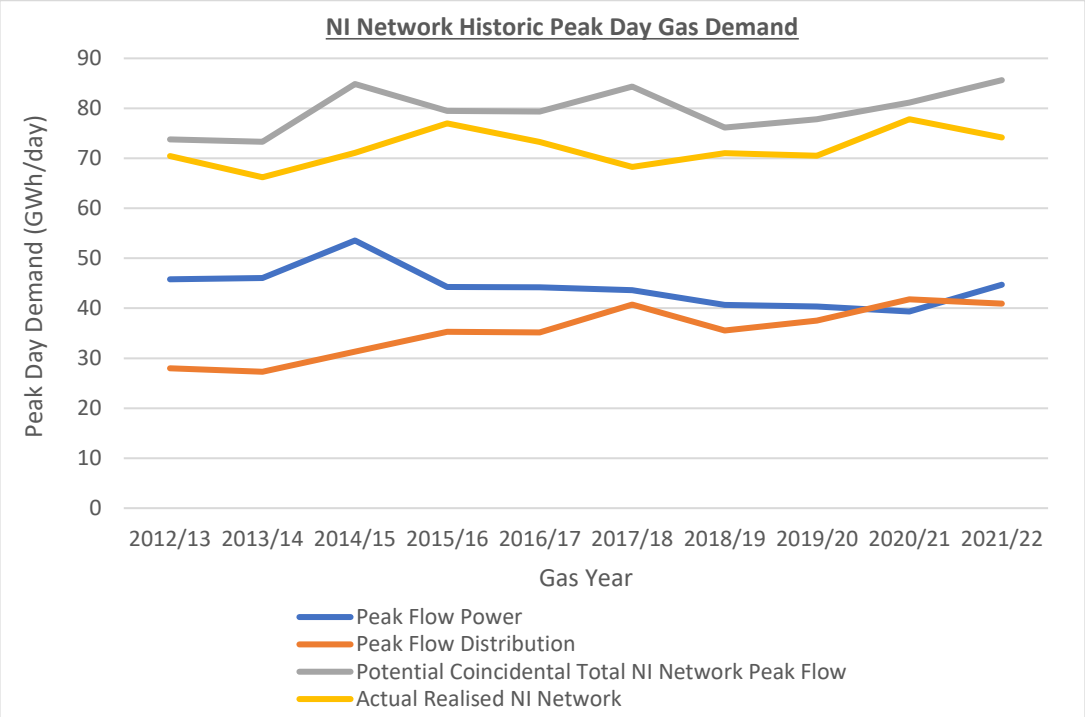


Figure 4-8: Historic Actual Peak Day Demand (GWh/day)

4.17 The actual peak demand in gas year 2021/22 (year to date) was 74.18 GWh/day. The individual peak demands in the power and distribution sectors occurred on 28th April 2022 and 7th December 2021, respectively. Had they occurred simultaneously, peak daily demand may have been 85.64 GWh/day. The historic peak daily demand on the NI Network occurred on 10 February 2021 of 77.82GWh/day, during coincidently high – but not individual peak – demand in both the power and distribution sector.

4.18 A consistent decline in power sector peak demand has been observed across the previous ten-year period, such that in gas year 2021/22 (year to date) it has been 16.5% less than the peak observed in 2014/15. The closure of Ballylumford B Station (initially in 2016 with the closure of one of three units and completely in December 2018) is a contributor to this trend (which provided peaking plant for such high demand days), along with the increasing penetration of renewable energy. However, it should be noted that, although wind generation profiles generally increase in winter, the potential for cold calm prevailing conditions (and the fact winter peak electricity demand occurs after sunset, when the benefit of solar capacity cannot be relied upon) means peak gas network capacity requirements for the power sector do not reduce.

4.19 Prior to gas year 2020/21, the historic distribution peak was 40.76 GWh/day on 1 March 2018. A number of relevant factors contributed to this previous record; (i) temperature conditions were such that seventeen "degree days"[17] were recorded, and (ii) public forewarning of the 'Beast from the East' extreme weather pattern and media coverage that National Grid had issued a gas deficit warning for GB, which may have helped spike domestic demand, in particular, beyond expectations on a purely temperature driven basis.

4.20 By contrast, the conditions on 11 February 2021 – on which a new distribution peak of 41.78 GWh/day was observed – were milder, with only 13.6 'degree days' recorded. This seems to confirm that higher peak demands are more likely in future, as greater numbers of consumers are connected to the gas distribution networks. It is noted that this peak demand was before the Haynestown operational commencement. For the first time, gas year 2020/21 (year to date) has seen peak distribution demand in excess of peak power sector demand.

Forecast Annual Demand

Overview

4.21 The power stations and distribution companies (including SGN for Stranraer and GNI for Haynestown) have provided their forecast annual gas demands for the next 10 gas years.[18] Table 4-4 and Figure 4-9 demonstrates the forecast changes for total demand and also the individual sectors.

[17] 1 degree day equalling each degree Celsius the average daily temperature is below a standard reference temperature of 15.5°C.

[18] All demands are based on the same gas quality assumptions used in the network modelling, as described in section 5.

Table 4-4: NI Network Forecast Annual Demand Gas Years 2022/23 to 2031/32 (GWh/year)

Gas Year	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
Power	8,270	11,754	11,367	9,647	9,158	9,275	9,109	9,043	9,275	9,109
Distribution	7,968	8,313	8,537	8,724	8,902	9,079	9,232	9,385	9,540	9,697
Total NI Demand	***16,239***	***20,067***	***19,905***	***18,372***	***18,061***	***18,355***	***18,343***	***18,429***	***18,817***	***18,808***
Haynestown	180	183	214	217	221	225	228	233	237	241
Stranraer	168	169	163	161	159	172	171	171	171	171
NI Network Total	***16,587***	***20,420***	***20,282***	***18,750***	***18,441***	***18,752***	***18,743***	***18,833***	***19,225***	***19,220***

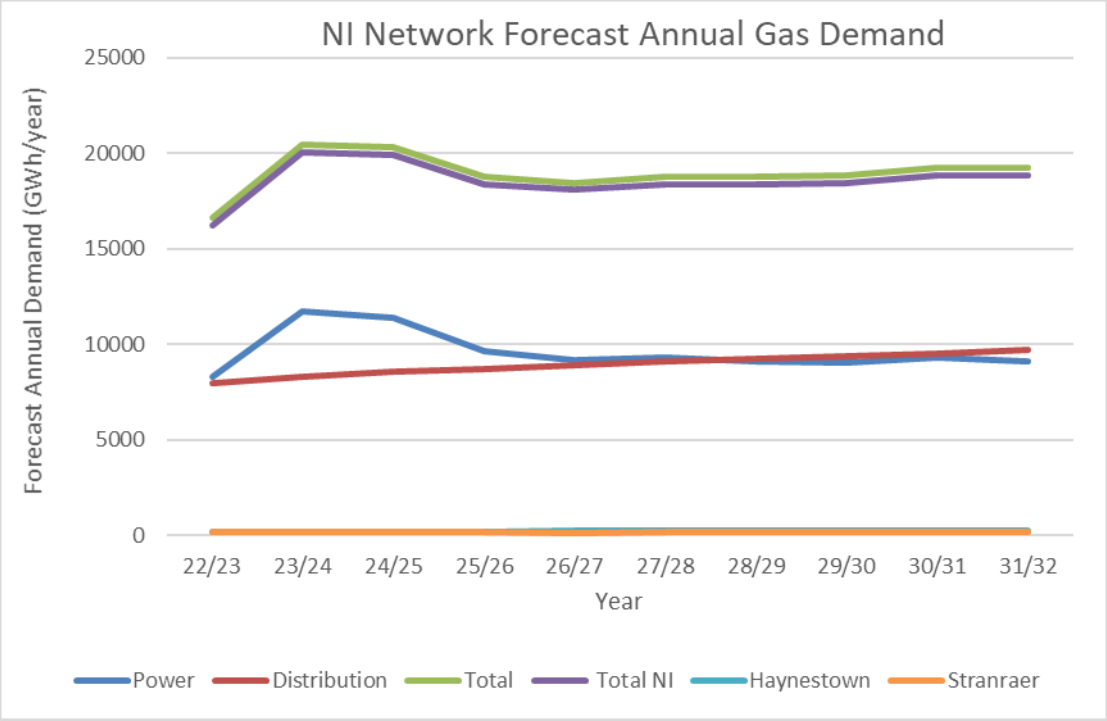


Figure 4-9: NI Network Forecast Annual Demand for Gas Years 2021/22 to 2031/32 (GWh/day)

4.22 The overall ten-year forecast indicates 15.8% forecast growth in gas demand in NI across the period and 15.87% forecast growth in total annual gas demand on the NI Network overall (to include serving the demands of SGN at Stranraer and GNI at Haynestown).

4.23 The forecasts also show a changing demand profile over the period; NI distribution demand is forecast to exceed power demand by 2028/29, as a result of increased distribution demand and forecast decreased power demand resulting from the 2nd N/S tie line, according to the responses received in the NIGCS questionnaires. Also, 'non-NI demand' (being Stranraer and Haynestown) is forecast to grow to

approximately 2.1% of 'total NI Network demand', driven to a greater extent by the Haynestown connection.[19]

4.24 It is important to note that although the above forecast power demand declines following the commissioning of the 2nd N/S tie line (due 2025/26), the TSO's don't believe this will be the case. There are credible scenarios in which this would lead to an increase in peak day gas-fired generation in NI, with the potential for larger electricity exports to ROI (circa 800MW) than is currently the case (circa 300MW). The TSO's are engaging with SONI to complete network analysis on such scenarios.

Capacity Factors

4.25 The 'NI Shipper Moffat Capacity Limit' is 88.35 GWh/day (being 89.28 GWh/day currently available to NI Shippers at Moffat,[20] less 0.931 GWh/day reserved capacity by SGN for Stranraer, as described at paragraph 3.18.1). The 'Total NI Shipper Entry Point Capacity Limit' includes the additional 59.7 GWh/day available to NI Shippers at the South North IP Entry Point (being 66.3 GWh/day technical capacity of Gormanston Phase 2 AGI, less 6.6 GWh/day reserved capacity by GNI for Haynestown, as described at paragraph 3.18.2). Therefore, the 'Total NI Shipper Entry Point Capacity Limit' is 148.05GWh/day. The Capacity Limit for Non-NI Demand is the total Capacity for Haynestown and Stranraer, i.e., 7.531GWh/day. The Capacity Limit for the Total NI Network Demand is the capacity available to NI Shippers from Moffat (including Stranraer's reserved capacity), plus the capacity available from Gormanston Phase 2 AGI, which is 155.58GWh/day total.

4.26 A 'Capacity Factor' is a percentage description of a certain demand divided by installed network capacity. The Capacity Factors across the forecast period for various average annual 'total demands' are provided in Table 4-5 below. These Capacity Factors have been calculated using the forecast Annual Demand figures, as provided in Table 4-4, and the network capacities as described in the paragraph above.

[19] referred to in the NI Network Gas Transmission Code as the "Haynestown Offtake Point", the individual offtake point within the "ROI System Exit Point" at which gas can flow from the NI Network into the ROI System.
[20] Note: this is not the technical capacity limit at Twynholm, rather the current limit commercially available to NI Shippers at Moffat.

Table 4-5: Capacity Factors of various total Annual Demand Gas Years 2022/23 to 2031/32

Capacity Factors of Total Annual Forecast Demands (GWh/day)				
Gas Year	Total NI Demand		Non-NI Demand	Total NI Network Demand
	NI Moffat Capacity[21]	Total NI Shipper Entry Capacity		
22/23	50.4%	30.1%	12.7%	28.6%
23/24	62.2%	37.1%	12.8%	35.3%
24/25	61.7%	36.8%	13.7%	35.1%
25/26	57.0%	34.0%	13.8%	32.4%
26/27	56.0%	33.4%	13.8%	31.8%
27/28	56.9%	34.0%	14.5%	32.3%
28/29	56.9%	33.9%	14.6%	32.3%
29/30	57.1%	34.1%	14.7%	32.5%
30/31	58.3%	34.8%	14.9%	33.1%
31/32	58.3%	34.8%	15.0%	33.1%

Power Sector

4.27 Forecasts have been provided by EPUKI for their Kilroot and Ballylumford power stations, as well as by ESB for Coolkeeragh. The total power generation forecasts provided in Table 4-4 and Figure 4-9 above are the aggregated demand for the three generators only (i.e. no new plant has been assumed. The recent T-4 awarded capacity of 216.22MWe new gas-fired power generation for Kilroot, referred to in Section 3.19, has also not been included).

4.28 Overall power sector forecast demand is expected to increase by 10.1% over the period. However, this is non-linear, with forecast demand peaking in 2023/24 and declining thereafter, with initial growth of 42% from 2022/23 to 2023/24, followed by a 29% decline to the end of the forecast period.

4.29 As there are a number of competing factors and assumptions, there is a level of uncertainty in the forecast annual demand figures for the power stations. This reflects the difficulties the power stations face in predicting a 10-year profile. The forecasts are based upon the power stations' best estimates and latest assumptions. The power stations have provided various commentary on underlying assumptions alongside their forecasts.

4.30 A key assumption (in some questionnaire responses) accounted for the second North South ("N/S") Interconnector becoming operational from 2025 (and that there

[21] For the avoidance of doubt, this relates to physical flows from Moffat via Twynholm (as used in the results section).

would be no other electrical network constraints), which is likely a significant contributing reason behind the aforementioned decline in demand. This would create the potential for newer, more efficient plant (including those located in ROI) to meet NI electricity demand, rather than certain older generation (some of which may be in NI). However, there are also currently credible scenarios where the power sector demand could increase on peak days following the second N/S interconnector due to larger exports from NI to ROI.

4.31 Power Generation forecasts were also provided by SONI for February 2024 which considers the dispatch of the three NI power stations in aggregate. Given that all power stations are unlikely to have their peak on the same day, the SONI scenario gives a more accurate forecast to the peak demand day for the power sector as a whole. SONI provided the hourly gas-fired generation for each power plant in MW, and this was converted into gas consumption (MSCMD) using the various efficiencies of each of the power plants.

4.32 The continued displacement of fossil fuel generation more generally is certainly another significant influencing factor. This is supported by the recent Department for the Economy ("**DfE**") new Energy Strategy 'Path to Net Zero' for NI,[22] which proposes to achieve at least 70% renewable electricity generation by 2030. Certain respondents assumed the ability for the power system to operate at 75% SNSP (i.e. renewable penetration) post 2023-24.

4.33 SONI is anticipating that the North South Interconnector will be fully operational by 2026.[23] Planning permission is in place in both ROI[24] and NI[25]. In October 2021 the approval of planning permission in NI was upheld by the High Court in Belfast following a legal challenge. The window to appeal this decision expired in February 2022. In ROI, a further review of the project has been undertaken on behalf of the Minister for the Environment, Climate and Communications. The results of this review are due shortly.[26] Any delays to this project will likely have significant impacts on forecast dispatch requirements on NI-located gas-fired generation.

4.34 It is now expected the that Kilroot coal-fired generation units will retire by 30 September 2023, by which time the new Kilroot gas-fired OCGT units are expected to be operational.

[22] https://www.economy-ni.gov.uk/sites/default/files/publications/economy/Energy-Strategy-for-Northern-Ireland-path-to-net-zero.pdf
[23] https://www.soni.ltd.uk/the-grid/projects/tyrone-cavan/the-project/
[24] https://www.eirgridgroup.com/the-grid/projects/north-south/the-project/
[25] https://www.infrastructure-ni.gov.uk/news/mallon-grants-planning-permission-north-south-electricity-interconnector
[26] https://www.oireachtas.ie/en/debates/question/2022-03-01/160/

4.35 The competitiveness of gas-fired power generation, and so their merit order within the market, will be influenced by energy policy looking to drive de-carbonisation of electrical generation, which although a devolved matter with the DfE having responsibility for such in NI, is heavily influenced by UK Government policy as well as at an all-island level, due to participation in SEM.

4.36 More generally, assumptions as to electricity demand behind the gas-fired power stations forecasts have been informed by SONI and Eirgrid's Joint All-Island Generation Capacity Statement 2021 – 2030[27] and SONI's Tomorrow's Energy Scenarios Northern Ireland 2020[28] publications, which consider the potential effects of electrification of heat, transport and industry, and other factors affecting potential supply and demand, such as energy efficiency and large new loads.

Distribution

4.37 Forecasted demand of the NI DNO's shows year on year growth ranging from 1.5–5.9%, with a 21.7% increase forecast across the period. Similarly, the NI DNO's have provided various commentary on underlying assumptions alongside their forecasts.

4.38 Estimated volumes for the domestic sector have been based on forecasted connection growth reflecting increasing penetration within the already established and growing network areas.

4.39 A sustained modest impact of business closures as a result of the COVID-19 response has been assumed in the short-term. Outside of some presently known large I&C load, demand in the interruptible sector has been assumed to remain relatively static, with only marginal further forecasted net growth.

4.40 The new NI Energy Strategy 'Path to Net Zero'[29] was published in December 2021, and clarifies issues affecting the future of gas supply and demand. Energy accounts for 59% of all greenhouse gas emissions in NI and heat accounts 38% of NI's total energy consumption[30]. Therefore, decarbonisation of heat is a key aspect of the strategy. With approximately 50.7% of distribution sector consumption in the 12 months to March 2022 (per the previous four UR Quarterly Transparency Reports)[30] being by domestic and small industrial and commercial consumers (which will predominantly be heating load), this will be of significant importance to DNO's future

[27] https://www.soni.ltd.uk/media/documents/208281-All-Island-Generation-Capacity-Statement-LR13A.pdf
[28] https://www.soni.ltd.uk/media/documents/TESNI-2020.pdf
[29] https://www.economy-ni.gov.uk/sites/default/files/publications/economy/Energy-Strategy-for-Northern-Ireland-path-to-net-zero.pdf
[30] Data source: UR Quarterly Transparency Reports, Q2 (April-June) 2021 to Q1 (January-March) 2022; https://www.uregni.gov.uk/market-information

demands (with potential for gas penetration continuing to replace carbon intensive oil fired central heating systems, since the NI natural gas industry is still in the growth phase), but so too will other strategies affecting demand (for example, alternative long-term heat strategies, energy efficiency and gas use in transport, amongst others), as well as potential future gas supply developments (e.g. storage, biomethane and hydrogen, etc.).

4.41 All DNO's have confirmed no consideration has yet been given in the forecasts to any potential demand for gas as a fuel for transport (e.g. Compressed Natural Gas ("**CNG**") for Heavy Goods Vehicles ("**HGV**")).

4.42 In terms of overall natural gas supply, no consideration for biomethane injection at Distribution level (which would manifest as reduced transmission demand) has been given by any of the DNO's. Equally, the TSO's have not considered in this document any such injection sources at transmission level. The NIGCS process will need to develop to incorporate wider NI strategic energy transition planning, (including new renewable energy sources of gas such as biomethane and hydrogen) and consider the impact in terms of both network planning and security of supply.

4.43 SGN demand at Stranraer and GNI demand at Haynestown are forecast to increase by 1% and 33%, respectively, across the period.

Forecast Peak Day Demand

4.44 To assess the system on days of different demand patterns, four sample demand days are analysed for each scenario over the ten-year period modelled: 1-in-20 severe year winter peak day, average year winter peak day, average spring day and summer minimum day. The demand data used for the modelling, as per Shippers' responses to questionnaires issued by the TSO's, is presented in Appendix 1 – Northern Ireland Demand Forecast.

4.45 Since the network is designed to meet firm winter peak demand, there is particular interest in assessing the ability of the network to meet the demands on the two winter peak days:

- the 1-in-20 severe winter firm demand, representing the demand expected in a severe winter peak day that is statistically likely to occur once every twenty years, and;
- an average year peak day firm demand, representing a winter peak day demand during a typical winter (i.e. not abnormally cold etc.).

4.46 Note that the forecast demand figures, used in the sections which follow, represent a simultaneous peak demand across all users of the NI Network and are

therefore conservative compared to historic peak demand days. However, this is considered appropriate for assessing the adequacy of the network as it must be deemed highly reliable and robust, particularly for meeting peak day demand forecasts.

1-in-20 Severe Winter Peak Day Demand (Firm and Interruptible)

4.47 The demand forecasts for the 1-in-20 Severe Winter Peak Firm and Interruptible case are presented in Figure 4-10 and Table 4-6 below. The 'Power' sector includes EPUKI Ballylumford, EPUKI Kilroot and ESB Coolkeeragh. The 'Distribution (NI)' demand includes those of the three NI DNO's (PNG, FeDL and SGNNG). The 'Non-NI' demand includes SGN at Stranraer and GNI at Haynestown.

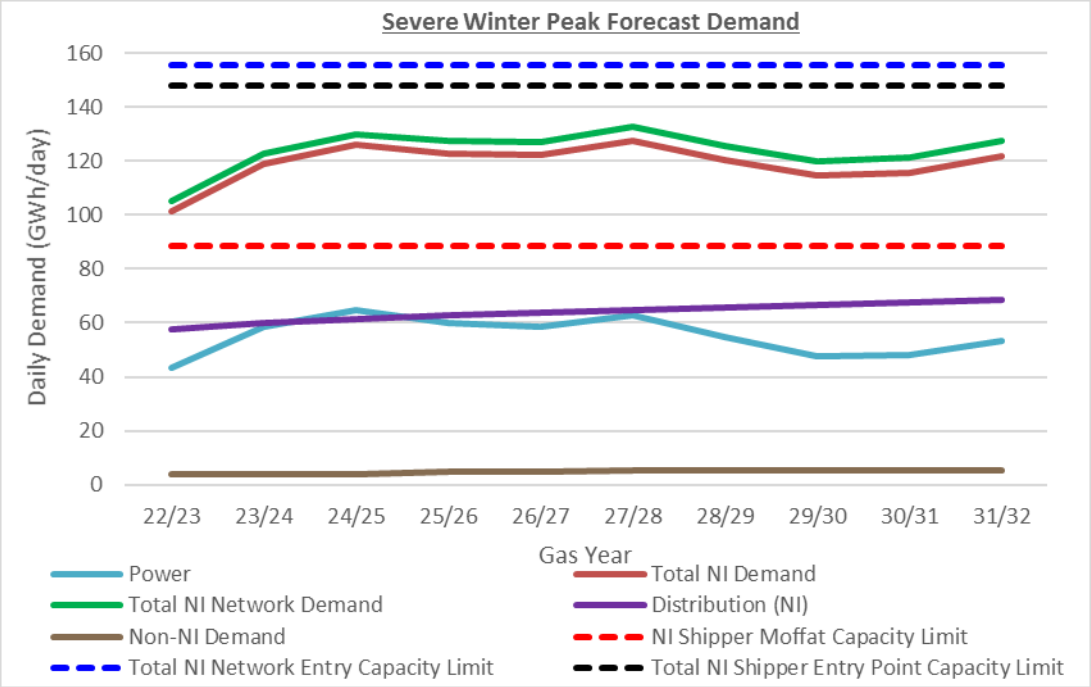


Figure 4-10: Severe Winter Peak Day (Firm & Interruptible) Forecast Demands (GWh/day)

Table 4-6: 1-in-20 Severe Winter Peak Day (Firm & Interruptible) Forecast Demands (GWh/day)

Severe Winter Peak Day (Firm & Interruptible) Forecast Demands (GWh/day)					
Year	**Power**	**Distribution (NI)**	**Total NI Demand**	**Non-NI Demand**	**Total NI Network Demand**
22/23	43.6	57.8	101.4	3.7	105.1
23/24	58.7	60.0	118.8	3.8	122.6
24/25	64.5	61.5	126.0	3.8	129.8
25/26	60.0	62.7	122.6	4.9	127.5
26/27	58.3	63.8	122.1	5.0	127.1
27/28	62.8	64.9	127.7	5.1	132.8
28/29	54.5	65.7	120.2	5.3	125.5
29/30	47.7	66.8	114.5	5.4	119.9
30/31	48.2	67.4	115.7	5.5	121.1
31/32	53.4	68.5	122.0	5.5	127.4

4.48 Peak Total NI Demand is forecast to increase by 22.6% across the period, however significant year-on-year variability is driven by the power sector. Whereas distribution demand (from the NI DNO's) shows consistent growth (ranging from 1.0 – 3.8% year-on-year), such that a 18.5% increase is forecast across the period in that sector, the power sector forecasts a 48% increase in peak demand from 2022/23 to 2024/25, followed by a decline from this point to 22.6% in excess of 2022/23 levels by the end of the forecast period. It is important to note, as stated previously within this report, there are credible scenarios where peak day power demand could increase following the 2nd N/S tie line due to large electricity exports through the interconnectors and therefore it is possible that the peak day power demands from 2025/26 onwards could be larger than those submitted in the NIGCS questionnaires.

4.49 Peak 'Total NI Demand' exceeds the current Moffat capacity available to NI Shippers in every year across the forecast period. This remains the case even when 'interruptible' distribution demands (typically medium and large I&C loads) are discounted from the demand basis. However, the largest peak day demand forecast (127.7 GWh/day) still remains within the current total entry capacity available to NI Shippers (148.05 GWh/day, including 59.7 GWh/day at the South North IP Entry Point). As such, the Capacity Factor of the largest peak 'Total NI Demand' forecast across the period against the current total entry capacity available to NI Shippers is 86.2%, confirming potential scope for further demand growth based on entry capacity. However, while NI has an entry capacity of 14 mscmd, this is not in line with the exit capacity available which varies depending on the demand profiles of users and resulting operating pressures on the NI system. Therefore, the potential of the system

to accommodate further exit demand growth would need to be assessed on a case by case basis.

4.50 The total Severe Winter Peak forecast demand figures have, in the past, been consistently higher than the actual winter peak demands that were recorded because, to date, the peak demands for the power stations and distribution companies have not occurred simultaneously and a severe winter peak day is statistically likely to occur only once every twenty years.

4.51 Interpolating between annual and peak forecasts, an 'Annual Load Factor' (a percentage description of the average load divided by the peak load) can be derived for each sector individually, and is described below;[31]

- Power: range 35.1–52.0%, average 41.7%
- Distribution (NI): range 37.8–38.8%, average 38.3%
- Non-NI Demand: range 20.5–27.4%, average 22.5%

4.52 'Non-NI' peak demand is forecast to grow from 3.5% to 4.2% of Total NI Network peak demand across the forecast period. It is noted that Stranraer forecast peak demand exceeds its current reserved capacity (0.931 GWh/day) from 2027/28 onwards peaking at 0.939 GWh/day, whereas Haynestown demand remains within its reserved capacity.

Average Winter Peak Day Demand (Firm and Interruptible)

4.53 The demand forecasts for the Average Winter Peak Firm and Interruptible case are presented in Figure 4-11 and Table 4-7 ,below.[32]

[31] note, these may vary significantly between individual network users within each sector.
[32] Note: these figures therefore represent a simultaneous peak demand across all users of the NI Network.

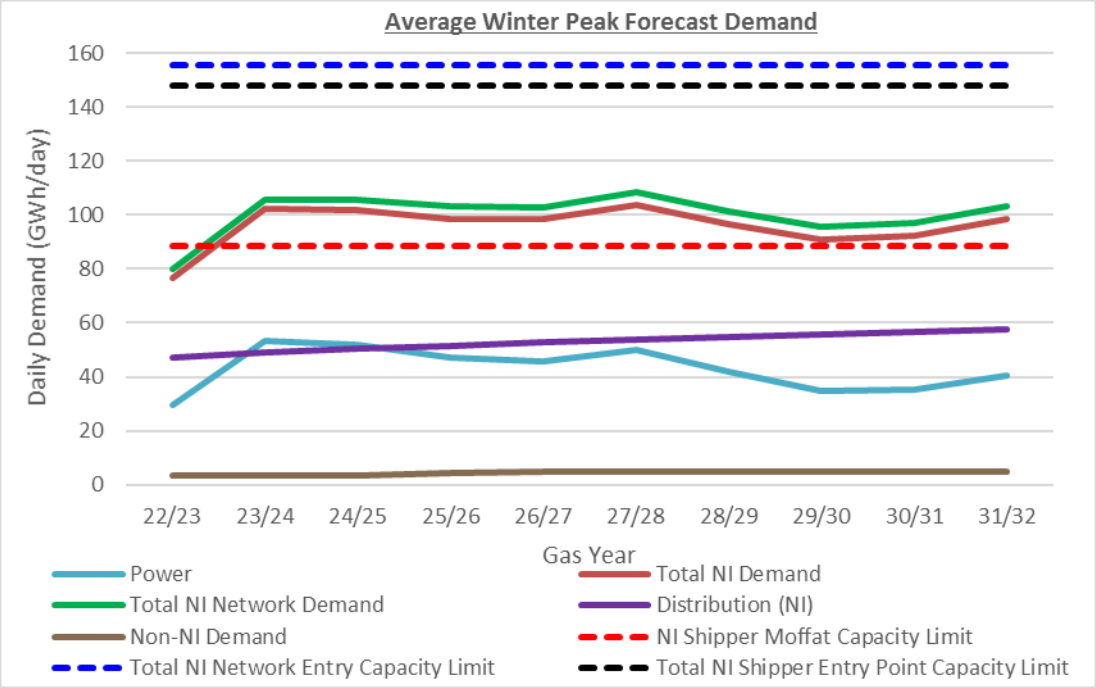


Figure 4-11: Average Winter Peak Day (Firm & Interruptible) Forecast Demands (GWh/day)

Table 4-7: Average Winter Peak Day Firm and Interruptible Forecast Demand for Base Case Scenario

Average Winter Peak Day (Firm & Interruptible) Forecast Demands (GWh/day)					
Year	**Power**	**Distribution (NI)**	**Total NI Demand**	**Non-NI Demand**	**Total NI Network Demand**
22/23	29.4	47.2	76.6	3.3	80.0
23/24	53.4	48.9	102.3	3.4	105.7
24/25	51.7	50.3	102.0	3.4	105.4
25/26	47.1	51.5	98.6	4.5	103.2
26/27	45.5	52.8	98.4	4.6	103.0
27/28	50.0	54.0	103.9	4.7	108.6
28/29	41.7	54.9	96.7	4.8	101.5
29/30	34.9	55.8	90.7	4.9	95.6
30/31	35.4	56.7	92.1	5.0	97.1
31/32	40.6	57.8	98.4	5.0	103.4

4.54 Total NI peak demand is forecast to increase by 28.4% across the period. However, similar to the Severe Winter Peak scenario, significant year-on-year variability is driven by the power sector forecasts. While 75% growth in power sector Average Winter Peak forecasts is observed up to 2023/24, this is followed by a decline, such that Average Winter Peak power sector demand is forecast to increase by 38% across the period overall. Overall Average Winter Peak distribution demand (from the

NI DNO's) is forecast to increase by 22% over the period, such that a 28.4% increase in total NI peak demand is forecast across the period.

4.55 Interpolating between annual and peak forecasts, an 'Annual Load Factor' (a percentage description of the average load divided by the peak load) can be derived for each sector individually, and is described below;[33]

- Power: range 42.4–77.1%, average 54.6%
- Distribution (NI): range 46.0–46.2%, average 46.2%
- Non-NI Demand: range 22.3–30.1%, average 24.6%

4.56 The current Moffat capacity threshold available to NI Shippers is exceeded in nine of the ten years across the forecast period. This is also the case when 'interruptible' demands are not included in the demand basis (i.e. accounting only for 'firm' distribution and power sector demands), due to reducing power sector Average Winter Peak forecasts. The Twynholm Entry Point capacity will be exceeded from Winter 2023/24 onwards and demand in excess of 89.285GWh/d (8.08MSCMD) will require capacity booking at the South North Entry Point. NI Shippers should ensure they are registered at the South North Entry point ahead of Winter 2023/24, allowing relevant timescales for this to be implemented.

SONI Sensitivity Analysis: Winter Peak Power Sector Demand

4.57 Demand requirements for gas-fired generation were provided by SONI as part of a stress analysis PLEXOS model. SONI provided a week of data for 2024 which included their 'worst day' for gas-fired generation and of this, the peak three demand days were modelled along with the Average Winter Peak Firm & Interruptible distribution demand. The demand requirements for this scenario are presented in Figure 4-12 and Table 4-8 below.

[33] note, these may vary significantly between individual network users within each sector.

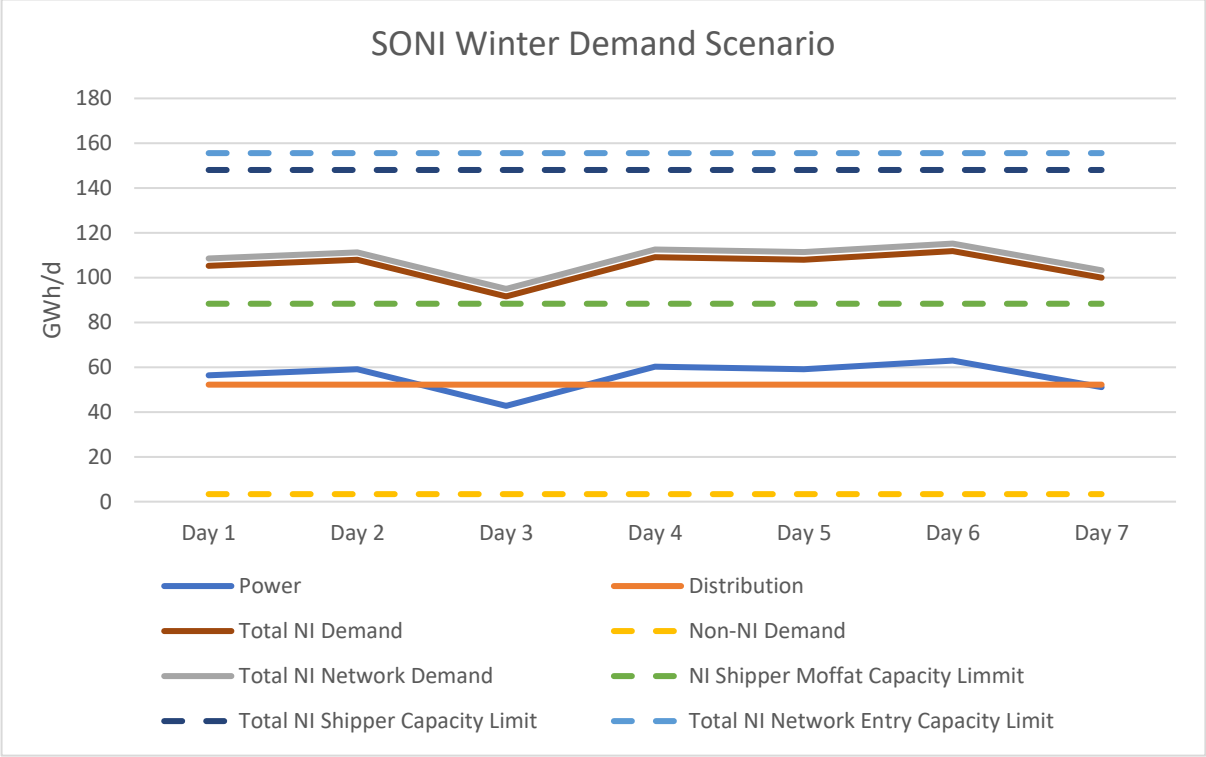


Figure 4-12: SONI Winter Peak Day Demand Scenario Forecasts (GWh/d)

Table 4-8: SONI Winter Peak Day Demand Scenario Forecasts

SONI Winter Peak Day Forecast Demands (GWh/day)					
Day	**Power**	**Distribution (NI)**	**Total NI Demand**	**Non-NI Demand**	**Total NI Network Demand**
1	56.394	52.226	105.259	3.361	108.620
2	59.056	52.226	107.922	3.361	111.283
3	42.746	52.226	91.611	3.361	94.972
4	60.290	52.226	109.156	3.361	112.517
5	59.145	52.226	108.010	3.361	111.371
6	62.973	52.226	111.838	3.361	115.199
7	51.086	52.226	99.952	3.361	103.313

The aggregate Firm & Interruptible Gas Year 2023/24 forecasts for the Average Winter Peak ("AWP") have been used as the distribution load for the SONI scenarios (52.226 GWh/d). SONI provided a week of data for 2024 which included their 'worst day' and of this, the peak three demand days were modelled. These are shown in Table 4-9 below.

4-9: SONI Scenarios Power System Demands Modelled

Daily Flow Requirements (GWh/D)				
Day	Ballylumford	Coolkeeragh	Kilroot	Total Power
3	18.054	18.452	22.553	59.059
5	18.341	18.861	23.095	60.297
7	25.251	19.281	18.441	62.972

General

4.58 In terms of distribution demand, it is worth stating that peak demand on any individual offtake within a DNO's network (or on the DNO's network overall) may occur outside of traditional winter peak period, particularly if that individual network is supplying a high proportion of non-temperature dependent I&C load. This is relevant to many areas of NI and 'non-NI' demand, particularly where a network is presently in its growth phase. This can be expected to continue until there is a significant increase in domestic load.

4.59 It is also worth stating again, that the DNO's forecasts do not account for any distribution level biomethane injection offsetting demands from the NI transmission network. It is standard industry practice to assume, from a system planning perspective, that biomethane injection cannot be guaranteed to be available under peak demand conditions and that all loads are to be met from the transmission network. However, the introduction of biomethane injection will impact the NI network planning and development in the very near term and going forward, i.e. new gas entry sources will predominantly displace existing city gate supplies in areas of low demand, resulting in potential infrastructure development, e.g. city gate metering change or distribution to transmission system backflow.

4.60 In terms of the power sector forecast demands, it is worth noting, again, that the variability seen in power sector forecast is the case despite a significant increase in gas-fired generation capacity coming on to the system after this time via the Kilroot OCGT units (see paragraph 3.19) although there are credible scenarios where the peak power demand may in fact increase following the commissioning of the second N/S electricity tie lie and therefore the peak power demand could be different to that forecast by the power stations.

4.61 The peak forecast demand figures outlined in this section represent a simultaneous peak demand across all users of the NI Network. For a true representation of potential power sector demand, attention should be paid to the

modelling scenario which analyses the gas-fired generation requirements provided by SONI. The above paragraphs support that analysis on the above demand basis will have an in-built degree of conservatism and it is prudent from a system planning perspective to 'stress test' the technical capability of the NI Network to meet potential peak demand requirements. However, any results on these demand bases, while appropriate for the purpose of this report, should be read in the context of the conservatism therein. For reference, Figure 4-13 below shows the historic peak demand forecast vs actual, along with the forecast demand for the Average Winter Peak scenarios for the period.

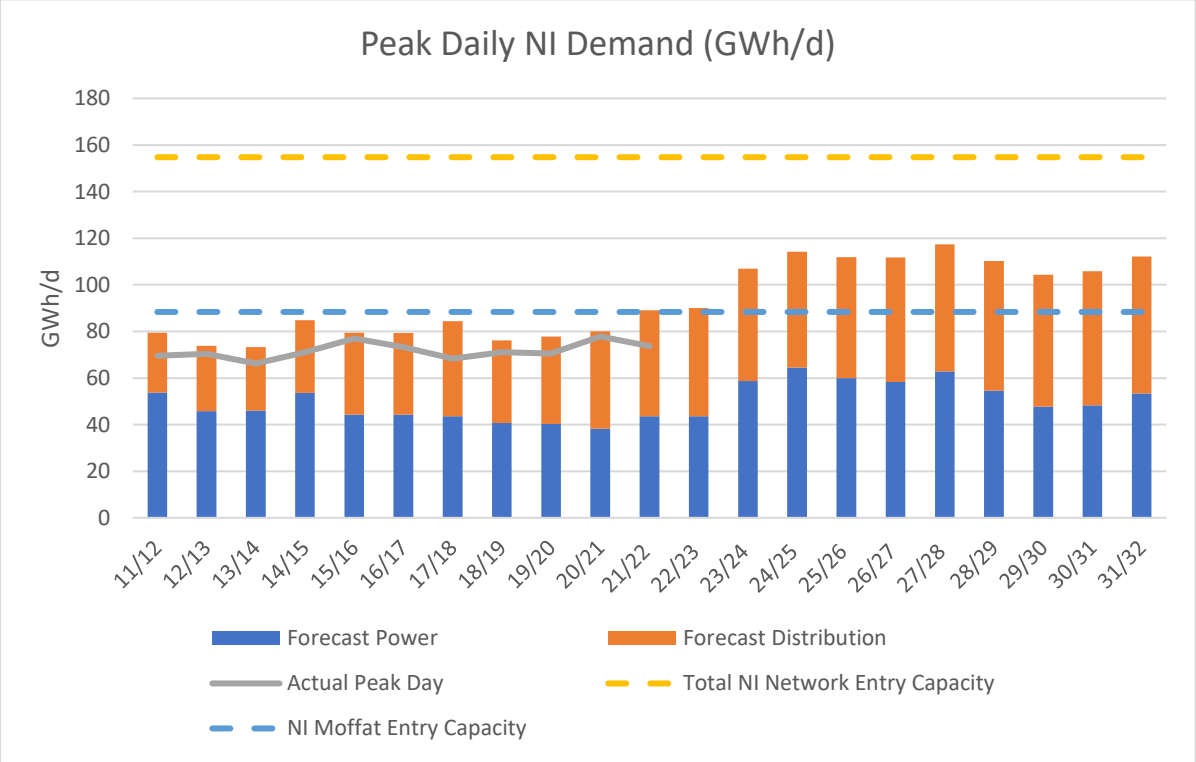


Figure 4-13: Historic vs Actual Peak Demand Days

4.62 The Beattock Station Splitting Project is due to be completed during 2023. Once complete it is GNI(UK)s intention to adjust inlet pressures to its compressors at Beattock as to operate them as efficiently as possible to minimise emissions and fuel gas whilst fulfilling its contractual obligations on delivery under the TA. It is anticipated that this will result in lower pressures being observed at Twynholm than has been the case in recent years. The implications of potential future lower pressures being observed at Twynholm as a result of this change will be assessed in detail as part of the Capacity Management Workstreams.

However, it should be noted that PTL has the contractual ability to request and pay for elevated Twynholm inlet pressures above the contractual guaranteed supply pressure to Twynholm inlet of 56 barg – see Table 5-1 for maximum pressures available.

5 Modelling Scenarios

Overview

5.1 A hydraulic model of the NI Network was constructed using hydraulic modelling software which allows the user to analyse the demand and supply balance on the network for a number of scenarios. The modelling considers the ability of the system to meet the daily demand within that day.

5.2 The model was run for the ten Gas Years from 2022/23 – 2031/32 inclusive, to determine if the existing NI Network has the capacity to meet forecasted and potential additional flow requirements.

5.3 The model was also run using power sector demand provided by SONI from a PLEXOS model which sought to stress test the electricity system. SONI provided one week of PLEXOS data for February 2024 and from this data, the peak three days were modelled, along with the Average Winter Peak distribution demand forecast for 2023/24, to determine if the NI Network has the capacity to support the gas-fired generation required by SONI in the given PLEXOS model.

Modelling Assumptions

5.4 There is no compressor station at Twynholm where gas feeds the SNIP, however, there is a guaranteed minimum contractual inlet pressure at Twynholm of 56 barg. It is noted that historically, the inlet pressures have been typically higher than the contractual guaranteed supply pressure. Figure 5-1 below shows the minimum, maximum and mean average hourly pressure at Twynholm inlet on each day in the 'winter' months (taken as October to March) of gas year 2021/22.

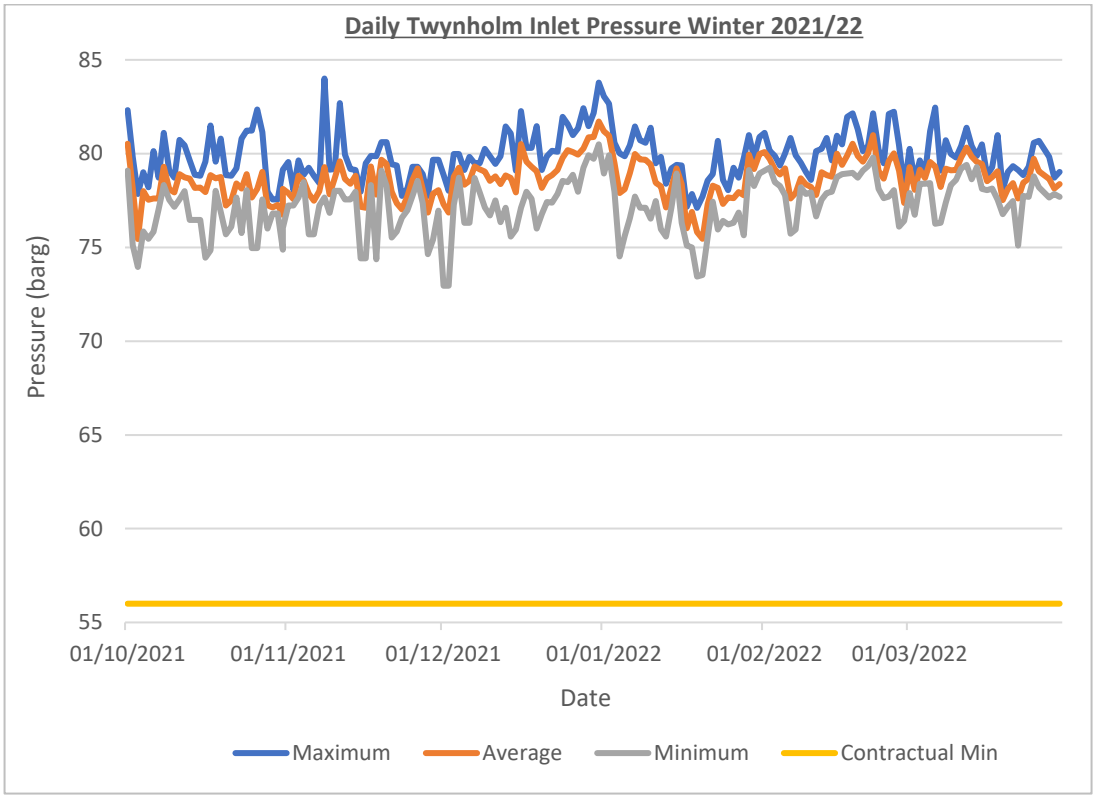


Figure 5-1: Daily Twynholm AGI Inlet Pressure Winter 2021/22

5.5 Figure 5-2 illustrates a duration curve of the same dataset looking at daily minimum pressure on each day, which may allow better depiction and easier understanding of historic pressure trends. As per 4.62, in future lower pressures may be observed at Twynholm than has been the case in recent years.

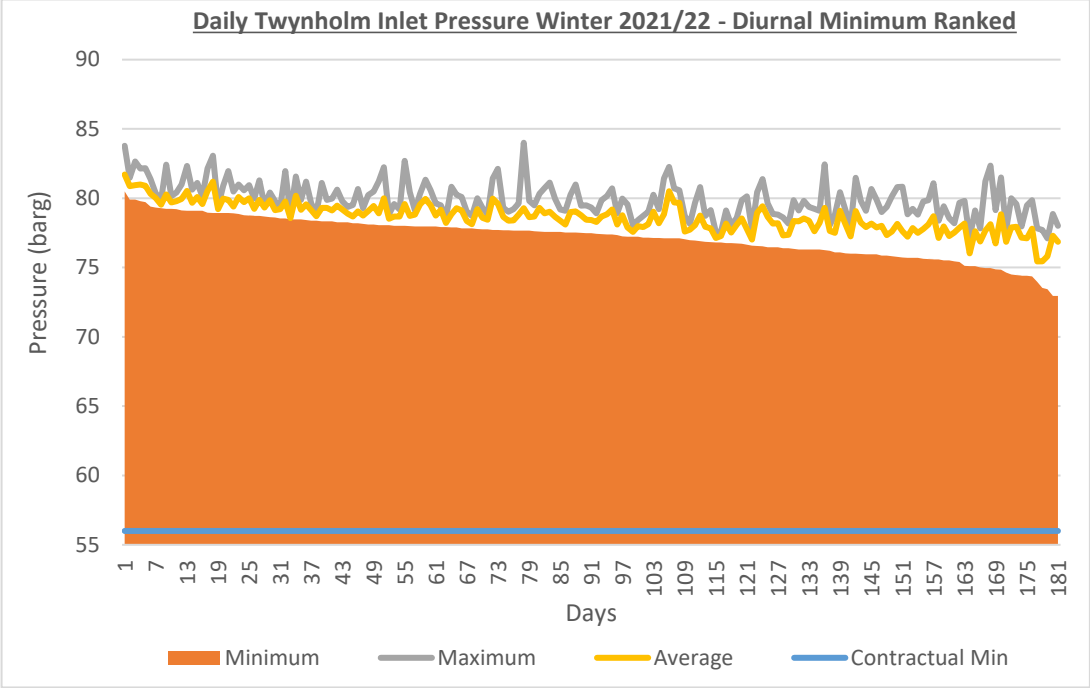


Figure 5-2: Duration Curve of Twynholm Inlet Pressure Winter 2021/22

5.6 The daily minimum average hourly Twynholm inlet pressure through the winter months of 2021/22 ranged from 72.9 – 80.4 barg, with the average being 77.1 barg.

5.7 The average hourly Twynholm inlet pressure each day across the period ranged from 75.4 – 81.7 barg, with the average being 78.6 barg.

5.8 The predominant use of the Moffat IP Entry Point stems from the commercial practice of the NI Shippers and as such reflects the historical and current physical operation of the Northern Ireland transmission network. However, the availability of higher Twynholm inlet pressures than is guaranteed are of great importance to the ability to deliver gas through the Moffat IP Entry Point up to the capacity made commercially available. Therefore, to examine the physical ability of the network to supply commercial nominations at the Moffat IP Entry Point, the impact of operation at both guaranteed contractual pressure and such pressures as would be necessary to meet potential commercial nominations are examined. PTL do however have the contractual ability to request and pay for elevated Twynholm inlet pressures above the minimum guaranteed supply pressure to Twynholm inlet of 56 barg, if it is operationally possible.

5.9 Table 5-1 below details the Maximum Twynholm diurnal inlet pressures as per the Maximum Pressure Cap under the new Transportation Agreement (maximum pressure cap varies depending on flows. GNI flow in the relevant SWSOS pipeline, IC1, assumed to be 17mscm/d in all cases)

Table 5-1 Maximum Pressure Cap and associated flows

GNI Assumed Flow in IC1 (mscm/d)	PTL Flow (mscm/d)	Total Flow IC1 (mscm/d)	Total Flow IC1 (GWh/d)	Maximum Pressure Cap (barg)
17	8.08	25.08	277.273	66.83
17	7.5	24.5	270.861	67.8
17	7	24	265.333	68.67
17	6.5	23.5	259.806	69.5
17	6	23	254.278	70.3
17	5.5	22.5	248.750	71
17	5	22	234.222	71.73
17	4.5	21.5	237.694	72.4
17	4	21	232.167	73.1
17	3.5	20.5	226.639	73.8
17	3	20	221.111	74.4
17	2.5	19.5	215.583	75
17	2	19	210.056	75.6
17	1	18	199	76.72

5.10 A summary of key assumptions is set out in Table 5-2. Detailed modelling assumptions can be reviewed in Appendix 2 – Summary of System Modelling Assumptions.

Table 5-2: Summary of NIGCS 2022/23 Key Modelling Assumptions

Moffat IP Entry Point (Twynholm AGI)	
Minimum system pressure at the inlet to Twynholm AGI	56 barg
Control mode	Volumetric Control with flows set flat at 1/24th total daily demand per hour
Pressure drop across AGI	2.5 barg
Entry flow profile	Flat
Twynholm AGI design capacity	8.64 mscm/d
Contractual capacity (via Twynholm)	89.28 GWh/day (8.08 mscm/d equivalent)
Difference between Twynholm design and commercially available capacity	-0.56 mscm/d
Capacity commercially available to NI Shippers (i.e. Moffat contractual capacity less Stranraer reserved capacity)	88.367 GWh/d
South North IP Entry Point (Gormanston AGI)	
Minimum system pressure at the inlet to Gormanston AGI	77.5 barg
Control mode	Volumetric Control with flows set flat at 1/24th total daily demand per hour

Pressure drop across AGI	2.5 barg
Entry flow profile	Flat
Gormanston Phase 2 AGI design capacity	66.3 GWh/day (6.0 mscm/d equivalent)
GNI Use of System Agreement Reserved Capacity	6.6 GWh/day (0.597 mscm/d equivalent)
Capacity commercially available to NI Shippers	57.7 GWh/day (5.403 mscm/d equivalent)
Carrickfergus AGI	
Control Mode	Modelled in constant pressure cut unidirectional mode, i.e. the pressure on the north-west pipeline side of Carrickfergus AGI will be controlled to 3 bar below the pressure on the Belfast gas transmission pipeline side, with no ability to reverse flow, as is the physical arrangement currently in place.
Pressure drop across AGI	2.5 barg
Pressure Requirements / Boundary Conditions	
Maximum Operating Pressure ("**MOP**")	75 barg (Note: this applies to the entirety of the NI Network presently)
Minimum (contractual) Operating Pressure	12 barg[34]
Minimum (operational) Operating Pressure	39 barg[35]
Maximum Pipeline Velocities	20 m/s

Network Conditions

5.11 Five scenarios of network conditions were modelled for this year's NIGCS.

- The first scenario (the 'base case') was aligned to contractual guaranteed pressures at Twynholm inlet and exit points on the NI Network (56 barg and 12 barg, respectively).
- Twynholm inlet pressure as necessary to facilitate required flat flow up to the capacity to be made commercially available to NI Shippers at the Moffat IP Entry Point, plus Stranraer demand, whilst maintaining 39barg minimum system pressure
- 56barg minimum diurnal Twynholm inlet pressure with flows through Gormanston as required to support 39barg minimum system pressure

[34] NI Network Gas Transmission Code; http://gmo-ni.com/assets/documents/NI-Network-Gas-Transmission-Code-Version-1.5-30th-April-2019.pdf

[35] NI TSO 'System Operator Agreement', as approved by UR.

- Maximum diurnal Twynholm inlet pressure as per the TA maximum pressure cap, with flows through Gormanston as required to support 39barg minimum system pressure

- Carrickfergus 'free flow' (i.e. allowing reverse flow through the station if the NI transmission network were to hydraulically require it). Nonetheless, a 0.5 barg differential pressure will be assumed as the pressure drop across the station, in whichever direction hydraulics would require. (Note this differential pressure is a change from previous publications where 3 barg was used).

The five network conditions scenarios modelled can therefore be summarised as per Table 5-3 below.

Table 5-3: Network Conditions Scenarios Modelled

Scenario		Minimum diurnal Twynholm inlet pressure	Maximum diurnal Twynholm inlet pressure	Minimum NI transmission system pressure
Base Case		56barg	77.5 barg	12barg
Network Conditions Sensitivities	NI transmission system pressure sensitivity	56barg	77.5 barg	39barg
	Enhanced pressure	>=56barg	Variable, as per TA maximum pressure cap for given Twynholm flow	39barg
	Twynholm inlet pressure sensitivity	Pressure as necessary to facilitate required flat flow (up to 8.08mscm/d) through Twynholm	77.5 barg	39barg
	Carrickfergus "free flow"	56barg	77.5 barg	39barg
	Carrickfergus "free flow"	>=56barg	Variable, as per TA maximum pressure cap for given Twynholm flow	39 barg

5.12 A standing assumption of the modelling (since it has been the historic custom and practice) is that the Moffat IP Entry Point shall be the primary supply of capacity, in so far as is hydraulically possible under the given network conditions scenario, with flows through the South North IP Entry Point (via Gormanston AGI) only being utilised for NI demand as necessary to balance supply and demand and/or to meet minimum pressure requirements. Haynestown demand will always be supplied via Gormanston.

5.13 In all scenarios, a flat flow profile of NI demand being supplied through Twynholm and Gormanston is also assumed, which means the inlet pressure required to physically flow capacity into the SNIP will increase as the operating pressure of the SNIP increases. This is in order to maintain minimum pressure assumptions/requirements across the NI Network. The model, therefore, does allow Twynholm inlet pressure to increase as necessary to facilitate such flat flow profile, meaning the actual diurnal inlet pressure requirement is typically significantly more than 56 barg. In these scenarios, the constraint on being able to deliver such a flow profile should be considered as the availability of the maximum diurnal pressure requirement computed by the modelling.

SONI Sensitivity Analysis

An additional Sensitivity Analysis was undertaken to model data provided by SONI. Demand requirements for gas-fired generation were provided by SONI as part of a stress analysis PLEXOS model. SONI provided a week of data for 2024 which included their 'worst day' for gas-fired generation and of this, the peak three demand days were modelled along with the Average Winter Peak Firm & Interruptible distribution demand. The same network condition scenarions shown in Table 5-3 were run for each of the 3 days of Plexos results modelled.

Demand

5.14 Four typical demand scenarios were modelled; (i) Severe Winter Peak, (ii) Average Winter Peak, (iii) Average Spring Day, and (iv) Summer Minimum, and each of the above on a Firm and Firm and Interruptible basis.

5.15 For the SONI sensitivity analysis, the forecast NI power demand from SONI's PLEXOS analysis was modelled along with the forecast Average Winter Peak 2023/24 demand for the distribution sector.

Gas Quality

5.16 All demands are modelled as energy flows. Volumetric flows are derived from supplied energy demand values by assuming a Moffat Gas Calorific Value ("**CV**") (which is a measure of the energy density of the fuel) of 39.8 MJ/m3, which is the measured long-term typical historical value seen at Moffat from NG NTS. It is noted that this figure is an average value and any changes to Moffat CV values would, in practice, impact on the volumes of gas required.

6 Modelling Results

Overview

6.1 Based on the demand figures supplied and the modelling assumptions outlined in section 5, the detailed modelling results in Appendix 3 – Detailed Modelling Results and Appendix 5 – SONI Analysis were obtained. This section discusses those results.

6.2 The NI Network has been built to meet firm demands. Therefore, although focus is given to meeting all demand (i.e. Firm and Interruptible), the key results from a system planning / security of supply perspective are those which indicate the ability of the network to meet firm demands.

Summer Minimum Day Demand Scenarios

Firm

6.3 Total NI demand, ranging from 19.557 – 25.428GWh/d, is less than both the current contractual capacity of Twynholm AGI (89.28GWh/d) in all years, and the capacity to be made commercially available to NI shippers at the Moffat IP Entry Point after 'ring-fencing' of the capacity to be reserved for Stranraer.

- With the addition of Haynestown demand, total system demands range from 21.547 – 27.418GWh/d

6.4 Total demand decreases by -15.6% over the period. Growth in the non-power sector (+22.9%) is outstripped by contraction in the power sector (-47.4%). The decline in power demand is due to EP(UK) Kilroot forecasting that they would not be dispatched during the period and EP(UK) Ballylumford forecasting that in summer minimum scenarios from GY 2024/25 onwards that the station would not be dispatched, which is based (amongst other things) on strengthening of N/S Tie-line around 2024/25.

6.5 Minimum system pressures above 39barg (ranging from 47.33 – 47.8 barg) are maintained in all cases with a minimum Twynholm inlet pressure of 56barg. Maximum diurnal Twynholm inlet pressures ranging from 57.38 – 57.86 barg are still required in such circumstances.

6.6 With Carrickfergus "fully open", minimum system pressures above 39barg (ranging from 49.92 - 50.39barg) are maintained in all cases with a minimum Twynholm inlet pressure of 56barg. Maximum diurnal Twynholm inlet pressures ranging from 57.25 - 57.85barg are required in such circumstances.

6.7 Flows through the South North IP Entry Point are not required in any case to support the normal operation of the system

Firm & Interruptible

6.8 Total NI demand, ranging from 20.552 – 26.533GWh/d, is less than both the current contractual capacity of Twynholm AGI (89.285GWh/d) in all years, and the capacity to be made commercially available to NI shippers at the Moffat IP Entry Point after 'ring-fencing' of the capacity to be reserved for Stranraer.

- With the addition of Haynestown demand, total system demands range from 22.542 – 28.532GWh/d

6.9 Total demand decreases by -14.9% over the period. Growth in the non-power sector (+20.8%) is outstripped by contraction in the power sector (-47.4%). The decline in power demand is due to EP(UK) Kilroot forecasting that they would not be dispatched during the period and EP(UK) Ballylumford forecasting that in summer minimum scenarios from GY 2024/25 onwards that the station would not be dispatched, which is based (amongst other things) on strengthening of N/S Tie-line around 2024/25.

6.10 Minimum system pressures above 39barg (ranging from 47.11 – 47.61barg) are maintained in all cases with a minimum Twynholm inlet pressure of 56barg. Maximum diurnal Twynholm inlet pressures ranging from 57.49 – 57.95 barg are still required in such circumstances.

6.11 With Carrickfergus "fully open", minimum system pressures above 39barg (ranging from 49.71 – 50.21 barg) are maintained in all cases with a minimum Twynholm inlet pressure of 56barg. Maximum diurnal Twynholm inlet pressures ranging from 57.3 – 57.95barg are required in such circumstances.

6.12 Flows through the South North IP Entry Point are not required in any case to support the normal operation of the system.

Average Spring Day Demand Scenarios

Firm

6.13 Total NI demand, ranging from 48.777 – 57.533GWh/d, is less than both the current contractual capacity of Twynholm AGI (89.28 GWh/d) in all years, and the capacity to be made commercially available to NI shippers at the Moffat IP Entry Point after 'ring-fencing' of the capacity to be reserved for Stranraer.

- With the addition of Haynestown demand, total system demands range from 51.099 – 59.855 GWh/d.

6.14 Total demand increases by +4.4% over the period. Growth in the non-power sector (+18.8%) is combated by contraction in the power sector (-18.1%). There is an initial increase in power demand in 23/24 with two new OCGTs, EP(UK) Kilroot, being in operation. The decline in power demand is then due to a step change reduction EP(UK) Ballylumford and EP(UK) Kilroot forecast demand from GY 2024/25 onwards, which is based (amongst other things) on strengthening of N/S Tie-line around 2024/25.

6.15 Minimum system pressures above 39barg (ranging from 39 – 41 barg) are maintained in all cases with a minimum Twynholm inlet pressure of 56barg. Maximum diurnal Twynholm inlet pressures ranging from 59.71 – 59.92 barg are required in such circumstances. In 2023/24 there is a requirement for additional flows equating to 1.647GWh/d to be supplied through the South North IP Entry Point to achieve 39barg minimum system pressure with 56barg minimum Twynholm inlet pressure.

6.16 With Carrickfergus “fully open”, minimum system pressures above 39barg (ranging from 41-43.7barg) are maintained in all cases with a minimum Twynholm inlet pressure of 56barg. Maximum diurnal Twynholm inlet pressures ranging from 59.65 – 59.91barg are required in such circumstances. There is no reverse flow required in this scenario, however the system does benefit from the 2.5barg of additional pressure provided by reducing the differential pressure at Carrickfergus from 3barg to 0.5barg.

Firm & Interruptible

6.17 Total NI demand, ranging from 51.430 – 60.186 GWh/d, is less than both the current contractual capacity of Twynholm AGI (89.28 GWh/d) in all years, and the capacity to be made commercially available to NI shippers at the Moffat IP Entry Point after ‘ring-fencing’ of the capacity to be reserved for Stranraer.

- With the addition of Haynestown demand, total system demands range from 53.752 – 62.508 GWh/d

6.18 Total demand increases by 4.0% over the period. Growth in the non-power sector (+17.1%) is combated by contraction in the power sector (-18.1%). There is an initial increase in power demand in 23/24 with two new OCGTs, EP(UK) Kilroot, being in operation. The decline in power demand is then due to a step change reduction EP(UK) Ballylumford and EP(UK) Kilroot forecast demand from GY 2024/25 onwards, which is based (amongst other things) on strengthening of N/S Tie-line around 2024/25.

6.19 Minimum system pressures above 39barg (ranging from 39 – 39.8 barg) are maintained in all cases with a minimum Twynholm inlet pressure of 56barg. Maximum diurnal Twynholm inlet pressures ranging from 59.96 – 60.08barg are still required in such circumstances. In 2023/24 there is a requirement for additional flows equating to 4.566GWh/d to be supplied through the South North IP Entry Point to achieve 39barg minimum system pressure with 56barg minimum Twynholm inlet pressure.

6.20 With Carrickfergus "fully open", minimum system pressures above 39barg (ranging from 39.68 – 42.56barg) are maintained in all cases with a minimum Twynholm inlet pressure of 56barg. Maximum diurnal Twynholm inlet pressures ranging from 59.81 – 60.08barg are required in such circumstances. There is no reverse flow required in this scenario, however the system does benefit from the 2.5barg of additional pressure provided by reducing the differential pressure at Carrickfergus from 3barg to 0.5barg.

6.21 Flows through the South North IP Entry Point are required in 23/24 to support the normal operation of the system, when Carrickfergus is operating in pressure control mode

Average Winter Peak Day Demand Scenarios

Firm

6.22 With total NI demand, ranging from 73.442 – 100.771GWh/d, the current Moffat IP Entry Point capacity (of 89.28GWh/d via Twynholm) is exceeded in all years except 2022/23, meaning the South North IP Entry Point (i.e. flows via Gormanston) is required in such cases

- With the addition of Haynestown demand, total system demands range from 75.874 – 104.530GWh/d.

6.23 Total demand increases by +23.6% over the period. This is driven by both sectors, with non-power demand increasing +20.9% and power demand increasing by +27.5%. The power sector initially increases by 44.9% between 2022/23 and 2023/24 with the addition of two OGCTs from EP(UK) Kilroot, however the power demand then begins to decrease from 2024/25 onwards, which is based (amongst other things) on the assumption that strengthening of N/S Tie-line around 2024/25 will result in a decrease in power sector demand.

6.24 Minimum system pressures of 12barg are maintained in all cases with a minimum Twynholm inlet pressure of 56barg. In all years except 2022/23, it is not feasible to maximise flows through Twynholm to achieve this and there is a

requirement for additional flows (ranging from 0.183 – 1.952GWh/d) to be brought through the South North IP Entry Point.

6.25 Maximising flow through Twynholm and omitting the TA pressure cap, minimum system pressures of 39barg require minimum diurnal Twynholm inlet pressures ranging from 63.33-69.1 barg and maximum diurnal Twynholm inlet pressures ranging from 68.48 - 77.5 barg. In 2027/28, it is not feasible to maximise flows through Twynholm and there is a requirement for 1.271GWh/d of additional demand to be supplied through the South North IP Entry Point (excluding the 3.759GWh/d required for Haynestown).

6.26 With 56barg minimum diurnal Twynholm inlet pressures, maintaining 39barg minimum system pressures requires demand to be partially met through the South North IP Entry Point, with additional flows ranging from 24.952 – 37.733GWh/d (2.432 – 4.091GWh/d would be required through Gormanston in any case to supply Haynestown). Maximum diurnal Twynholm inlet pressures ranging from 62.04 - 72.01 barg are still required in such circumstances.

6.27 For Carrickfergus “fully open” with 56barg minimum diurnal Twynholm inlet pressure, maintaining 39barg minimum system pressure, requires demand to be partially met through the South North IP Entry Point, with flows ranging from 15.124 – 30.049GWh/d (2.432 – 4.091GWh/d would be required through Gormanston in any case to supply Haynestown). Healthier maximum pressures are seen compared to above when Carrickfergus is in pressure control mode, with maximum diurnal Twynholm inlet pressures ranging from 61.66 – 67.41 barg. Reverse flow through Carrickfergus is required for 7 – 14hrs/d, with peak flows ranging from 0.602 – 0.810GWh.

6.28 Maintaining 39barg minimum system pressure, within the Maximum Pressure Cap, requires additional demand to be partially met through the South North IP Entry Point (except in 2023/23), with flows ranging from 16.880 – 21.457GWh/d. Minimum Twynholm inlet pressures of 60.48 – 63.33barg are required, along with maximum Twynholm diurnal outlet pressures of 68.48 – 70.03barg. The maximum Twynholm diurnal outlet pressures are all within the Maximum Pressure Cap, except for 2027/28 where is it not possible to achieve 39barg minimum system pressure within the maximum pressure cap.

6.29 Maintaining 39barg minimum system pressure, within the Maximum Pressure Cap, with Carrickfergus “fully open” requires less additional demand to be met through the South North IP Entry Point, with flows ranging from 13.575 – 19.932GWh/d. Healthier inlet pressures at Twynholm are seen, with minimum pressures ranging from 59.42 – 61.41barg and maximum pressures ranging from 66.44 – 69.83barg. The

maximum pressure cap is not exceeded in any instances, unlike when Carrickfergus is operating in pressure control mode. Reverse flow through Carrickfergus is required for 1 – 11hrs/d, with peak flows ranging from 0.049 – 0.337GWh.

Firm & Interruptible

6.30 With total NI demand, ranging from 77.533 – 104.862GWh/d, the current Moffat IP Entry Point capacity (of 89.28GWh/d via Twynholm) is exceeded in all years except 2022/23, meaning the South North IP Entry Point (i.e. flows via Gormanston) is required in such cases

- With the addition of Haynestown demand, total system demands range from 79.965 – 108.621GWh/d

6.31 Total demand increases by 22.7% over the period. This is driven by both sectors, with non-power demand increasing +19.6% and power demand increasing by +27.5%. The power sector initially increases by 44.9% between 2022/23 and 2023/24 with the addition of two OGCTs from EP(UK) Kilroot, however the power demand then begins to decrease from 2024/25 onwards, which is based (amongst other things) on the assumption that strengthening of N/S Tie-line around 2024/25 will results in a decrease in power sector demand.

6.32 Minimum system pressures of 12barg are maintained in all cases with a minimum Twynholm inlet pressure of 56barg. In all years except 2022/23, there is a required for additional flows (ranging from 0.675 – 2.366GWh/d) to be brought through the South North IP Entry Point in order to achieve this.

6.33 Maximising flow through Twynholm and omitting the TA pressure cap, minimum system pressures of 39barg require minimum diurnal Twynholm inlet pressures ranging from 65.02 – 69.24barg and maximum diurnal Twynholm inlet pressures ranging from 70.37- 77.5 barg. In 2027/28, there is a requirement for 2.897GWh/d of the demand to be supplied through the South North IP Entry Point (excluding the 3.759GWh/d required for Haynestown).

6.34 With 56barg minimum diurnal Twynholm inlet pressures, maintaining 39barg minimum system pressures requires demand to be partially met through the South North IP Entry Point, with flows ranging from 25.290 – 27.026 GWh/d. (2.432 – 4.091GWh/d would be required through Gormanston in any case to supply Haynestown). Maximum diurnal Twynholm inlet pressures ranging from 62.52 – 73.6 barg are still required in such circumstances.

6.35 Carrickfergus “fully open” with 56barg minimum diurnal Twynholm inlet pressure, maintaining 39barg minimum system pressure, requires less demand to be partially met through the South North IP Entry Point, with flows ranging from 29.060 – 30.453GWh/d (2.432 – 4.091GWh/d would be required through Gormanston in any case to supply Haynestown). Healthier maximum pressures are seen compared to above when Carrickfergus is in pressure control mode, with maximum diurnal Twynholm inlet pressures ranging from 62.10 – 67.93 barg. Reverse flow through Carrickfergus is required for 7 – 14hrs/d, with peak flows ranging from 0.670 – 0.897GWh.

6.36 Maintaining 39barg minimum system pressure, within the Maximum Pressure Cap, requires additional demand to be partially met through the South North IP Entry Point (except in 2022/23), with flows ranging from 3.538 – 25.722GWh/d. Minimum Twynholm inlet pressures of 59.42 – 63.69barg are required, along with maximum Twynholm diurnal outlet pressures of 69.14 – 70.18barg. The maximum Twynholm diurnal outlet pressures are all within the Maximum Pressure Cap, except for 2027/28 where is it not possible to achieve 39barg minimum system pressure within the maximum pressure cap.

6.37 Maintaining 39barg minimum system pressure, within the Maximum Pressure Cap, with Carrickfergus “fully open” requires less additional demand to be met through the South North IP Entry Point, with flows ranging from 15.097 – 21.509GWh/d. Healthier inlet pressures at Twynholm are seen, with minimum pressures ranging from 59.06 – 63.15barg and maximum pressures ranging from 68.38 – 70.03barg. The maximum pressure cap is not exceeded in any instances, unlike when Carrickfergus is operating in pressure control mode. Reverse flow through Carrickfergus is required for 7 – 14hrs/d, with peak flows ranging from 0.177 – 0.458GWh.

Severe Winter Peak Day Demand Scenarios

Firm

6.38 With NI demands ranging from 97.764 – 124.099GWh/d, the current Moffat IP Entry Point capacity (of 89.285GWh/d via Twynholm) is exceeded in all years, meaning the South North IP Entry Point (i.e. flows via Gormanston) is required in all cases

- With the addition of Haynestown demand, total system demands range from 100.528 – 128.300GWh/d

6.39 Severe winter peak day firm demand increases by +18.2% over the period. This is driven by both sectors, with non-power sector seeing +18.0% growth and power section +18.4%.

6.40 Minimum system pressures of 12barg are maintained in all cases with a minimum Twynholm inlet pressure of 56barg. In 2022/23, there is a requirement for additional flows (0.156GWh/d) to be brought through the South North IP Entry Point in order to achieve this.

6.41 Maximising flow through Twynholm and omitting the TA pressure cap, minimum system pressures of 39barg require minimum diurnal Twynholm inlet pressures ranging from 63.32 – 68.25barg and maximum diurnal Twynholm inlet pressures ranging from 75.67 – 77.5barg. In 2024/25 and 2027/28, it is not possible to maintain 39barg minimum system pressure, although the system pressure does exceed 35barg.

6.42 In all years except 2022/23, it is not possible to maintain 39barg minimum system pressure with 56barg minimum diurnal Twynholm inlet pressure. In 2022/23, there is a requirement for 30.171GWh/d of the demand to be supplied through the South North IP Entry Point (excluding 2.763GWh/d required for Haynestown) and the maximum diurnal Twynholm outlet pressure requirement is 65.61barg.

6.43 With Carrickfergus “fully open”, in all years except 2022/23, it is also not possible to maintain 39barg minimum system pressure with 56barg minimum diurnal Twynholm inlet pressure. In 2022/23, there is a requirement for less of the demand (28.911GWh/d) to be supplied through the South North IP Entry Point (excluding 2.763GWh/d required for Haynestown) and a lower maximum diurnal Twynholm outlet pressure requirement of 64.6barg. In 2022/23 reverse flow through Carrickfergus is required for 6hrs/d, with peak flows reverse flow of 0.111GWh.

6.44 Maintaining 39barg minimum system pressure, within the Maximum Pressure Cap, is only possible in 2022/23 and requires 17.833GWh/d of additional demand to be met through the South North IP Entry Point. The maximum Twynholm diurnal inlet pressure in this instance is 69.5barg, which is below its maximum pressure cap of 69.52barg.

6.45 Maintaining 39barg minimum system pressure, within the Maximum Pressure Cap, with Carrickfergus “fully open” is possible in all years except 2023/24 and 2027/28. This requires the demand to be partially met through the South North IP Entry Point, with flows ranging from 13.554 – 22.067GWh/d. Minimum Twynholm diurnal inlet pressures of 58.16 – 61.25barg are required to achieve this and the maximum Twynholm diurnal inlet pressures (ranging from 68.9 – 70.12barg) are below the

maximum pressure cap in 8/10 years, unlike when Carrickfergus is operating in pressure control mode and it is only possible to achieve 39barg minimum system pressure within the maximum pressure cap in one year (2022/23).

Firm & Interruptible

6.46 With NI demands ranging from 102.297 – 128.631GWh/d, the current Moffat IP Entry Point capacity (of 89.285GWh/d, via Twynholm) is exceeded in all years, meaning the South North IP Entry Point (i.e. flows via Gormanston) is required in all cases

- With the addition of Haynestown demand, total system demands range from 105.061 – 132.833 GWh/d

6.47 Severe winter peak day firm demand increases by +17.6% over the period. This is driven by both sectors, with non-power sector seeing +16.9% growth and power section +18.4%.

6.48 Minimum system pressures of 12barg are maintained in all cases with a minimum Twynholm inlet pressure of 56barg. In 2022/23, there is a requirement for additional flows (0.520GWh/d) to be brought through the South North IP Entry Point in order to achieve this.

6.49 Maximising flow through Twynholm and omitting the TA pressure cap, minimum system pressures of 39barg require minimum diurnal Twynholm inlet pressures ranging from 65.48 – 68.39barg and maximum diurnal Twynholm inlet pressures ranging from 75.68 – 77.50barg. In 2024/25 and 2027/28, it is not possible to maintain 39barg minimum system pressure.

6.50 In all years except 2022/23, it is not possible to maintain 39barg minimum system pressure with 56barg minimum diurnal Twynholm inlet pressure. In 2022/23, there is a requirement for 28.687GWh/d of the demand to be supplied through the South North IP Entry Point (excluding 2.763GWh/d required for Haynestown) and the maximum diurnal Twynholm outlet pressure requirement is 66.3barg.

6.51 With Carrickfergus “fully open”, in all years except 2022/23, it is also not possible to maintain 39barg minimum system pressure with 56barg minimum diurnal Twynholm inlet pressure. In 2022/23, there is a requirement for 28.885GWh/d of additional demand to be supplied through the South North IP Entry Point (excluding 2.763GWh/d required for Haynestown) and a lower maximum diurnal Twynholm outlet pressure requirement of 65.17barg. In 2022/23 reverse flow through Carrickfergus is required for 12hrs/d, with peak flows reverse flow of 0.255GWh.

6.52 Maintaining 39barg minimum system pressure, within the Maximum Pressure Cap, is only possible in 2022/23 and requires 19.502GWh/d of demand to be met through the South North IP Entry Point. The maximum Twynholm diurnal inlet pressure in this instance is 69.74barg, which is below its maximum pressure cap of 69.76barg.

6.53 Maintaining 39barg minimum system pressure, within the Maximum Pressure Cap, with Carrickfergus "fully open" is only possible in 2022/23 and requires less demand (14.483GWh/d) to be met through the South North IP Entry Point. The maximum Twynholm diurnal inlet pressure in this instance is 69.03barg, which is below its maximum pressure cap of 69.04barg. Although it is still not possible to maintain 39barg within the maximum pressure cap with Carrickfergus "fully open" it is possible in 8/10years to achieve minimum system pressure of 36barg, which is better than the minimum system pressure of 26.8barg in the same scenario without reverse flow at Carrickfergus. Reverse flow through Carrickfergus is required for 15 – 16hrs/d, with peak flows ranging from 1.073 – 1.082GWh.

General

6.54 For the Severe Winter Peak ("SWP") scenarios, it is possible to maintain the base case of 12barg minimum system pressure with 56barg minimum Twynholm diurnal inlet pressure in all scenarios, for both Firm and Firm & Interruptible ("F&I") demand.

6.55 Ignoring commercial limitations such as the TA maximum pressure cap and accounting only for the physical limitations of 75barg maximum operating pressure ("MOP"), i.e. 77.5barg maximum Twynholm diurnal inlet pressure, it is possible in all years except 2024/25 and 2027/28 to maintain 39barg minimum system pressure. For SWP Firm, the minimum system pressure seen across the period in this scenario is 37.62barg, which although is below the 39barg target, the TSO's would be able to manage for short periods of time within day but may be low enough to create issues operationally. For SWP F&I the minimum system pressure seen across the period in this scenario is 34.76barg which would likely cause issues operationally.

6.56 When Carrickfergus is operating in pressure control mode (its current mode of operation), it is only possible to achieve 39barg minimum system pressure, without exceeding the TA maximum pressure cap, in 2022/23 SWP for both Firm and F&I demand. With Carrickfergus "fully open", it is possible to achieve 39barg minimum system pressure, without exceeding the TA maximum pressure cap, for SWP F&I in 4 out of the 10years. For 4 out of the 6years which have failed, the minimum system pressure is above 35barg. For SWP Firm demand, it is possible to achieve 39barg minimum system pressure for 8 out of the 10years.

6.57 With Carrickfergus “fully open” and operating within the limitations of the TA maximum pressure cap, the maximum demand which can be met whilst maintaining 39barg minimum system pressure and with the offtake profiles being modelled is in SWP 2031/32 Firm with 122.894GWh/d. The next highest demand scenario which was ran and subsequently failed, was SWP F&I 2031/32 with 127.429GWh/d. Therefore, using the demands and profiles provided for the SWP scenarios, somewhere between 122.894 – 127.429GWh/d the system reaches its capability to deliver the required exit capacities and associated profiles and cannot maintain 39barg minimum system pressure within the limitations of the TA maximum pressure cap.

6.58 In general, with Carrickfergus operating in pressure control mode the entry point capacity of the South North Entry Point is restricted to the total demand downstream of Carrickfergus (forecast peak of 54.747GWh/d for SWP, 48.788GWh/d for AWP,) as opposed to when Carrickfergus is operating fully open and the South North Entry Point capacity increases to full 66.33GWh/d available. This is because with Carrickfergus fully open gas can flow in both directions across the AGI, meaning Exit Points upstream of Carrickfergus can access flows from the South North Entry Point.

SONI Sensitivity Analysis

6.59 On Day 7 (the peak day for gas-fired generation) of the demand scenario (115.20 GWh/d total demand), in order to maintain 39barg minimum system pressure whilst facilitating maximising flows via Twynholm, 67.97 – 77.51barg diurnal Twynholm inlet pressure is required with 88.721GWh/d being supplied via Twynholm and 26.478 GWh/d being required via Gormanston and the South North IP Entry Point (0.553 GWh/d of Twynholm capacity not utilised and instead flow diverted to Gormanston).

6.60 On this same flow basis but with Twynholm inlet pressures ranging from 56–64.38barg on the peak day, minimum system pressures of only 12.67 barg could be maintained.

6.61 Were the higher Twynholm inlet pressures required to maximise Moffat IP Entry Point flows unavailable, and the system was limited to 56barg minimum diurnal Twynholm inlet and with Carrickfergus was operating in pressure control mode, it would not be possible to maintain 39barg minimum system pressure on any of the days. It is also not possible to maintain 39barg by utilising the TA pressure request, as the pressures required are in excess of those available under the TA maximum pressure cap. In this scenario it is infeasible to flow via Gormanston up to the capacity commercially available (66.33GWh/d) as demand downstream of Carrickfergus (c. 42.4GWh/d on day 7) is less than that commercially available at Gormanston, and all demand upstream of Carrickfergus cannot access supply flows from Gormanston due to the unidirectional flow requirements of the site. Therefore, Gormanston capacity is

limited to the total demand downstream of Carrickfergus as opposed to the commercial capacity.

6.62 In the same scenario as above but with Carrickfergus fully open, maintaining 39barg minimum system pressure can be achieved by utilising greater South North IP Entry Point flows. On Day 7, 56 – 68.06barg diurnal Twynholm inlet pressure is required with 61.745GWh/d being supplied via Twynholm and 53.454 GWh/d being required via Gormanston and the South North IP Entry Point (27.529 GWh/d of Twynholm capacity not utilised and instead flow diverted to Gormanston). In such instances, reverse flow at Carrickfergus is required for 16hrs with a peak reverse flow of 1.081GWh.

6.63 When elevated pressures above 56barg diurnal Twynholm inlet are available (i.e TA pressure request as per TA maximum pressure cap) and Carrickfergus is fully open, diurnal Twynholm inlet pressures of 58.6 – 69.83barg are required with 69.263GWh/d being supplied via Twynholm and 45.936 GWh/d being required via Gormanston and the South North IP Entry Point (20.011 GWh/d of Twynholm capacity not utilised and instead flow diverted to Gormanston). In such instances, reverse flow at Carrickfergus is required for 14hrs with a peak reverse flow of 0.796GWh.

6.64 Noting the need for reverse flow capability at Carrickfergus AGI (in the absence of the necessary Twynholm inlet pressure to maximise physical use of Moffat IP Entry Point flows, increased South North IP Entry Point flows being required instead), the required flow rate at Carrickfergus AGI in each of the various scenarios on Day 7 is shown in the Figure 6-1 below;

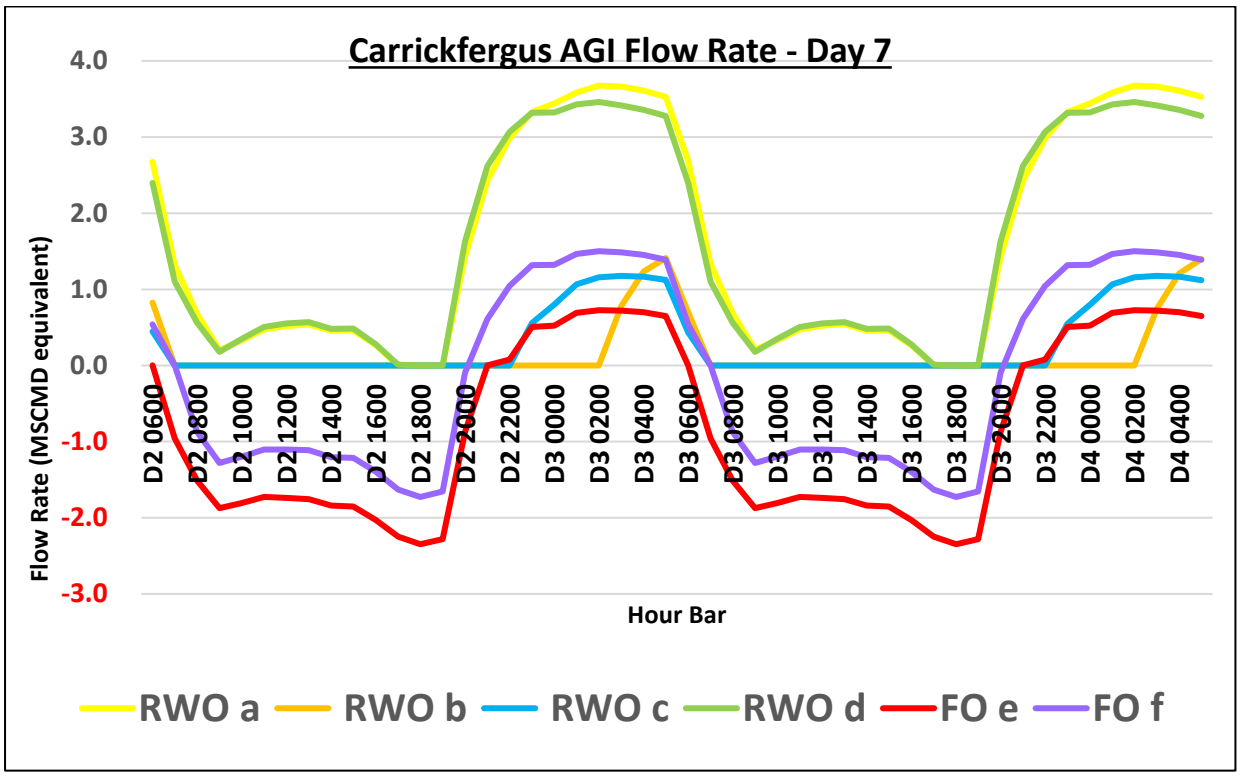


Figure 6-1: Required flow rate at Carrickfergus AGI for each Scenario on Day 7

a) Carrickfergus Regulator Wide Open: Maximising flows through Twynholm up to the capacity commercially available to NI shippers (89.274GWh/d) with 56barg minimum diurnal Twynholm inlet pressure

b) Carrickfergus Regulator Wide Open: Maintaining 39barg minimum system pressure with 56barg minimum diurnal Twynholm inlet pressure (scenario failed)

c) Carrickfergus Regulator Wide Open: Maximum diurnal Twynholm inlet pressure as per TA maximum pressure cap, maintain 39barg minimum system pressure (scenario failed)

d) Carrickfergus Regulator Wide Open: Maximising flows through Twynholm up to the capacity commercially available to NI shippers (89.274GWh/d) , maintain 38barg minimum system pressure

e) Carrickfergus Fully Open: Maintaining 39barg minimum system pressure with 56barg minimum diurnal Twynholm inlet pressure

f) Carrickfergus Fully Open: Maximum diurnal Twynholm inlet pressure as per TA maximum pressure cap, maintain 39barg minimum system pressure

7 Commentary

NI Network Capacity

Moffat IP Entry Point Capacity

7.1 Aggregate Average and Severe Winter Peak Firm (and Firm and Interruptible) forecast NI demands across the period exist which are greater than the 88.349 GWh/day Moffat IP Entry Point capacity currently available to NI Shippers (i.e. PTL's current 89.28 GWh/day Moffat capacity holding less 0.931 GWh/day reserved for SGN use at Stranraer)

7.2 There is a growing likelihood, with foreseeable and potential load growth, of the Moffat IP Entry Point capacity (as the primarily utilised entry point) becoming congested for NI Shippers.

7.3 In addition, the physical delivery of nominations at the Moffat IP Entry Point (via Twynholm AGI) relies on suitable Twynholm inlet pressures, frequently in excess above 56 barg – in some cases up to 77.5 barg. In the event of such required pressure being unavailable, Shipper registrations at the South North IP Entry Point would give the market the ability to respond to any potential shortfall in physically deliverable supply capacity from the Moffat IP Entry Point to maintain balance in overall entry and exit nominations and so NI Network operating pressures.

7.4 As SONI have a holistic view of how the NI power stations will be dispatched in aggregate, the TSO's believe the most credible scenario within the NIGCS is that presented by SONI. Full details of this network analysis scenario can be found within Appendix 5. It is clear that Moffat will become congested in the next gas year 2023/24 and nominations will be required at the South North Entry point. If there are insufficient pressures available in Scotland (i.e if pressures in the SWSOS are lower than the historic pressures presented in Section 5.4 of this report), a proportion of the 89GWh nominated at Moffat, that could historically have been flowed at Moffat, will be required to flow at Gormanston where higher pressures (than in SWSOS) will be available.

South North IP Entry Point

7.5 The use of the South North IP Entry Point would be required either where NI demand is in excess of Moffat IP Entry Point capacity currently commercially available to NI Shippers, or where it is in excess of that which is physically deliverable, considering operating conditions in SWSOS and the NI Network.

7.6 Shipper registrations at the South North IP Entry Point, outside of those awarded under the balancing gas contract, are therefore required in such

circumstances. However, the TSO's note the continued limited registrations. The TSO's wish to highlight that Shippers wishing to flow gas at this entry point, will need to have liaised with Gas Market Operator for Northern Ireland ("**GMO**") to ensure that all the relevant obligations in the NI Network Gas Transmission Code are met (e.g. applying for an IP Registration) and, in conjunction, the Commission for Regulation of Utilities ("**CRU**") in ROI and GNI requirements for the shipping of gas in ROI would need to be fulfilled.

7.7 Shippers should be aware of lead times for fulfilling these requirements, which will mean it would not be possible to access such capacity on the particular day any such need may arise without advance registration.

Security of Supply

7.8 The NIGCS provides an assessment of the technical capability of the NI Network to meet potential peak demand requirements under a range of various assumptions. A key assumption is that the NI Network (in its current form) is fully functioning, without failure or constraint, as are the upstream networks such that the entry point capacity is fully available. In that sense, it assists those with responsibility for monitoring issues relating to security of supply with regards physical transportation capacity to meet forecast demand.

7.9 It does not (seek to) assess or inform as to wider security of supply concerns stemming from failure of infrastructure / constraints, for which separate security of supply risk assessments are performed by those with responsibility to do so,[36] (although such assessments, being at UK national level, do not take account of failure / constraint of intra-NI Network infrastructure).

NI Network Operating Pressures

7.10 Historically, NI Network pressure in excess of the NI Network Gas Transmission Code specified 12 barg has been provided, but it is not guaranteed. The modelling results have confirmed that the NI Network has sufficient technical capacity to maintain 12 barg minimum NI Network Exit Point operating pressure. It should be noted that the NI transmission system, in fact no transmission system in Europe, is operated anywhere close to 12barg. The TSO's operate the system to target (but do not contractually guarantee) 39barg in order to balance supply and demand and maintain line pack in event of a security of supply emergency.

36 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/774288/national-risk-assessment-security-gas-supply.pdf

Shipper Use of the System

7.11 The network analysis makes certain assumptions as to entry and offtake profiles, which directly influence the modelling results. While Shippers may use gas at offtake according to their own requirements, they are in control of their nominations, which influence the TSO's scheduling of End of Day Quantity ("**EODQ**") physical flows to balance daily supply and demand. Larger within day imbalances in such entry and exit profiles drive a flexibility requirement of the NI Network which challenges the physical deliverability of exit capacity offered on a 'flat flow' basis, all such Exit Capacity presently is under the NI Network Gas Transmission Code. The GMO, on behalf of the TSO's, have engaged with Shippers on this matter and improvements have been seen, which are to be welcomed. As the system reaches capacity, the level of flexibility that can be offered is reduced and therefore more accurate and timely nominations within day will become more important to allow TSO's to better operate the system in order to benefit all users of the NI gas system.

7.12 It is recognised that the impact of the SEM wholesale electricity market with respect to the NI gas market continues to challenge power sector Shippers nomination behaviour, due to increased volatility and uncertainty (both day ahead and even within day) as to their dispatch requirements.

Enhanced Pressure

7.13 If a user wishes to guarantee pressure at a particular level, they currently have the right to request and pay for enhanced pressure under the NI Network Gas Transmission Code, as the TSO's (via PTL) have the contractual ability (via the TA) to request enhanced Twynholm inlet pressures, in so far as is operationally possible, to be delivered. However, they are not guaranteed and additional costs may be incurred.

Balancing Gas

7.14 The TSO's have in place balancing gas buy contracts at both the Moffat IP Entry Point (as the primary) and the South North IP Entry Point (as the secondary contract). The combined capacity of these contracts will be not less than 8.667 GWh/day. However, the minimum capacity of any contract is 5 GWh/day, hence, this will be the minimum at the South North IP Entry Point. This offers extra redundancy to the TSO's operating the NI Network.

7.15 The procedures on the use of these contracts are outlined in a Schedule to the System Operator Agreement ("**SOA**") which have been approved by UR following a consultation with industry undertaken by the TSO's in 2019 to outline how, in a set of limited unlikely circumstances, this tool would prove valuable to balancing the system.

System Constraint

7.16 Should the use of balancing gas be insufficient and/or inappropriate to maintain operationally acceptable network pressures, arrangements are in place, through a TSO declaration of a 'System Constraint' under 10.3 of the NI Network Gas Transmission Code, for the TSO's to mandate demand side response in the form of a power station reducing consumption.

7.17 If load shedding of power sector demand was insufficient to balance the network, similar arrangements are in place to communicate with Distribution Shippers as to how their demands should be reduced, through their Interruptible customers in the first instance.

7.18 Alternatively, the market (i.e. NI Shippers) has the option to respond to such shortfall on a supply basis by accessing capacity through the South North IP Entry Point, assuming they can and sufficient capacity is available for them to book in the ROI system.

Operation of Carrickfergus AGI

7.19 In gas year 2021/22, the TSO's completed the implementation of an update to the operating configuration of Carrickfergus AGI. This new configuration is expected to deliver improved pressure benefits from the previous Volumetric flow control configuration, although 'reverse flow' through the AGI (from the NWP to the BGTP) will not be routinely possible (without manual intervention at site) using the current configuration of Carrickfergus AGI.

7.20 The modelling results have shown that, under the current mode of operation of Carrickfergus AGI, the 39 barg minimum system operating pressure cannot be maintained within the limits of the Maximum Pressure Cap under the new Transportation Agreement in 9-out-of-10 years for the Severe Winter Peak scenarios. This is the case for both the Firm and Firm and Interruptible demand levels.

7.21 Sensitivity modelling results have shown that with Carrickfergus "Fully Open", with the ability to reverse flow, the number of years that the 39 barg minimum system operating pressure cannot be maintained within the limits of the Maximum Pressure Cap under the new Transportation Agreement reduces from 9-out-of-10 to 2-out-of-10 years for the Severe Winter Peak Firm demand levels, however, for the Severe Winter Peak Firm and Interruptible demand levels, the 39 barg cannot be maintained in 9-out-of-10 years even with "Free Flow" implemented at Carrickfergus, although improved network pressures are observed.

7.22 The SONI Sensitivity Scenarios, which the TSO's believe are the most credible scenarios within the NIGCS, highlighted the need for reverse flow capability at Carrickfergus AGI. This was in the absence of the necessary Twynholm inlet pressures to maximise physical use of Moffat IP Entry Point flows with increased South North IP Entry Point flows being instead required.

7.23 As part of the Capacity Management Workstreams the design capacity of Carrickfergus will be reviewed and any changes that may be required can be completed as part of any necessary reconfiguration works.

Gas Quality

7.24 While a gas CV of 39.8 MJ/m3 has been assumed, any changes to Moffat CV values would, in practice, impact on the volumes of gas required. The average CV of gas from Moffat reaching the NI Network in gas year 2021/22 (year to date) has been 39.7 MJ/m3.

Gas Safety Management Regulations

7.25 Gas being conveyed in GB and NI must conform, respectively, to requirements of the Gas Safety (Management) Regulations 1996 ("**GS(M)R 1996**") and the Gas Safety (Management) Regulations (Northern Ireland) 1997 ("**GS(M)R(NI) 1997**").

7.26 It is worth noting the ongoing industry process to modify the framework in the coming years, with a planned amendment of GS(M)R 1996 that seeks to move the requirements of both Parts I and II of Schedule 3 from the GS(M)R into an Institution of Gas Engineers and Managers ("**IGEM**") gas quality standard being developed. The purpose of the standard is to provide a more dynamic means and framework of gas quality specification, against a background in GB of declining gas supplies from the North Sea, increasing reliance on imported supplies (both via interconnector and Liquified Natural Gas ("**LNG**")) and the need to decarbonise the gas networks.

7.27 The outputs from this process will have consequential impacts to permissible CV ranges of within specification gas in GB and so that will be seen at Moffat during the forecast period. The timeline for implementation cannot be certain, as ultimately the changes require legislative amendments.

NI Biomethane Injection

7.28 UR and the NI gas network operators are progressing a regulatory workstream to develop the necessary regulatory frameworks to allow biomethane injection into the NI gas networks at distribution and transmission level, expected to be in place in 2022.

7.29 The NI gas network operators are also developing the connection arrangement and technical specifications to facilitate Biomethane injection. This typically includes developing Network Connection and Network Entry Agreements, details the gas quality specifications, monitoring and network protection needs, which producers will be required to meet.

Network Development

7.30 The Corrib gas field is in decline and ROI gas demand has exceeded indigenous supply capacity such that Moffat has and is expected to remain the predominant supply point of ROI demand across the forecast period.

7.31 ROI indigenous supply contributed to throughput variations on GNI (UK)'s SWSOS transportation system and led to the decision to undertake 'batching' of Twynholm flows for operational reasons on a regular basis. This results in flows outside of a flat profile for demands required at the Moffat IP Entry Point and so affects daily diurnal pressures on the downstream system (i.e. SNIP and therefore the NI Network). With Corrib supplies in decline, the frequency of batching of Twynholm flows is expected to decrease over the period. However, it has and will not affect the delivery of the EODQ or availability of 56 barg minimum inlet pressure at Twynholm.

7.32 The potential gas storage project by Islandmagee Storage Ltd., were it to go ahead and begin operating through the forecast period, would likely have significant impacts to future gas flows to and within the NI Network. Project specific network analysis will be required as part of their connection request process and as more information and certainty on the details of the projects are known, which will better inform the impact it may have to the NI Network.

7.33 The scale and complexity of putting in place any physical infrastructure and/or commercial arrangements, which may be deemed necessary arising from a gas connection study, should not be overlooked as a potential significant risk to any future successful projects. The NI gas TSO's recommend and encourage early engagement in determining the gas network's capacity adequacy and/or to indicate what further solutions may be required. Any actual physical network investment requirements will only be determined from such specific studies.

7.34 The potential network investment signals derived from the analysis support the need for greater early co-ordination between gas and electricity sectors (including potential new generators / developers considering competing in future SEM T-4, or other, auctions), especially in light of growing capacity requirements contributed to by new connections in the power generation sector. This is particularly important in the context of an all-island electricity market (especially as physical transmission capacity

constraints potentially decrease with greater interconnectivity) but separated gas networks and markets on the island of Ireland.

7.35 As part of this year's NIGCS, the TSO's have engaged with SONI to gather their view as to the validity of the power sector gas demands provided by the individual power generators within the context of the overall SEM future power demands. In future years the TSOs plan to further deepen the engagement with SONI to provide more detailed inputs to the power sector demands, given their significant and increasing impact on the NI network's gas demands and future capacity requirements.

7.36 SONI provided the TSO's with a PLEXOS modelling scenario which had been completed as a stress analysis of the electricity system for February 2024 and the TSOs have subsequently modelled this power demand on the NI gas system, to understand the impact on the gas network. This modelling scenario has been included within this year's NIGCS. Further engagement with SONI will be required to determine the likelihood and frequency of the above scenario and the TSO's and UR will need to work together proactively to determine suitable solutions required to meet NI Network demand, should this demand basis occur regularly.

7.37 SONI anticipates larger demands at Kilroot than forecast in the NIGCS questionnaires (longer run hours resulting in greater daily demand). The SONI forecasts for Ballylumford and Coolkeeragh are broadly in line with their forecasts from the NIGCS questionnaires. Based on the SONI Plexos data, there are credible scenarios where power sector demand could be in fact higher due to large electricity exports from NI to ROI. This is likely to continue for a number of years. As a result of the SONI forecasts and subsequent impacts on the NI gas system identified in the modelling, the TSOs and GMO are engaged in Capacity Management Workstreams to develop potential solutions to the capacity issues identified.

Future Energy Policy and Strategy

7.38 The gas grid is widely expected to play a key role in the decarbonising energy (and wider) industry, with natural gas as a transition fuel in the short to mid-term, transitioning to renewable gases (biomethane and hydrogen) in the mid to long-term, as we progress towards a net zero emissions economy. Its inherent benefits include the proven ability to be a crucial component of a flexible and integrated energy system, affordable cost, and reliability, which ensures security of supply.

7.39 Understanding the interaction between the respective energy (gas and electricity) networks is critical to planning for the future development of the markets so as to produce efficient outcomes on a whole energy supply system basis. For example, the critical role the gas grid will continue to play in ensuring ongoing security of energy supply through the energy transition, the increasing need for large-scale energy

storage solutions, and the critical role green hydrogen will play in facilitating both these objectives, while also helping to manage the curtailment of renewable electricity generation. The TSO's expect this co-ordination to be a crucial aspect of developing energy policy and strategy aimed at delivering a decarbonised energy transition. The recently proposed FSO (Future System Operator) model in GB maybe a suitable model to be employed in NI. This 'whole system' approach within the energy system could assist the drive towards net zero while maintaining energy security and minimising costs for consumers.

7.40 The TSO's welcome the recent publication of the new Energy Strategy for NI 'Path to Net Zero', which proposes a number of key policy ambitions to achieve an overall goal of net zero carbon-energy by 2050. The policy landscape is expected to continue to develop following the enactment of the NI Climate Action Bill and together with the ongoing evaluation of energy policy will impact the future use and expansion of the existing gas network and proposals for decarbonisation of the gas being transported in the system, including hydrogen and biomethane injection. Additionally, differing considerations for gaseous fuels, and the gas network, to support the decarbonisation of industry and transport are outlined. The TSO's look forward to playing our role in the implementation of the Energy Strategy into the future.

7.41 While energy policy in NI is a devolved matter, which DfE have responsibility for in NI, the future energy transition is heavily influenced by UK Government policy as well as at that in ROI, due to the SEM all-island electricity market and other factors such as decarbonisation solutions for transport, etc.

Appendix 1 – Northern Ireland Demand Forecast

Entry Point Capacities

Table A1 - 1 Entry Point Capacities

Capacity Available to NI from Entry Points						
	Moffat IP Entry Point			South North IP Entry Point		
	Contractual Capacity	Stranraer Reserved Capacity	Capacity available to NI shippers	Commercially Available and Physical Capacity[37]	Haynestown reserved capacity	Capacity available to NI shippers
GWh/d	89.28	0.931	88.349	66.3	6.6	59.7
Mscm/d	8.08	0.084	7.996	6	0.6	5.4

[37] Shipper registration at the South North IP Entry Point is required so that the market has the ability to book capacity at the South North IP Entry point.

Severe Winter Peak Day

Firm

Table A1 - 2: Severe Winter Peak Day (Firm)

Severe Winter Peak Day (Firm) Forecast Demands (GWh/day)					
Year	Power	Distribution (NI)	Total NI Demand	Non-NI Demand	Total NI Network Demand
2022/23	43.6	53.3	96.8	3.7	100.5
2023/24	58.7	55.6	114.4	3.8	118.2
2024/25	64.5	56.9	121.5	3.8	125.2
2025/26	60.0	58.2	118.1	4.9	123.0
2026/27	58.3	59.3	117.6	5.0	122.6
2027/28	62.8	60.4	123.2	5.1	128.3
2028/29	54.5	61.1	115.7	5.3	120.9
2029/30	47.7	62.2	110.0	5.4	115.3
2030/31	48.2	62.9	111.1	5.5	116.6
2031/32	53.4	64.0	117.4	5.5	122.9

Firm & Interruptible

Table A1 - 3: Severe Winter Peak Day (Firm & Interruptible)

Severe Winter Peak Day (Firm & Interruptible) Forecast Demands (GWh/day)					
Year	Power	Distribution (NI)	Total NI Demand	Non-NI Demand	Total NI Network Demand
2022/23	43.6	57.8	101.4	3.7	105.1
2023/24	58.7	60.0	118.8	3.8	122.6
2024/25	64.5	61.5	126.0	3.8	129.8
2025/26	60.0	62.7	122.6	4.9	127.5
2026/27	58.3	63.8	122.1	5.0	127.1
2027/28	62.8	64.9	127.7	5.1	132.8
2028/29	54.5	65.7	120.2	5.3	125.5
2029/30	47.7	66.8	114.5	5.4	119.9
2030/31	48.2	67.4	115.7	5.5	121.1
2031/32	53.4	68.5	122.0	5.5	127.4

Average Winter Peak Day

Firm

Table A1 - 4: Average Winter Peak Day (Firm)

Average Winter Peak Day (Firm) Forecast Demands (GWh/day)					
Year	**Power**	**Distribution (NI)**	**Total NI Demand**	**Non-NI Demand**	**Total NI Network Demand**
2022/23	29.4	43.1	72.5	3.3	75.9
2023/24	53.4	44.8	98.2	3.4	101.6
2024/25	51.7	46.2	97.9	3.4	101.4
2025/26	47.1	47.4	94.6	4.5	99.1
2026/27	45.5	48.8	94.3	4.6	98.9
2027/28	50.0	49.9	99.8	4.7	104.5
2028/29	41.7	50.9	92.6	4.8	97.4
2029/30	34.9	51.7	86.6	4.9	91.6
2030/31	35.4	52.6	88.0	5.0	93.1
2031/32	40.6	53.7	94.3	5.0	99.3

Firm & Interruptible

Table A1 - 5: Average Winter Peak Day (Firm & Interruptible)

Average Winter Peak Day (Firm & Interruptible) Forecast Demands (GWh/day)					
Year	**Power**	**Distribution (NI)**	**Total NI Demand**	**Non-NI Demand**	**Total NI Network Demand**
2022/23	29.4	47.2	76.6	3.3	80.0
2023/24	53.4	48.9	102.3	3.4	105.7
2024/25	51.7	50.3	102.0	3.4	105.4
2025/26	47.1	51.5	98.6	4.5	103.2
2026/27	45.5	52.8	98.4	4.6	103.0
2027/28	50.0	54.0	103.9	4.7	108.6
2028/29	41.7	54.9	96.7	4.8	101.5
2029/30	34.9	55.8	90.7	4.9	95.6
2030/31	35.4	56.7	92.1	5.0	97.1
2031/32	40.6	57.8	98.4	5.0	103.4

Average Spring Day

Firm

Table A1 - 6: Average Spring Day (Firm)

Average Spring Day (Firm) Forecast Demands (GWh/day)					
Year	Power	Distribution (NI)	Total NI Demand	Non-NI Demand	Total NI Network Demand
2022/23	24.8	24.1	48.9	2.6	51.5
2023/24	32.2	25.0	57.2	2.7	59.9
2024/25	22.5	25.9	48.4	2.7	51.1
2025/26	21.8	26.3	48.1	3.7	51.8
2026/27	21.0	27.0	47.9	3.7	51.6
2027/28	21.0	27.3	48.3	3.8	52.1
2028/29	21.1	27.7	48.9	3.8	52.7
2029/30	21.1	28.0	49.1	3.8	52.9
2030/31	21.1	28.4	49.5	3.9	53.4
2031/32	21.0	28.9	49.8	4.0	53.8

Firm and Interruptible

Table A1 - 7: Average Spring Day (Firm and Interruptible)

Average Spring Day (Firm & Interruptible) Forecast Demands (GWh/day)					
Year	Power	Distribution (NI)	Total NI Demand	Non-NI Demand	Total NI Network Demand
2022/23	24.8	26.9	51.6	2.6	54.2
2023/24	32.2	27.6	59.8	2.7	62.5
2024/25	22.5	28.5	51.1	2.7	53.8
2025/26	21.8	29.0	50.7	3.7	54.4
2026/27	21.0	29.6	50.6	3.7	54.2
2027/28	21.0	30.0	50.9	3.8	54.7
2028/29	21.1	30.4	51.6	3.8	55.4
2029/30	21.1	30.6	51.8	3.8	55.6
2030/31	21.1	31.1	52.2	3.9	56.1
2031/32	21.0	31.5	52.5	4.0	56.5

Summer Minimum Day

Firm

Table A1 - 8: Summer Minimum Day (Firm)

Summer Minimum Day (Firm) Forecast Demands (GWh/day)					
Year	Power	Distribution (NI)	Total NI Demand	Non-NI Demand	Total NI Network Demand
2022/23	18.9	6.0	24.9	2.2	27.1
2023/24	18.9	6.3	25.2	2.2	27.4
2024/25	12.8	6.5	19.3	2.2	21.5
2025/26	12.8	6.5	19.3	3.2	22.5
2026/27	12.8	6.7	19.6	3.3	22.9
2027/28	12.8	6.7	19.6	3.3	22.9
2028/29	12.8	6.9	19.7	3.3	23.0
2029/30	12.8	7.0	19.8	3.3	23.1
2030/31	12.8	7.1	19.9	3.3	23.2
2031/32	12.8	7.2	20.0	3.4	23.4

Firm and Interruptible

Table A1 - 9: Summer Minimum Day (Firm & Interruptible)

Summer Minimum Day (Firm & Interruptible) Forecast Demands (GWh/day)					
Year	Power	Distribution (NI)	Total NI Demand	Non-NI Demand	Total NI Network Demand
2022/23	18.9	7.1	26.0	2.2	28.2
2023/24	18.9	7.4	26.3	2.2	28.5
2024/25	12.8	7.5	20.3	2.2	22.5
2025/26	12.8	7.6	20.5	3.2	23.6
2026/27	12.8	7.8	20.7	3.3	24.0
2027/28	12.8	7.8	20.7	3.3	24.0
2028/29	12.8	8.0	20.8	3.3	24.1
2029/30	12.8	8.0	20.8	3.3	24.1
2030/31	12.8	8.2	21.0	3.3	24.3
2031/32	12.8	8.3	21.1	3.4	24.5

Appendix 2 – Summary of System Modelling Assumptions

General Assumptions

- The systems upstream and downstream of the NI Network have not been considered in this analysis, notwithstanding the assumption regarding the 56 barg minimum inlet pressure at Twynholm.
- All entry points are modelled on a flat flow basis, unless otherwise indicated.
- The entire NI Network has a maximum operating pressure of 75 barg.
- All scenarios simulate the 24-hour demand cycle of the NI Network repeated over a three-day period to obtain steady consistent results.
- All demands are modelled as energy flows. Volumetric flows are derived from supplied energy demand values by assuming a Moffat Gas Calorific Value ("**CV**") (which is a measure of the energy density of the fuel) of 39.8 MJ/m3, which is the measured typical historical value seen at Moffat from NG NTS. It is noted that this figure is an average value and any changes to Moffat CV values would, in practice, impact on the volumes of gas required.
- A minimum system pressure limit of 12 barg is assumed for all offtakes on the NI Network, in line with the TSO's contractual commitments at the various exit points per the NI Network Gas Transmission Code.

Demand Assumptions

- Forecasted annual and peak NI demands are as per those provided to the TSO's by NI Shippers and users of the NI Network (note, this includes SGN at Stranraer and GNI (via GNI (UK)) at Haynestown).
- Separate figures have been provided for firm and interruptible demands. Models are run for both firm and firm & interruptible demands.
- The hourly profiles of the NI power stations total demand is based on the information provided to the TSO's in the questionnaire responses or as subsequently updated in agreement with the TSO's.
- The hourly demand for all other AGI offtakes is derived from their contribution to the (in aggregate) peak demand day in Gas Year 2020/21 of the specific Exit Point to which they belong. Profiles for Haynestown were supplied by GNI (UK) (on behalf of GNI) and profiles for Stranraer were supplied by SGN.
- Distribution sector Shippers have provided the breakdown per offtake of their cumulative demand.

Network Operation / Pressure Assumptions

Twynholm

- The capacity to be made available to NI Shippers at the Moffat IP Entry Point shall be assumed to be 89.28 GWh/day (equating to 8.08 mscm/d), minus 0.931GWh/day to be reserved for Stranraer (equating to 0.084 mscm/d). Hence, the base case analysis shall assume capacity available through Twynholm for NI deliveries shall be up to 88.349 GWh/day. A quantum equal to Stranraer demand shall at all times be added to the flow requirements through Twynholm for NI deliveries.
- The minimum diurnal inlet pressure at Twynholm AGI was assumed to be 56 barg for each scenario, in line with the contractual obligations between the TSO's and users of the NI Network. As a sensitivity, inlet pressures at Twynholm were allowed to vary in order to achieve the various pressure requirements and boundary conditions.
- Twynholm AGI is modelled as a flow-control regulating AGI, with an assumed pressure drop across the AGI of 2.5 barg. The daily flows through the Twynholm entry point are assumed to follow a flat flow profile, with the diurnal swing in the demand profile being absorbed by the downstream system.
- Pressures at Twynholm are inlet pressures in the diurnal cycle. The current Maximum Operating Pressure of the SNIP is 75 barg, so with the 2.5 barg design pressure drop across the station, the maximum permissible inlet pressure is 77.5 barg.
- As a flat flow profile at Twynholm is assumed, this modelling has not considered the impact of Corrib Entry Point becoming operational on the ROI gas transmission network or the impact of the twinning of the SWSOS network between Cluden and Brighouse Bay in Scotland. This can (and has had) a significant effect on a flat flow profile through the Moffat IP Entry Point (via Twynholm) being maintained (compressor station 'batching' of flows being deemed necessary), which has knock on operational (pressures) implications on the Northern Ireland network across any given day.

Gormanston

- The flow through Gormanston AGI shall be that required over the capacity available via Moffat or that portion of the overall NI demand that is required to achieve the various target pressures of the modelling (e.g. 12 / 39 barg minimum system pressure). The capacity to be made available to NI Shippers at the South North IP Entry Point shall be assumed to be 59.7 GWh/day, with a further 6.6 GWh/day to be reserved for GNI's use (via GNI (UK)) at

Haynestown. A quantum equal to Haynestown demand shall at all times be added to the flow requirements through Gormanston AGI for NI deliveries.

- Flows in excess 59.7 GWh/day for NI deliveries, or 66.3 GWh/day in total, shall not be permitted through Gormanston AGI in the model.
- Gormanston AGI is modelled as a volumetric flow-control regulating AGI, with the daily flows through the AGI assumed to follow a flat flow profile, with the diurnal swing in the demand profile being absorbed by the downstream system.
- Pressures quoted at Gormanston are outlet pressures and were allowed to vary as necessary to achieve the various pressure requirements and boundary conditions.
- There was no minimum inlet pressure assumed at Gormanston AGI, only a Maximum Operating Pressure on the outlet of 75 barg, as is currently declared MOP on the South North Pipeline.

Carrickfergus

- Carrickfergus AGI will be modelled in constant pressure cut unidirection mode, i.e. the pressure on the north west pipeline side of Carrickfergus AGI will be controlled to 0.5 bar below the pressure on the Belfast gas transmission pipeline side, with no ability to reverse flow, as is the physical arrangement currently in place.
- A pressure drop across the station of 0.5 barg is assumed (provided a 0.5 barg differential exists in the system, otherwise no flow will be permitted).

Appendix 3 – Detailed Modelling Results

Overview

The following outlines the approach taken when carrying out the network analysis, and the measured system limits.

Note:

As per the approach employed in the Network Modelling for the previous number of Gas Capacity Statements, rather than analysing every scenario through transient modelling across all years, in some cases it was sufficient to deem a scenario compliant with pressure requirements, by the association of results from adjoining years with the supply and demand trend.

Where such results were obtained by association, rather than through detailed transient modelling, pressures and velocities are listed in the results tables in Section 5 as 'OK'.

- All scenarios simulate the 24-hour demand cycle over a period of 3 days to obtain steady results (the results of the first day are ignored for this purpose).
- The SNIP, North-West, South-North Pipeline and West Transmission Pipelines are modelled in full detail, including exact internal diameters and lengths and validated friction factors. The maximum operating pressure of SNIP and SNP is 75 barg.
- Flow via Twynholm (and Moffat IP Entry Point) maximised up to capacity to be made available to NI shippers (i.e. 89.28 GWh/day less 0.931 GWh/day to be reserved for Stranraer) plus Stranraer demand and flat flow is maintained through both Twynholm into SNIP and Gormanston into the SNP.
- Flows via Gormanston into the SNP are restricted to 66.33 GWh/day (59.70 GWh/day plus 6.63 GWh/day reserved for Haynestown)
- The minimum pressure loss across the Twynholm AGI is 2.5 barg. Minimum pressure at the discharge is therefore 53.5 barg, based on a minimum inlet pressure of 56barg.
- The following system conditions shall be met:
    - Minimum system pressure of 12 barg at Coolkeeragh AGI (the most peripheral point on the NI Transmission System)
    - Minimum system pressure of 56 barg at the inlet to Twynholm AGI.
- As a sensitivity analysis, pressure and flow conditions to achieve a minimum system pressure of 39 barg at Coolkeeragh AGI shall also be performed, under the following scenarios;

- Pressure as required at Twynholm AGI to utilise maximum capacity available up to 89.285GWh/d on a flat flow basis.
- Minimum system pressure of 56 barg at the inlet to Twynholm AGI. Flows through Gormanston AGI as required to support system pressures.
- Maximum Twynholm diurnal inlet pressure as per the Maximum Pressure Cap under the new Transportation Agreement (maximum pressure cap varies depending on flows. GNI flow in the relevant SWOS pipeline, IC1, assumed to be 17MSCMD in all cases- see Table A2-1 for examples of flows and associated pressure cap)

GNI Assumed Flow in IC1 (MSCMD)	PTL Flow (MSCMD)	Total Flow IC1 (MSCMD)	Total Flow IC1 (GWh/d)	Maximum Pressure Cap (bar)
17	8.08	25.08	277.273	66.83
17	7.5	24.5	270.861	67.8
17	7	24	265.333	68.67
17	6.5	23.5	259.806	69.5
17	6	23	254.278	70.3
17	5.5	22.5	248.750	71
17	5	22	234.222	71.73
17	4.5	21.5	237.694	72.4
17	4	21	232.167	73.1
17	3.5	20.5	226.639	73.8
17	3	20	221.111	74.4
17	2.5	19.5	215.583	75
17	2	19	210.056	75.6
17	1	18	199	76.72

Table A2-1: Maximum Pressure Cap and associated flows

- Carrickfergus AGI was modelled in constant pressure cut unidirectional mode, i.e. the pressure on the north-west pipeline side of Carrickfergus AGI will be controlled to 3 bar below the pressure on the Belfast gas transmission pipeline side, with no ability to reverse flow, as is the physical arrangement currently in place.
- As a sensitivity analysis, Carrickfergus was modelling in ‘free flow’ (i.e. allowing reverse flow through the station if the NI transmission network were to hydraulically require it). A 0.5barg differential pressure was assumed as the pressure drop across the station, in whichever direction hydraulics would require.

- The systems upstream and downstream of the NI Transmission System[38] have not been considered in this analysis, notwithstanding the assumption regarding the 56 barg minimum inlet pressure at Twynholm.

The following section outlines the results of the network analysis carried out on the basis of the supplies and demands in Section 4.

Where two pressures are presented, they represent the minimum and maximum pressures in the 24 hour cycle.

Where results fall outside the target limits of the model scenario, the failed results shall be highlighted in **red font**. For scenarios which are seeking to achieve a minimum system pressure of 39barg and the minimum pressure results ranges from 35 – 39barg, the result has highlighted in **orange font**.

Where the model was deemed compliant with pressure requirements by association of the results from adjoining years with the supply and demand trend, the model was not run for that year and is said to be OK.

Where the model was deemed to fail by association of the results from adjoining years with the supply and demand trend, the model was not run for that year and is said to FAIL.

The following notes apply, as indicated in the table headings, to all network analysis result tables in this section:

(1) Pressures at Twynholm (SNIP) are the minimum and maximum inlet pressures in the diurnal cycle. The current Maximum Operating Pressure of the SNIP is 75barg, so with the 2.5barg design pressure drop across the station, the maximum permissible inlet pressure is 77.5barg.

(2) Pressures at Gormanston (SNP) are the minimum and maximum outlet pressures in the diurnal cycle. The current Maximum Operating Pressure of both the SNP is 75barg.

(3) Pressures at Ballylumford, Tullykeneye and Coolkeeragh are the minimum and maximum in the diurnal cycle and are those in the pipeline upstream of the AGI's.

(4) Pressures at the Carrickfergus inlet are those upstream of the AGI (i.e. on the Middle Division Offtake side) and those at the outlet are downstream of the AGI in the North West Pipeline.

[38] Insofar as this is understood to relate to the physical dedicated NI transmission system, legally and commercially this begins at the Moffat IP Entry Point.

(5) Velocities of flows were assessed at three locations in the NI transmission system, with the maxim being recorded and denoted with [i], [ii] or [iii] as below to indicate the location of the maximum velocity of flow.

[i] Ballylumford Inlet

[ii] Carrickfergus Outlet

[iii] Coolkeeragh

Maximum permissible pipeline velocities as per the standards detailed in IGEM/TD13.

(6) Where Carrickfergus is modelled as “fully open”, flow at Carrickfergus is the net flow through the AGI in the given day. A negative value indicates a net flow from NWP > BTP whereas a positive value indicates a net flow from BTP > NWP. The number of hours that the AGI operates in reverse flow is provided in brackets beside the net flow. Further details on the peak flow in either direction is provided after the results table.

A3.1 Severe Winter Peak Day

Severe Winter Peak Day- (Firm)

A3.1.1 Twynholm Minimum Pressure 56barg, Minimum System Pressure 12bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenney e	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	12 (Min)	12 (Min)	12 (Min)	42.01 (max)	12 (Min)	12 (Min)	12 (Min)	20 (max)
2022/23	89.130*	56.01 / 61.93	11.398	23.73 / 35.72	29.51 / 41.71	27.57 / 40.14	27.18 / 39.82	33.211	24.18 / 36.82	19.78 / 31.55	12 / 31.31	11.12 [iii]
2023/24	89.274[1]	56.01 / 63.86	28.888	34.6 / 45.48	26.93 / 44.43	23.04 / 43.17	23.66 / 43.02	17.468	23.67 / 40.02	23.64 / 36.71	14.32 / 36.19	13.44 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	89.285[1]	56.01 / 67.89	39.015	42.91 / 55.39	26.11 / 50.72	21.53 / 49.86	22.27 / 49.71	11.022	26.7 / 46.71	27.95 / 43.86	18.56 / 43.61	14.17 [i]
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	89.285[1]	56.01 / 65.3	33.609	36.72 / 48.93	27.8 / 46.51	24.02 / 45.4	24.39 / 45.2	18.374	23.3 / 42.2	23 / 37.63	12.82 / 38.33	12.97 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

[1] Maximum available capacity accounting for SGN Stranraer reserved capacity.

A3.1.2 Maximum flow through Twynholm, Twynholm pressure as necessary, minimum system pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenney e	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	**89.285 (Max)**	**77.5 (Max)**	**66.33 (Max)**	**75 (Max)**	**39 (Min)**	**39 (Min)**	**39 (Min)**	**42.01 (max)**	**39 (Min)**	**39 (Min)**	**39 (Min)**	**20 (max)**
2022/23	89.263[1]	68.25 / 75.67	11.266	44.03 / 54.85	48.85 / 59.35	47.69 / 58.39	47.47 / 58.2	33.344	44.47 / 55.2	42 / 52.69	39 / 52.41	6.37 [i]
2023/24	89.274[1]	67.8 / 76.51	28.888	49.96 / 61.21	46.77 / 61.17	44.72 / 60.34	45.02 / 60.24	17.523	43.71 / 57.24	43.19 / 55.38	39 / 54.93	7.55 [i]
2024/25	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	87.074*	63.32 / 77.51	41.226[2]	55.86 / 67.88	40.38 / 63.5	37.62 / 62.92	38.03 / 62.82	8.811	43.1 / 59.82	44.51 / 58.43	38.59 / 57.89	8.99 [i]
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	86.410*	66.74 / 77.51	36.483	53.42 / 65.57	46.91 / 63.28	44.86 / 62.62	45.05 / 62.5	15.566	43.69 / 59.5	57.2 / 57.2	39 / 57.19	7.65 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

[1] Maximum available capacity accounting for SGN Stranraer reserved capacity.

[2]Maximum available capacity accounting for demand downstream of Carrickfergus

A3.1.3 Twynholm Minimum Pressure 56barg, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykennee	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	59.114*	56 / 65.61	41.414	56.65 / 63.65	44.48 / 56.8	44.18 / 56.55	44.13 / 56.51	3.118	43.26 / 53.51	45.81 / 54.1	39 / 51.58	5.18 [i]
2023/24	72.690*	56.01 / 70.22	45.472[2]	61.77 / 67.21	36.67 / 58.92	34.16 / 58.5	34.57 / 58.47	0.896	47.48 / 55.66	49.59 / 56.19	43.5 / 53.43	9.09 [i]
2024/25	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2025/26	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2026/27	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2027/28	80.440*	56.01 / 75.03	47.860[2]	63.64 / 70.77	32.45 / 62.59	29.03 / 62.17	29.58 / 62.1	2.576	48.77 / 59.2	50.76 / 59.25	44.83 / 57.33	11.12 [i]
2028/29	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2029/30	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2030/31	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2031/32	71.596*	56.01 / 72.9	51.298[2]	66.49 / 72.45	38.05 / 62.32	36.54 / 62	36.58 / 61.94	0.873	50.36 / 59.3	52.18 / 59.57	46.42 / 57.03	8.73 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

[2]Maximum available capacity accounting for demand downstream of Carrickfergus

A3.1.4 Carrick Sensitivity – Twynholm Minimum Pressure 56barg, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow (6)	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285(Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	60.374*	56 / 64.6	40.154	55.93 / 63.82	44.23 / 55.33	43.9 / 55.05	43.83 / 55	4.389 (6)	43.4 / 54.5	45.52 / 54.82	39 / 52.61	5.14 [i]
2023/24	61.248*	56 / 66.63	56.914	67.48 / 74.98	43.2 / 57.46	42.05 / 57.18	42.47 / 57.18	-10.635 (20)	42.98 / 57.68	54.74 / 64.33	38.89 / 55.62	6.03
2024/25	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2025/26	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2026/27	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2027/28	70.490*	56 / 69.3	57.810	64.41 / 74.98	39.57 / 58.59	37.93 / 58.32	38.45 / 58.28	-7.695 (17)	38.95 / 58.09	45.01 / 59.35	33.97 / 56.26	7.29 [i]
2028/29	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2029/30	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2030/31	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2031/32	65.106*	56.01 / 68.23	57.810	65.96 / 75	41.9 / 58.42	41.28 / 58.1	41.31 / 58.04	-5.683 (17)	41.81 / 58.24	47.32 / 59.04	36.82 / 56.03	6.52 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

	Carrickfergus AGI Flows	
	Peak Flow NWP > BTP (GWh)	Peak Flow BTP > NWP (GWh)
2022/23	0.111	0.720
2023/24	1.273	0.150
2027/28	1.123	0.595
2031/32	1.169	0.459

A3.1.5 Twynholm Maximum Pressure as per TA Maximum Pressure Cap, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285(Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	71.452*	61.68 / 69.5	29.076	49.78 / 59.01	47.38 / 58.06	46.78 / 57.57	46.67 / 57.49	15.533	43.67 / 54.49	43.33 / 53.39	39 / 52.41	5.4 [i]
2023/24	72.690*	56.01 / 70.22	45.472[2]	61.77 / 67.21	36.67 / 58.92	34.16 / 58.5	34.57 / 58.47	0.896	47.48 / 55.66	49.59 / 56.19	43.5 / 53.43	9.09 [i]
2024/25	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2025/26	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2026/27	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2027/28	80.440*	56.01 / 75.03	47.860[2]	63.64 / 70.77	32.45 / 62.59	29.03 / 62.17	29.58 / 62.1	2.576	48.77 / 59.2	50.76 / 59.25	44.83 / 57.33	11.12 [i]
2028/29	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2029/30	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2030/31	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2031/32	71.596*	56.01 / 72.9	51.298[2]	66.49 / 72.45	38.05 / 62.32	36.54 / 62	36.58 / 61.94	0.873	50.36 / 59.3	52.18 / 59.57	46.42 / 57.03	8.73 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

Twynholm pressures in green indicate that the maximum inlet pressure does not exceed the maximum pressure cap for the given Twynholm flow

[2]Maximum available capacity accounting for demand downstream of Carrickfergus

	PTL Flow (MSCMD)	GNI Flow in IC1 (MSCMD)	Total IC1 (MSCMD)	Max Pressure Cap (barg)
2022/23	6.463	17	23.463	69.52
2027/28	7.276	17	24.276	68.20
2031/32	6.476	17	23.476	69.50

A3.1.6 Carrick Sensitivity – Twynholm Maximum Pressure as per TA Maximum Pressure Cap, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykennee	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow (6)	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	75.731*	61.25 / 68.9	25.804	48.29 / 58.26	45.17 / 56.13	44.43 / 55.53	44.29 / 55.43	19.347 (0)	43.79 / 54.93	42.88 / 53.51	39 / 52.73	5.94 [i]
2023/24	71.640*	59.77 / 69.5	46.522	60.2 / 69.05	43.98 / 58.32	42.51 / 57.9	42.9 / 57.87	-0.232 (11)	43.4 / 57.37	46.9 / 57.83	39 / 55.42	6.61
2024/25	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	70.490*	56 / 69.3	57.810[2]	64.41 / 74.98	39.57 / 58.59	37.93 / 58.32	38.45 / 58.28	-7.695 (17)	38.95 / 58.09	45.01 / 59.35	33.97 / 56.26	7.29 [i]
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	67.218*	58.16 / 70.12	55.698	65.55 / 74.89	43.9 / 60.18	43.25 / 59.86	43.28 / 59.81	-3.648 (17)	43.78 / 59.68	48.33 / 60.13	39 / 57.64	6.37 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston. [2]Maximum available capacity accounting for demand downstream of Carrickfergus

	Carrickfergus AGI Flows	
	Peak Flow NWP > BTP (GWh)	Peak Flow BTP > NWP (GWh)
2023/24	0.897	0.693
2027/28	1.123	0.595
2031/32	1.095	0.562

	PTL Flow (MSCMD)	GNI Flow in IC1 (MSCMD)	Total IC1 (MSCMD)	Max Pressure Cap (barg)
2022/23	6.85	17	23.85	68.90
2023/24	6.48	17	23.48	69.5
2027/28	6.376	17	23.376	69.66
2031/32	6.08	17	23.08	70.12

Severe Winter Peak Day- (Firm & Interuptable)

A3.1.7 Twynholm Minimum Pressure 56barg, Min System Pressure 12bar

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenney e	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	12 (Min)	12 (Min)	12 (Min)	42.01 (max)	12 (Min)	12 (Min)	12 (Min)	20 (max)
2022/23	88.765*	56.01 / 62.3	16.296	26.15 / 38.11	29.73 / 42.43	27.81 / 40.96	27.44 / 40.66	30.989	24.44 / 37.66	20.43 / 32.89	12 / 32.39	11.35 [iii]
2023/24	89.285[1]	56.01 / 64.52	33.310	38.06 / 48.42	26.45 / 45.44	22.29 / 44.24	22.9 / 44.1	15.456	23.94 / 41.1	25.06 / 38.07	14.75 / 37.27	13.570 [I]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	89.285[1]	56.01 / 69.45	43.548	47.87 / 59.5	26.02 / 52.83	21.21 / 52.05	21.93 / 51.91	9.143	29.27 / 48.91	31.66 / 51.55	21.68 / 46	14.46 [i]
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	89.285[1]	56.01 / 65.93	38.142	40.26 / 51.92	27.41 / 47.44	23.38 / 46.39	23.73 / 46.19	16.628	23.58 / 43.19	24.35 / 38.93	12.89 / 39.32	13.38 [i]

1 Maximum available capacity accounting for SGN Stranraer reserved capacity.

A3.1.8 Maximum flow through Twynholm, Twynholm pressure as necessary, minimum system pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenney e	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	89.263[1]	68.39 / 75.68	15.798	45.22 / 56.4	48.99 / 60.03	47.84 / 59.1	47.62 / 58.93	31.486	44.62 / 55.93	42.28 / 53.53	39 / 53.19	6.37 [i]
2023/24	89.285	67.64 / 77.01	33.310	52.27 / 63.33	46.13 / 61.84	43.95 / 61.03	44.25 / 60.94	15.566	43.62 / 57.94	43.91 / 56.2	39 / 55.64	7.76 [i]
2024/25	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	87.184*	61.88 / 77.46	45.648[2]	58.73 / 69.8	37.87 / 63.47	34.76 / 62.91	35.2 / 62.81	7.109	43.47 / 59.81	45.78 / 58.7	39 / 57.82	9.8 [i]
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	85.360*	65.48 / 77.51	42.066	56.71 / 68.12	45.36 / 63.64	43.14 / 63.02	43.33 / 62.91	12.747	44.02 / 59.91	45.09 / 57.9	39 / 57.62	7.98 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

[1] Maximum available capacity accounting for SGN Stranraer reserved capacity.

[2]Maximum available capacity accounting for demand downstream of Carrickfergus

A3.1.9 Twynholm Minimum Pressure 56barg, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykennee	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	60.607*	56.01 / 66.3	44.454	58.51 / 65.47	43.93 / 57.26	43.58 / 56.98	43.52 / 56.93	2.852	43.5 / 54.01	46.3 / 54.74	39 / 51.96	5.41 [i]
2023/24	74.912*	56.01 / 70.17	47.683	61.73 / 67.65	35.44 / 58.27	32.67 / 57.81	33.1 / 57.77	1.260	45.71 / 54.93	48.13 / 55.48	41.32 / 52.58	9.66 [i]
2024/25	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2025/26	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2026/27	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2027/28	83.834*	56.01 / 73.91	48.998[2]	60.72 / 69.07	30.16 / 60.29	26.21 / 59.79	26.8 / 59.7	3.969	43.72 / 56.7	46.15 / 56.34	39 / 54.64	12.29 [i]
2028/29	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2029/30	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2030/31	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2031/32	73.254*	56.01 / 73.25	54.172[2]	67.79 / 73.96	37.14 / 62.38	35.49 / 62.03	35.5 / 61.96	0.697	49.93 / 59.45	52 / 59.84	45.68 / 57.02	9.14 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

[2]Maximum available capacity accounting for demand downstream of Carrickfergus

A3.1.10 Carrick sensitivity - Twynholm Minimum Pressure 56barg, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow (6)	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285(Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	60.430*	56.01 / 65.17	44.631	58.71 / 66.55	44 / 56.02	43.67 / 55.74	43.61 / 55.69	2.675 (12)	43.64 / 55.27	46.43 / 55.97	39 / 53.28	5.12 [i]
2023/24	64.520*	56 / 66.87	58.075	67.26 / 75.02	41.96 / 56.95	40.66 / 56.61	41.09 / 56.6	-9.187	41.59 / 57.1	48.72 / 59.23	37 / 54.82	6.47 [i]
2024/25	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2025/26	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2026/27	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2027/28	73.663*	56.01 / 69.4	59.169	64.19 / 74.98	38.06 / 57.87	36.19 / 57.56	36.73 / 57.51	-6.291 (16)	37.23 / 57.28	43.45 / 58.37	31.46 / 55.27	7.9 [i]
2028/29	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2029/30	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2030/31	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2031/32	68.500*	56 / 68.37	58.926	65.56 / 74.97	40.4 / 57.78	39.63 / 57.42	39.65 / 57.35	-4.168 (15)	40.15 / 57.37	45.73 / 58.03	34.51 / 55.02	7.03 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

	Carrickfergus AGI Flows	
	Peak Flow NWP > BTP (GWh)	Peak Flow BTP > NWP (GWh)
2022/23	0.255	0.630
2023/24	1.229	0.238
2027/28	1.082	0.664
2031/32	1.119	0.539

A3.1.11 Twynholm Maximum Pressure as per TA Maximum Pressure Cap, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykennee	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	69.783*	61.32 / 69.74	35.278	53.05 / 62.09	47.49 / 58.82	46.94 / 58.38	46.84 / 58.31	12.006	43.84 / 55.31	44.29 / 54.6	39 / 53.26	5.31 [i]
2023/24	74.912*	56.01 / 70.17	47.683[2]	61.73 / 67.65	35.44 / 58.27	32.67 / 57.81	33.1 / 57.77	1.260	45.71 / 54.93	48.13 / 55.48	41.32 / 52.58	9.66 [i]
2024/25	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2025/26	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2026/27	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2027/28	83.834*	56.01 / 73.91	48.998[2]	60.72 / 69.07	30.16 / 60.29	26.21 / 59.79	26.8 / 59.7	3.969	43.72 / 56.7	46.15 / 56.34	39 / 54.64	12.29 [i]
2028/29	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2029/30	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2030/31	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2031/32	73.254*	56.01 / 73.25	54.172[2]	67.79 / 73.96	37.14 / 62.38	35.49 / 62.03	35.5 / 61.96	0.697	49.93 / 59.45	52 / 59.84	45.68 / 57.02	9.14 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

Twynholm pressures in green indicate that the maximum inlet pressure does not exceed the maximum pressure cap for the given Twynholm flow

[2]Maximum available capacity accounting for demand downstream of Carrickfergus

	PTL Flow (MSCMD)	GNI Flow in IC1 (MSCMD)	Total IC1 (MSCMD)	Max Pressure Cap (barg)
2022/23	6.312	17	23.312	69.76
2023/24	6.776	17	23.776	69.02
2027/28	7.583	17	24.583	67.69
2031/32	6.626	17	23.626	69.26

A3.1.12 Carrick sensitivity - Twynholm Maximum Pressure as per TA Maximum Pressure Cap, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenney e	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	74.802*	61.11 / 69.03	30.259	50.45 / 60.21	45.33 / 56.62	44.6 / 56.05	44.46 / 55.95	17.026 (0)	43.96 / 55.45	43.48 / 54.18	39 / 53.29	5.9 [i]
2023/24	70.048	59.33 / 69.72	52.547	64.34 / 72.89	44.11 / 58.98	42.68 / 58.55	43.07 / 58.52	-3.604 (14)	43.57 / 58.48	48.51 / 59.49	39 / 56.28	6.5 [i]
2024/25	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2025/26	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2026/27	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2027/28	73.663*	56.01 / 69.4	59.169[2]	64.19 / 74.98	38.06 / 57.87	36.19 / 57.56	36.73 / 57.51	-6.291 (16)	37.23 / 57.28	43.45 / 58.37	31.46 / 55.27	7.9 [i]
2028/29	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL	FAIL
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	69.772*	57.6 / 69.78	58.053[2]	65.5 / 74.99	42.04 / 59.17	41.27 / 58.81	41.28 / 58.75	-2.908 (15)	41.78 / 58.56	46.7 / 59.01	36.38 / 56.35	6.86 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

Twynholm pressures in green indicate that the maximum inlet pressure does not exceed the maximum pressure cap for the given Twynholm flow

[2]Maximum available capacity accounting for demand downstream of Carrickfergus

	Carrickfergus AGI Flows	
	Peak Flow NWP > BTP (GWh)	Peak Flow BTP > NWP (GWh)
2023/24	1.035	0.526
2027/28	1.082	0.664
2031/32	1.073	0.599

	PTL Flow (MSCMD)	GNI Flow in IC1 (MSCMD)	Total IC1 (MSCMD)	Max Pressure Cap (barg)
2022/23	6.766	17	23.766	69.04
2023/24	6.336	17	23.336	69.74
2027/28	6.663	17	23.663	69.20
2031/32	6.311	17	23.311	69.76

A3.2 Average Winter Peak Day

Average Winter Peak Day- (Firm)

A3.2.1 Twynholm Minimum Pressure 56barg, Min System Pressure 12bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	12 (Min)	12 (Min)	12 (Min)	42.01 (max)	12 (Min)	12 (Min)	12 (Min)	20 (max)
2022/23	73.442	56.01 / 60.88	2.432	31.87 / 40.39	39.08 / 46.64	37.59 / 45.53	37.29 / 45.31	37.224	34.29 / 42.31	30.51 / 38.82	26.74 / 38.46	7.78 [ii]
2023/24	89.097*	56.01 / 61.83	12.482	23.88 / 36.21	28.5 / 41.28	24.57 / 39.6	25.1 / 39.37	28.125	22.1 / 36.37	19.99 / 32.42	12 / 31.71	11.88 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	87.792*	56.01 / 63.94	16.738	25.51 / 40.96	29.61 / 45.65	25.05 / 44.25	25.62 / 43.97	27.661	22.62 / 40.97	19.27 / 36.09	12 / 36.29	11.28 [i]
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	87.328*	56.01 / 62.76	12.017	23.36 / 37.41	30.29 / 43.48	26.45 / 41.77	26.6 / 41.43	34.151	23.6 / 38.43	19.03 / 32.49	12 / 33.43	11.44 [ii]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

A3.2.2 Maximum flow through Twynholm, Twynholm pressure as necessary, minimum system pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenney e	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	73.442	63.33 / 68.48	2.432	42.63 / 50.56	48.88 / 56.06	47.71 / 55.13	47.48 / 54.95	37.224	44.48 / 51.95	41.6 / 49.44	39 / 49.12	5.81 [ii]
2023/24	89.274[1]	68.39 / 75.25	12.305	44.11 / 55.29	48.51 / 59.43	46.28 / 58.39	46.54 / 58.25	28.302	43.54 / 55.25	41.93 / 53.25	39 / 52.61	6.87 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	88.013*	68.41 / 77.51	16.517	44.95 / 59.31	49.16 / 62.99	46.54 / 62.08	46.83 / 61.91	27.871	43.83 / 58.91	41.65 / 56.39	39 / 56.46	6.68 [i]
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	89.285[1]	69.1 / 76.88	10.061	43.54 / 56.2	49.62 / 61.38	47.64 / 60.23	47.47 / 60	36.107	44.47 / 57	41.38 / 53.7	39 / 54.03	6.69 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

1 Maximum available capacity accounting for SGN Stranraer reserved capacity.

A3.2.3 Twynholm Minimum Pressure 56barg, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenney e	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	51.552*	56 / 62.04	24.322	47.56 / 54.43	46.96 / 54.33	46.46 / 53.96	46.36 / 53.89	15.334	43.36 / 50.89	42.89 / 50.24	39 / 48.93	3.97 [i]
2023/24	64.332*	56.01 / 67.8	37.246	57 / 62.77	40.91 / 58.06	39 / 57.67	39.39 / 57.65	3.405	46.35 / 54.65	48.55 / 55.04	42.75 / 52.75	7.18 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	63.824*	56 / 72.01	40.707	60.7 / 68.36	41.31 / 63.1	39 / 62.79	39.44 / 62.74	3.803	49.4 / 59.76	51.37 / 59.96	45.95 / 58.23	6.84 [i]
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	61.491*	56 / 67.42	37.854	54.08 / 62.38	42.94 / 58.09	41.08 / 57.68	41.32 / 57.6	8.325	42.88 / 54.6	44.73 / 53.92	39 / 52.55	6.6 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

A3.2.4 Carrick sensitivity - Twynholm Minimum Pressure 56barg, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow (6)	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285(Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	58.318*	56.01 / 61.66	17.556	45.23 / 52.64	44.98 / 52.31	44.25 / 51.77	44.12 / 51.68	22.100 (0)	43.62 / 51.18	42.32 / 49.99	39 / 49.02	4.62 [i]
2023/24	60.750*	56 / 64.84	40.828	56.86 / 64.64	43.36 / 55.61	42.08 / 55.26	42.48 / 55.25	-0.088 (7)	42.98 / 54.85	46.36 / 55.64	39 / 52.89	5.8 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	59.589*	56.01 / 67.41	44.941	58.45 / 68.92	43.88 / 58.9	42.28 / 58.64	42.73 / 58.59	-0.398 (14)	43.23 / 58.36	45.95 / 58.82	39 / 56.62	5.52 [i]
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	59.236*	56.01 / 65.91	40.110	55.44 / 64.57	44.23 / 56.92	43.22 / 56.54	43.24 / 56.47	6.191 (7)	43.18 / 55.97	44.95 / 55.59	39 / 54.01	5.61 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

	Carrickfergus AGI Flows	
	Peak Flow NWP > BTP (GWh)	Peak Flow BTP > NWP (GWh)
2023/24	0.810	0.579
2027/28	0.711	0.714
2031/32	0.602	0.815

A3.2.5 Twynholm Maximum Pressure as per TA Maximum Pressure Cap, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285(Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	73.442	63.33 / 68.48	2.432	42.63 / 50.56	48.88 / 56.06	47.71 / 55.13	47.48 / 54.95	37.224	44.48 / 51.95	41.6 / 49.44	39 / 49.12	5.81 [ii]
2023/24	72.370*	60.48 / 69.4	29.209	50.12 / 58.76	43.71 / 57.65	41.88 / 57.07	42.24 / 57.02	11.454	43.21 / 54.02	43.86 / 53.3	39.01 / 51.95	6.95 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	63.824*	56 / 72.01	40.707	60.7 / 68.36	41.31 / 63.1	39 / 62.79	39.44 / 62.74	3.803	49.4 / 59.76	51.37 / 59.96	45.95 / 58.23	6.84 [i]
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	67.793*	60.69 / 70.03	31.553	50.61 / 60.84	46.97 / 59.5	45.2 / 58.95	45.42 / 58.86	14.538	43.29 / 55.86	43.33 / 54.43	39 / 53.72	6.19 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

Twynholm pressures in green indicate that the maximum inlet pressure does not exceed the maximum pressure cap for the given Twynholm flow

	PTL Flow (MSCMD)	GNI Flow in IC1 (MSCMD)	Total IC1 (MSCMD)	Max Pressure Cap (barg)
2022/23	6.643	17	23.643	69.24
2023/24	6.546	17	23.546	69.39
2027/28	5.773	17	22.773	70.59
2031/32	6.132	17	23.132	70.04

A3.2.6 Carrick sensitivity - Twynholm Maximum as per TA Max Pressure Cap, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow (6)	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285(Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	73.442	61.41 / 66.44	2.432	42.62 / 50.58	46.44 / 53.64	45.21 / 52.66	44.96 / 52.47	37.235 (0)	44.46 / 51.97	41.6 / 49.46	39 / 49.15	5.82 [ii]
2023/24	75.675*	61.33 / 68.91	25.903	48.7 / 58.37	44.43 / 56.12	42.64 / 55.44	43 / 55.38	14.737 (4)	43.32 / 54.88	43.36 / 53.84	39 / 52.75	6.64 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	69.318*	59.42 / 69.83	35.212	52.58 / 64.43	44.58 / 59.23	42.61 / 58.78	43.02 / 58.7	9.110 (11)	43.49 / 58.2	43.83 / 57.45	39 / 56.49	6.1 [i]
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	72.502*	60.79 / 69.36	26.843	48.31 / 59.51	45.51 / 57.48	44.17 / 56.8	44.12 / 56.68	19.292 (1)	43.62 / 56.18	42.55 / 54.35	39 / 53.91	6.38 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

Twynholm pressures in green indicate that the maximum inlet pressure does not exceed the maximum pressure cap for the given Twynholm flow

	Carrickfergus AGI Flows	
	Peak Flow NWP > BTP (GWh)	Peak Flow BTP > NWP (GWh)
2023/24	0.246	1.281
2027/28	0.337	1.174
2031/32	0.049	1.446

	PTL Flow (MSCMD)	GNI Flow in IC1 (MSCMD)	Total IC1 (MSCMD)	Max Pressure Cap (barg)
2022/23	6.643	17	23.643	69.24
2023/24	6.845	17	23.845	68.91
2027/28	6.27	17	23.27	69.83
2031/32	6.558	17	23.558	69.37

Average Winter Peak Day- (Firm & Interuptable)

A3.2.7 Twynholm Minimum Pressure 56barg, Min System Pressure 12bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenney e	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	12 (Min)	12 (Min)	12 (Min)	42.01 (max)	12 (Min)	12 (Min)	12 (Min)	20 (max)
2022/23	77.533	56.01 / 60.93	2.432	28.81 / 38.14	37.03 / 45.19	35.23 / 43.88	34.86 / 43.61	39.833	31.86 / 40.61	27.13 / 36.16	22.71 / 36.05	9.02 [ii]
2023/24	88.610*	56.01 / 62.2	17.059	26.45 / 38.53	28.83 / 42.15	24.94 / 40.57	25.46 / 40.36	26.157	22.46 / 37.36	20.84 / 33.69	12 / 32.83	11.75 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	87.295*	56.01 / 64.32	21.326	28.34 / 43.29	29.96 / 46.41	25.45 / 45.1	26.01 / 44.84	25.671	23.01 / 41.84	20.11 / 37.29	12 / 37.4	11.43 [iii]
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	86.919*	56.01 / 63.11	16.517	25.64 / 39.59	30.56 / 44.21	26.79 / 42.59	26.9 / 42.27	32.260	23.9 / 39.27	19.71 / 33.8	12 / 34.42	11.28 [iii]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

A3.2.8 Maximum flow through Twynholm, Twynholm pressure as necessary, minimum system pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykennee	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	77.533	65.02 / 70.37	2.432	42.78 / 51.28	49.49 / 57.12	48.17 / 56.08	47.91 / 55.88	39.844	44.91 / 52.88	41.62 / 50.01	39 / 49.85	6.13 [ii]
2023/24	89.274[1]	68.55 / 75.76	16.395	45.3 / 56.73	48.7 / 60.11	46.46 / 59.1	46.72 / 58.97	26.821	43.72 / 55.97	42.28 / 54.01	39 / 53.32	6.87 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	86.388*	67.96 / 77.51	22.233	46.88 / 61.14	49.25 / 63.48	46.69 / 62.66	46.98 / 62.5	24.764	43.98 / 59.5	42.13 / 57.21	39 / 57.2	6.6 [i]
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	89.285[1]	69.24 / 77.34	14.151	44.52 / 57.53	49.78 / 61.98	47.8 / 60.86	47.63 / 60.64	34.626	44.63 / 57.64	41.66 / 54.5	39 / 54.68	6.69 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

1 Maximum available capacity accounting for SGN Stranraer reserved capacity.

A3.2.9 Twynholm Minimum Pressure 56barg, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenney e	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	50.889*	56.01 / 62.52	29.076	49.78 / 56.75	47.12 / 55.02	46.63 / 54.67	46.54 / 54.61	13.189	43.54 / 51.61	43.49 / 51.2	39 / 49.62	3.94 [i]
2023/24	63.990*	56 / 68.81	41.679	60.72 / 66.01	40.98 / 59.36	39 / 59	39.39 / 58.98	1.625	48.36 / 56.05	50.7 / 56.84	44.64 / 54.04	7.25 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	63.558*	56.01 / 73.6	45.062	65.43 / 72.02	41.38 / 65	39 / 64.73	39.42 / 64.68	2.145	52.78 / 61.95	54.81 / 62.39	49.33 / 60.21	6.95 [i]
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	62.254*	56 / 68.06	41.182	56.12 / 64.28	42.62 / 58.66	40.72 / 58.24	40.96 / 58.17	7.673	43.26 / 55.17	45.36 / 54.63	39 / 53.05	6.75 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

A3.2.10 Carrick sensitivity - Twynholm Minimum Pressure 56barg, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow (6)	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285(Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	57.787*	56.01 / 62.1	22.177	46.88 / 54.52	45.12 / 52.97	44.41 / 52.46	44.28 / 52.37	20.088 (0)	43.78 / 51.87	42.71 / 50.78	39 / 49.72	4.6 [i]
2023/24	60.220*	56.01 / 65.35	45.449	59.9 / 67.59	43.58 / 56.34	42.31 / 55.99	42.71 / 55.97	-2.233 (13)	43.21 / 55.69	47.48 / 60.09	39 / 53.74	5.76 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	58.926*	56.01 / 67.93	49.695	61.6 / 71.88	44.12 / 59.65	42.53 / 59.42	42.98 / 59.38	-2.499 (14)	43.48 / 59.24	47.06 / 60.09	39 / 57.43	5.48 [i]
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	58.827*	56 / 66.46	44.609	58.28 / 67.25	44.38 / 57.66	43.34 / 57.3	43.36 / 57.24	4.223 (7)	43.48 / 56.74	45.89 / 56.69	39 / 54.72	5.6 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

	Carrickfergus AGI Flows	
	Peak Flow NWP > BTP (GWh)	Peak Flow BTP > NWP (GWh)
2023/24	0.897	0.476
2027/28	0.795	0.606
2031/32	0.669	0.717

A3.2.11 Twynholm Maximum Pressure as per TA Maximum Pressure Cap, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenney e	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	73.995	63.69 / 69.14	5.970	43.22 / 51.63	49.1 / 56.72	47.91 / 55.8	47.68 / 55.62	36.295	44.68 / 52.62	41.91 / 50.27	39.02 / 49.8	5.68 [ii]
2023/24	71.397*	59.42 / 69.45	34.272	52.83 / 61.04	42.57 / 58.03	40.6 / 57.49	40.97 / 57.44	8.889	43.12 / 54.44	44.83 / 54.01	39 / 52.35	7.21 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	63.558*	56.01 / 73.6	45.062	65.43 / 72.02	41.38 / 65	39 / 64.73	39.42 / 64.68	2.145	52.78 / 61.95	54.81 / 62.39	49.33 / 60.21	6.95 [i]
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	66.455*	59.92 / 70.18	36.981	53.77 / 63.43	46.08 / 60.04	44.21 / 59.54	44.42 / 59.45	11.796	43.3 / 56.45	44.48 / 55.32	39 / 54.32	6.36 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

Twynholm pressures in green indicate that the maximum inlet pressure does not exceed the maximum pressure cap for the given Twynholm flow

	PTL Flow (MSCMD)	GNI Flow in IC1 (MSCMD)	Total IC1 (MSCMD)	Max Pressure Cap (barg)
2022/23	6.693	17	23.693	69.16
2023/24	6.458	17	23.458	69.53
2027/28	5.749	17	22.749	70.62
2031/32	6.011	17	23.011	70.23

A3.2.12 Carrick sensitivity - Twynholm Maximum Pressure as per TA Maximum Pressure Cap, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenney e	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow (6)	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	77.533	63.15 / 68.38	2.432	42.79 / 51.32	47.08 / 54.72	45.69 / 53.64	45.41 / 53.43	39.833 (0)	44.91 / 52.93	41.64 / 50.06	39.03 / 49.91	6.13 [ii]
2023/24	74.183*	60.97 / 69.1	31.486	51.5 / 60.99	44.54 / 56.84	42.76 / 56.22	43.11 / 56.16	11.829 (5)	43.61 / 55.66	44.3 / 57.09	39 / 53.56	6.55 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	67.771*	59.06 / 70.03	40.850	55.86 / 67.4	44.73 / 59.91	42.81 / 59.5	43.22 / 59.43	6.147 (11)	43.64 / 58.93	44.86 / 58.61	39 / 57.22	6.01 [i]
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	70.988*	60.42 / 69.58	32.448	51.13 / 62.06	45.63 / 58.19	44.14 / 57.57	44.3 / 57.46	16.373 (2)	43.8 / 56.96	43.4 / 55.33	39 / 54.73	6.28 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

Twynholm pressures in green indicate that the maximum inlet pressure does not exceed the maximum pressure cap for the given Twynholm flow

	Carrickfergus AGI Flows	
	Peak Flow NWP > BTP (GWh)	Peak Flow BTP > NWP (GWh)
2023/24	0.363	1.136
2027/28	0.458	1.025
2031/32	0.177	1.301

	PTL Flow (MSCMD)	GNI Flow in IC1 (MSCMD)	Total IC1 (MSCMD)	Max Pressure Cap (barg)
2022/23	7.013	17	24.013	68.64
2023/24	6.71	17	23.71	69.13
2027/28	6.13	17	23.13	70.04
2031/32	6.421	17	23.421	69.59

A3.3 Average Spring Day

Average Spring Day- (Firm)

A3.3.1 Twynholm Minimum Pressure 56barg, Min System Pressure 12bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	12 (Min)	12 (Min)	12 (Min)	42.01 (max)	12 (Min)	12 (Min)	12 (Min)	20 (max)
2022/23	49.241	56 / 59.83	2.211	43.21 / 48.13	47.63 / 52.24	47.17 / 51.84	47.07 / 51.76	26.014	44.07 / 48.76	42.76 / 47.62	41.01 / 47.1	4 [ii]
2023/24	57.533	56 / 59.67	2.322	40.63 / 45.62	45.27 / 49.96	44.65 / 49.44	44.57 / 49.34	26.644	41.57 / 46.34	40.03 / 44.89	38.28 / 44.42	4.51 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	50.192	56 / 59.92	3.648	42.48 / 47.84	47.36 / 52.12	46.73 / 51.64	46.61 / 51.55	28.722	43.61 / 48.55	41.67 / 47.02	40.18 / 46.76	4.37 [ii]

A3.3.2 Maximum flow through Twynholm, Twynholm pressure as necessary, minimum system pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	49.241	56 / 59.83	2.211	43.21 / 48.13	47.63 / 52.24	47.17 / 51.84	47.07 / 51.76	26.014	44.07 / 48.76	42.76 / 47.62	41.01 / 47.1	4 [ii]
2023/24	57.533	56.55 / 60.21	2.322	41.31 / 46.28	45.92 / 50.6	45.31 / 50.08	45.24 / 49.99	26.644	42.24 / 46.99	40.72 / 45.56	39 / 45.09	4.44 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	50.192	56 / 59.92	3.648	42.48 / 47.84	47.36 / 52.12	46.73 / 51.64	46.61 / 51.55	28.722	43.61 / 48.55	41.67 / 47.02	40.18 / 46.76	4.37 [ii]

A3.3.3 Twynholm Minimum Pressure 56barg, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	49.241	56 / 59.83	2.211	43.21 / 48.13	47.63 / 52.24	47.17 / 51.84	47.07 / 51.76	26.014	44.07 / 48.76	42.76 / 47.62	41.01 / 47.1	4 [ii]
2023/24	55.886*	56 / 59.71	3.969	41.44 / 46.39	45.78 / 50.46	45.22 / 49.98	45.15 / 49.89	24.997	42.15 / 46.89	40.79 / 45.64	39 / 45.08	4.33 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	50.192	56 / 59.92	3.648	42.48 / 47.84	47.36 / 52.12	46.73 / 51.64	46.61 / 51.55	28.722	43.61 / 48.55	41.67 / 47.02	40.18 / 46.76	4.37 [ii]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

A3.3.4 Carrick sensitivity - Twynholm Minimum Pressure 56barg, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	49.241	56 / 59.81	2.211	45.76 / 50.65	47.62 / 52.21	47.17 / 51.82	47.07 / 51.74	26.014	46.57 / 51.24	45.33 / 50.17	43.7 / 49.68	3.77 [ii]
2023/24	57.533	56 / 59.65	2.322	43.19 / 48.15	45.27 / 49.94	44.65 / 49.42	44.57 / 49.33	26.644	44.07 / 48.83	42.62 / 47.47	41 / 47.02	4.5 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	50.192	56 / 59.91	3.648	45.06 / 50.37	47.36 / 52.11	46.74 / 51.63	46.61 / 51.54	28.722	46.11 / 51.04	44.29 / 49.6	42.9 / 49.36	4.11 ii]

Notes: Twynholm pressures in green indicate that the maximum inlet pressure does not exceed the maximum pressure cap for the given Twynholm flow

	PTL Flow (MSCMD)	GNI Flow in IC1 (MSCMD)	Total IC1 (MSCMD)	Max Pressure Cap (barg)
2022/23	4.454	17	21.454	72.50
2023/24	5.204	17	22.204	71.43
2031/32	4.54	17	21.54	72.38

A3.3.5 Twynholm Maximum Pressure as per TA Maximum Pressure Cap, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	49.241	56 / 59.83	2.211	43.21 / 48.13	47.63 / 52.24	47.17 / 51.84	47.07 / 51.76	26.014	44.07 / 48.76	42.76 / 47.62	41.01 / 47.1	4 [ii]
2023/24	57.533	56.55 / 60.21	2.322	41.31 / 46.28	45.92 / 50.6	45.31 / 50.08	45.24 / 49.99	26.644	42.24 / 46.99	40.72 / 45.56	39 / 45.09	4.44 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	50.192	56 / 59.92	3.648	42.48 / 47.84	47.36 / 52.12	46.73 / 51.64	46.61 / 51.55	28.722	43.61 / 48.55	41.67 / 47.02	40.18 / 46.76	4.37 [ii]

Notes: Twynholm pressures in green indicate that the maximum inlet pressure does not exceed the maximum pressure cap for the given Twynholm flow

	PTL Flow (MSCMD)	GNI Flow in IC1 (MSCMD)	Total IC1 (MSCMD)	Max Pressure Cap (barg)
2022/23	4.454	17	21.454	72.50
2023/24	5.204	17	22.204	71.43
2031/32	4.54	17	21.54	72.38

Average Spring Day- (Firm & Interruptable)

A3.3.6 Twynholm Minimum Pressure 56barg, Min System Pressure 12bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	12 (Min)	12 (Min)	12 (Min)	42.01 (max)	12 (Min)	12 (Min)	12 (Min)	20 (max)
2022/23	52.005	56 / 60.01	2.211	42.19 / 47.51	46.89 / 51.82	46.34 / 51.36	46.23 / 51.27	27.926	43.23 / 48.27	41.64 / 46.89	39.84 / 46.46	4.33 [ii]
2023/24	60.186	56 / 59.82	2.322	39.45 / 44.84	44.4 / 49.42	43.69 / 48.83	43.6 / 48.72	28.446	40.6 / 45.72	38.73 / 43.99	36.93 / 43.6	4.8 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	52.846	56 / 60.08	3.648	41.45 / 47.21	46.63 / 51.7	45.92 / 51.15	45.77 / 51.05	30.524	42.77 / 48.05	40.5 / 46.26	39 / 46.1	4.74 [ii]

A3.3.7 Maximum flow through Twynholm, Twynholm pressure as necessary, minimum system pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	52.005	56 / 60.01	2.211	42.19 / 47.51	46.89 / 51.82	46.34 / 51.36	46.23 / 51.27	27.926	43.23 / 48.27	41.64 / 46.89	39.84 / 46.46	4.33 [ii]
2023/24	60.186	57.52 / 61.35	2.322	41.39 / 46.71	46.25 / 51.22	45.57 / 50.65	45.48 / 50.54	28.446	42.48 / 47.54	40.71 / 45.9	39 / 45.52	4.6 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	52.846	56. / 60.08	3.648	41.45 / 47.21	46.63 / 51.7	45.92 / 51.15	45.77 / 51.05	30.524	42.77 / 48.05	40.5 / 46.26	39 / 46.1	4.74 [ii]

A3.3.8 Twynholm Minimum Pressure 56barg, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	52.005	56 / 60.01	2.211	42.19 / 47.51	46.89 / 51.82	46.34 / 51.36	46.23 / 51.27	27.926	43.23 / 48.27	41.64 / 46.89	39.84 / 46.46	4.33 [ii]
2023/24	55.621*	56 / 59.96	6.888	41.83 / 47.08	45.85 / 50.82	45.3 / 50.36	45.23 / 50.28	23.880	42.23 / 47.28	40.9 / 46.09	39 / 45.47	4.32 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	52.846	56 / 60.08	3.648	41.45 / 47.21	46.63 / 51.7	45.92 / 51.15	45.77 / 51.05	30.524	42.77 / 48.05	40.5 / 46.26	39 / 46.1	4.74 [ii]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

A3.3.9 Carrick sensitivity - Twynholm Minimum Pressure 56barg, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	52.005	56 / 60.01	2.211	44.76 / 50.04	46.9 / 51.81	46.35 / 51.35	46.23	27.926	45.73 / 50.76	44.24 / 49.47	42.56 / 49.06	4.08 [ii]
2023/24	60.186	56 / 59.81	2.322	42.03 / 47.38	44.4 / 49.41	43.7 / 48.81	43.6 / 48.7	28.446	43.1 / 48.2	41.35 / 46.58	39.68 / 46.21	4.8 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	52.846	56 / 60.08	3.648	44.03 / 49.75	46.63 / 51.69	45.92 / 51.15	45.77 / 51.04	30.524	45.27 / 50.54	43.14 / 48.86	41.74 / 48.71	4.45 [ii]

Notes: Twynholm pressures in green indicate that the maximum inlet pressure does not exceed the maximum pressure cap for the given Twynholm flow

	PTL Flow (MSCMD)	GNI Flow in IC1 (MSCMD)	Total IC1 (MSCMD)	Max Pressure Cap (barg)
2022/23	4.704	17	21.704	72.15
2023/24	5.444	17	22.444	71.08
2031/32	4.78	17	21.78	72.04

A3.3.10 Twynholm Maximum Pressure as per TA Maximum Pressure Cap, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	52.005	56 / 60.01	2.211	42.19 / 47.51	46.89 / 51.82	46.34 / 51.36	46.23 / 51.27	27.926	43.23 / 48.27	41.64 / 46.89	39.84 / 46.46	4.33 [ii]
2023/24	60.186	57.52 / 61.35	2.322	41.39 / 46.71	46.25 / 51.22	45.57 / 50.65	45.48 / 50.54	28.446	42.48 / 47.54	40.71 / 45.9	39 / 45.52	4.6 [i]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	52.846	56 / 60.08	3.648	41.45 / 47.21	46.63 / 51.7	45.92 / 51.15	45.77 / 51.05	30.524	42.77 / 48.05	40.5 / 46.26	39 / 46.1	4.74 [ii]

Notes: Twynholm pressures in green indicate that the maximum inlet pressure does not exceed the maximum pressure cap for the given Twynholm flow

	PTL Flow (MSCMD)	GNI Flow (MSCMD)	Total IC1 (MSCMD)	Max Pressure Cap (barg)
2022/23	4.704	17	21.704	72.15
2023/24	5.444	17	22.444	71.08
2031/32	4.78	17	21.78	72.04

A3.4 Summer Minimum Day

Summer Minimum Day- (Firm)

A3.4.1 Twynholm Minimum Pressure 56barg, Min System Pressure 12bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykenney e	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	12 (Min)	12 (Min)	12 (Min)	42.01 (max)	12 (Min)	12 (Min)	12 (Min)	20 (max)
2022/23	25.096	56 / 57.83	1.990	48.72 / 50.7	52.06 / 53.98	51.96 / 53.9	51.94 / 53.88	16.163	48.94 / 50.88	48.66 / 50.61	47.38 / 49.93	2.08 [ii]
2023/24	25.428	56 / 57.86	1.990	48.67 / 50.69	52.02 / 53.98	51.92 / 53.89	51.9 / 53.87	16.418	48.9 / 50.87	48.6 / 50.58	47.33 / 49.92	2.11 [ii]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	20.232	56 / 57.38	3.206	49.16 / 50.72	52.56 / 54	52.45 / 53.9	52.42 / 53.88	16.893	49.42 / 50.88	49.06 / 50.59	47.8 / 49.95	2.11 [ii]

A3.4.2 Carrick sensitivity - Twynholm Minimum Pressure 56barg, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	25.096	56 / 57.82	1.990	51.23 / 53.2	52.06 / 53.98	51.96 / 53.89	51.94 / 53.87	16.163	51.44 / 53.37	51.18 / 53.11	49.97 / 52.47	1.97 [ii]
2023/24	25.428	56 / 57.85	1.990	51.18 / 53.19	52.02 / 53.98	51.92 / 53.88	51.9 / 53.86	16.418	51.4 / 53.36	51.12 / 53.09	49.92 / 52.46	2 [ii]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	20.232	56 / 57.25	3.206	51.66 / 53.07	52.57 / 53.87	52.45 / 53.77	52.43 / 53.75	16.882	51.93 / 53.25	51.59 / 52.97	50.39 / 52.37	1.99 [ii]

Notes: Twynholm pressures in green indicate that the maximum inlet pressure does not exceed the maximum pressure cap for the given Twynholm flow

	PTL Flow (MSCMD)	GNI Flow (MSCMD)	Total IC1 (MSCMD)	Max Pressure Cap (barg)
2022/23	2.27	17	19.27	75.30
2023/24	2.3	17	19.3	75.26
2031/32	1.83	17	18.83	75.81

Summer Minimum Day- (Firm & Interruptable)

A3.4.3 Twynholm Minimum Pressure 56barg, Min System Pressure 12bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	12 (Min)	12 (Min)	12 (Min)	42.01 (max)	12 (Min)	12 (Min)	12 (Min)	20 (max)
2022/23	26.202	56 / 57.93	1.990	48.54 / 50.65	51.93 / 53.97	51.82 / 53.87	51.8 / 53.85	17.026	48.8 / 50.85	48.47 / 50.54	47.18 / 49.87	2.18 [ii]
2023/24	26.533	56 / 57.95	1.990	48.47 / 50.62	51.88 / 53.96	51.77 / 53.85	51.74 / 53.83	17.269	48.74 / 50.83	48.4 / 50.49	47.11 / 49.84	2.21 [ii]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	21.337	56 / 57.49	3.206	49 / 50.69	52.46 / 54.01	52.33 / 53.9	52.3 / 53.88	17.744	49.3 / 50.88	48.89 / 50.55	47.61 / 49.92	2.22 [ii]

A3.4.4 Carrick sensitivity - Twynholm Minimum Pressure 56barg, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
2022/23	26.202	56 / 57.92	1.990	51.05 / 53.15	51.92 / 53.96	51.82 / 53.86	51.8 / 53.84	17.026	51.3 / 53.34	50.99 / 53.05	49.77 / 52.41	2.06 [ii]
2023/24	26.533	56 / 57.95	1.990	50.99 / 53.12	51.88 / 53.95	51.77 / 53.85	51.75 / 53.83	17.269	51.25 / 53.33	50.92 / 53.01	49.71 / 52.39	2.09 [ii]
2024/25	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2025/26	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2026/27	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2027/28	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2028/29	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2029/30	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2030/31	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
2031/32	21.337	56 / 57.36	3.206	51.51 / 53.04	52.47 / 53.88	52.34 / 53.77	52.31 / 53.75	17.744	51.81 / 53.25	51.42 / 52.93	50.21 / 52.34	2.1 [ii]

Notes: Twynholm pressures in green indicate that the maximum inlet pressure does not exceed the maximum pressure cap for the given Twynholm flow

	PTL Flow (MSCMD)	GNI Flow in IC1 (MSCMD)	Total IC1 (MSCMD)	Max Pressure Cap (barg)
2022/23	2.37	17	19.37	75.18
2023/24	2.4	17	19.4	75.14
2031/32	1.93	17	18.93	75.70

Appendix 4 – Maps

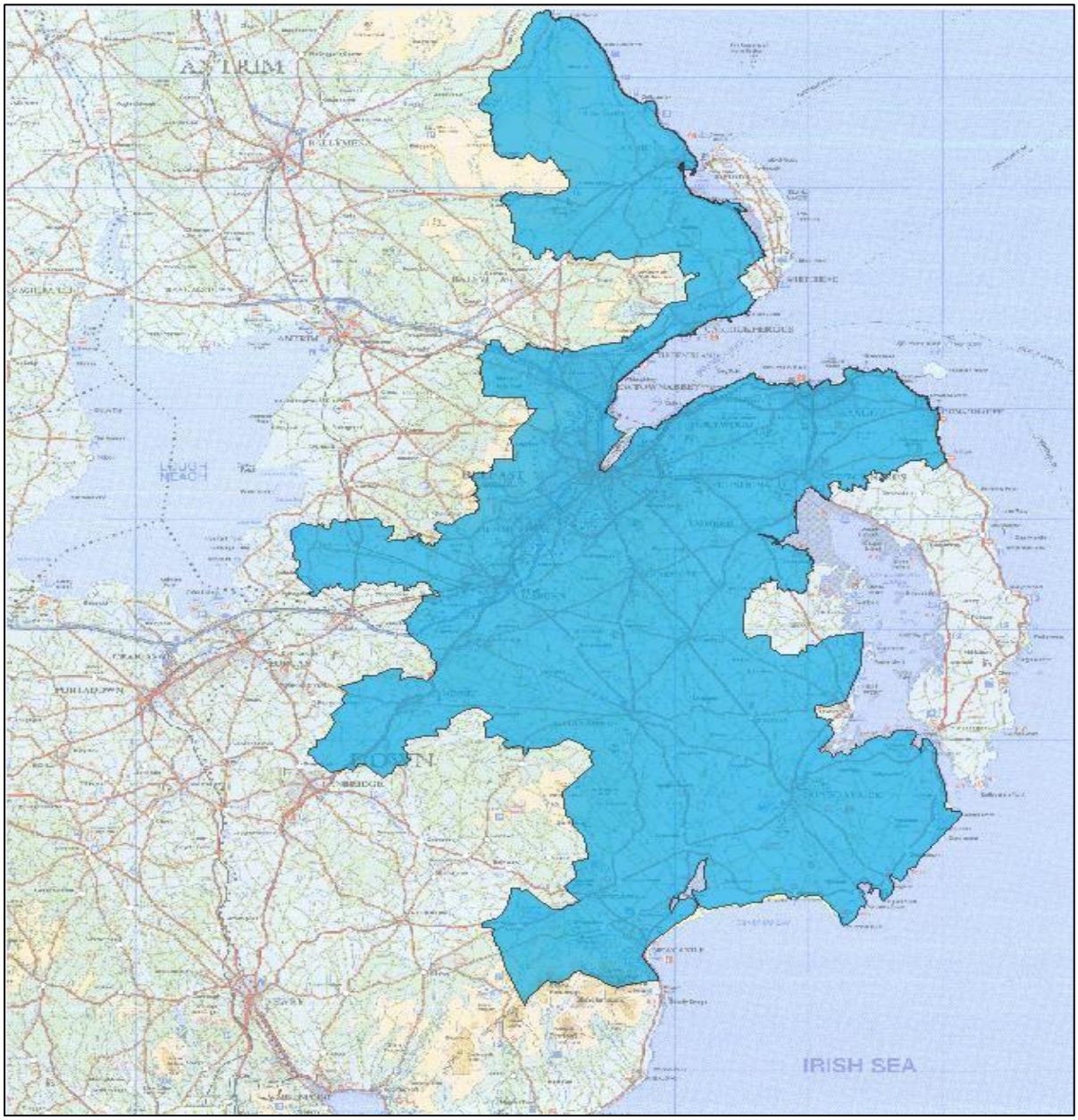


Figure A4-1: PNGL Licensed Area

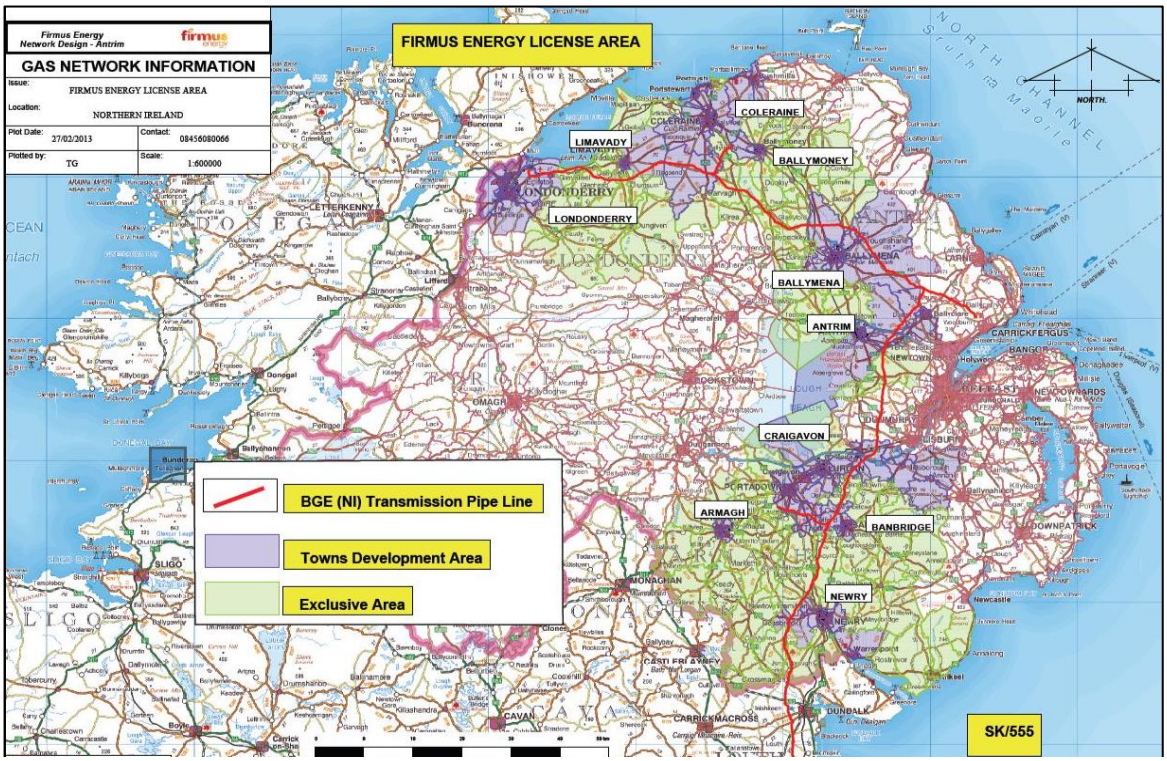


Figure A4-2: FeDL Licensed Area

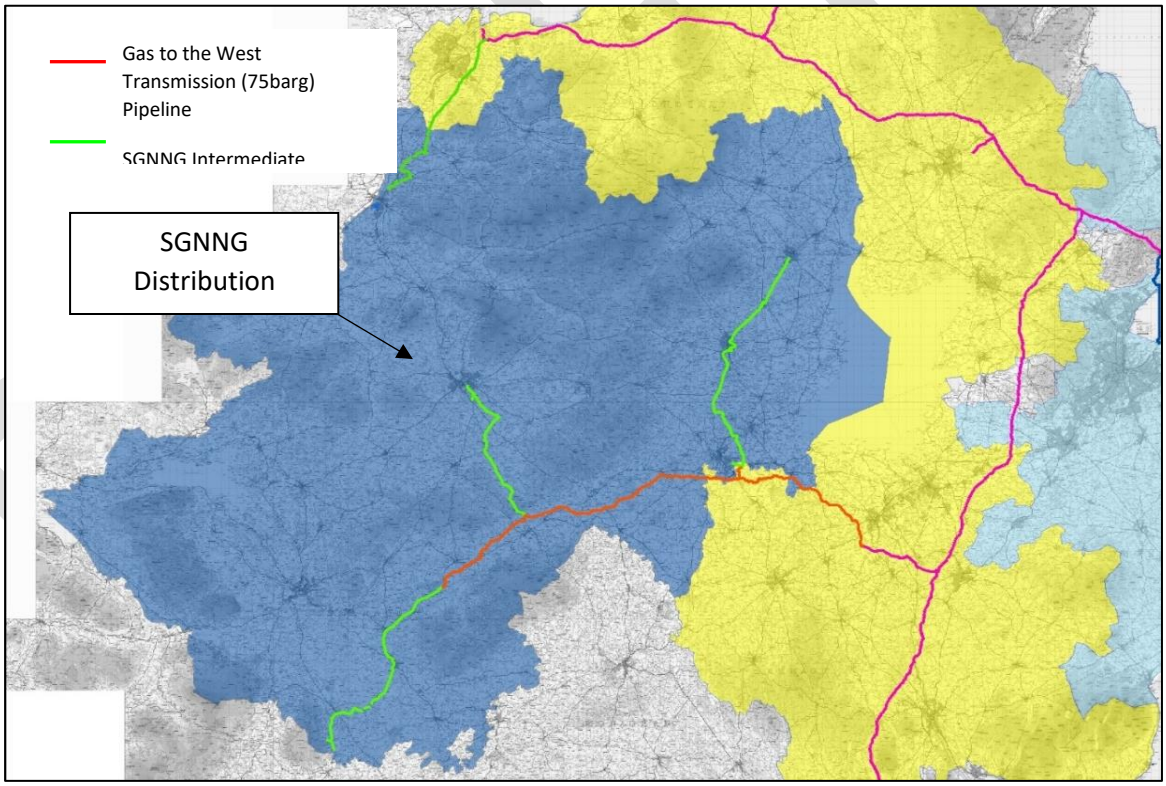


Figure A4-3: SGNNG Licensed Area

Northern Ireland Gas Capacity Statement 2020/21

Technical Note 2

Sensitivity Analysis

Network Modelling Results

Stakeholder	Purpose
NIAUR	Consultation
GNI (UK) & MEL (on behalf of PTL, BGTL and WTL)	Agree Results

1.1 Introduction

This document details the results of the network modelling completed using a SONI PLEXOS model stress test scenario which provides gas-fired power demand for winter (February) 2024. This sensitivity analysis was performed in addition to that set out in, *"2022 NIGCS Technical Note 1 – v0.6"*, and comprises the following sections;

- Section 2 summaries the demand and supply assumptions.
- Section 3 summaries the modelling features and assumptions.
- Section 4 presents the aggregated demand and supply balances.
- Section 5 contains the results of the network analysis.
- Section 6 contains key observations of the network analysis results.

1.2 Demand and Supply Overview

The full suite of demand and supply assumptions used for network modelling, are as outlined in the document *"NI Capacity Statement 2022-23 - Network Modelling Assumptions - FINAL"* which was agreed between the TSO's, in consultation with NIAUR. The network modelling results outlined in the following technical note should be viewed and interpreted in conjunction with the complete set of assumptions documented therein.

1.3 Abridged Demand & Supply Overview

- Forecasted peak NI distribution demands are taken from information provided by NI Shippers and GNI for Haynestown.
- The hourly gas demand of distribution offtakes was based on their contribution to gas year 2021/22 (year to date) peak day flows.
- The hourly gas demand of the NI power stations was taken from the output of gas-fired generation required from SONI PLEXOS model (see Appendix 1 for PLEXOS generation data)
- Responders to the NIGCS questionnaires were asked to provide their forecast gas flow volumes by converting any energy forecasts by assuming a Moffat Gas Calorific Value of 39.8 MJ/m^3 (measured historical value).
- Supplies are modelled on a flat-flow basis through Twynholm Supply Point and Gormanston Supply Point.
- Firm and interruptible demands are as per those provided by questionnaire responders. Interruptible demands are taken to be those which NI Distribution Network Operator Shippers deem to be interruptible based on contracts in place with customers for interruption of supply.

1.4 Model Features / Scenarios

The following outlines the approach taken when carrying out the network analysis, and the measured system limits.

- All scenarios simulate the 24-hour demand cycle over a period of 3 days to obtain steady results (the results of the first day are ignored for this purpose).
- The SNIP, North-West, South-North Pipeline and West Transmission Pipelines are modelled in full detail, including exact internal diameters and lengths and validated friction factors. The maximum operating pressure of SNIP and SNP is 75 barg.

- Flow via Twynholm (and Moffat IP Entry Point) maximised up to capacity to be made available to NI shippers (i.e. 89.285 GWh/day less 0.931 GWh/day to be reserved for Stranraer) plus Stranraer demand and flat flow is maintained through both Twynholm into SNIP and Gormanston into the SNP.
- Flows via Gormanston into the SNP are restricted to 66.33 GWh/day (59.70 GWh/day plus 6.63 GWh/day reserved for Haynestown)
- The minimum pressure loss across the Twynholm AGI is 2.5 barg. Minimum pressure at the discharge is therefore 53.5 barg, based on a minimum inlet pressure of 56barg.
- The following system conditions shall be met:
    - Minimum system pressure of 12 barg at Coolkeeragh AGI (the most peripheral point on the NI Transmission System)
    - Minimum system pressure of 56 barg at the inlet to Twynholm AGI.
- As a sensitivity analysis, pressure and flow conditions to achieve a minimum system pressure of 39 barg at Coolkeeragh AGI shall also be performed, under the following scenarios;
    - Pressure as required at Twynholm AGI to utilise maximum capacity available up to 89.285GWh/d on a flat flow basis.
    - Minimum system pressure of 56 barg at the inlet to Twynholm AGI. Flows through Gormanston AGI as required to support system pressures of 39barg minimum.
- Maximum Twynholm diurnal inlet pressure as per the Maximum Pressure Cap under the new Transportation Agreement (maximum pressure cap varies depending on flows. GNI flow in the relevant SWOS pipeline, IC1, assumed to be 17MSCMD in all cases- see Table 1 for examples of flows and associated pressure cap).

GNI Assumed Flow in IC1 (MSCMD)	PTL Flow (MSCMD)	Total Flow IC1 (MSCMD)	Total Flow IC1 (GWh/d)	Maximum Pressure Cap (bar)
17	8.08	25.08	277.273	66.83
17	7.5	24.5	270.861	67.8
17	7	24	265.333	68.67
17	6.5	23.5	259.806	69.5
17	6	23	254.278	70.3
17	5.5	22.5	248.750	71
17	5	22	234.222	71.73
17	4.5	21.5	237.694	72.4
17	4	21	232.167	73.1
17	3.5	20.5	226.639	73.8
17	3	20	221.111	74.4
17	2.5	19.5	215.583	75
17	2	19	210.056	75.6
17	1	18	199	76.72

Table 4: Maximum Pressure Cap and associated flows

- Carrickfergus AGI was modelled in constant pressure cut unidirectional mode, i.e. the pressure on the north-west pipeline side of Carrickfergus AGI will be controlled to 3 bar below the pressure on the Belfast gas transmission pipeline side, with no ability to reverse flow, as is the physical arrangement currently in place.

- As a sensitivity analysis, Carrickfergus was also modelled in 'free flow' (i.e. allowing reverse flow through the station if the NI transmission network were to hydraulically require it). A 0.5barg differential pressure ("**DP**") was assumed as the pressure drop across the station, in whichever direction hydraulics would require. This differs from the DP stated in "*NI Capacity Statement 2022-23 - Network Modelling Assumptions – FINAL"* document which originally listed 3barg DP. The true DP of Carrickfergus AGI when "fully open" will not be known until design feasibility studies have been completed and the DP implemented as Carrickfergus may be higher than 0.5barg, however it is currently too early to say.
- The systems upstream and downstream of the NI Transmission System[39] have not been considered in this analysis, notwithstanding the assumption regarding the 56 barg minimum inlet pressure at Twynholm.

1.5 Demand Summary

This section outlines the demand basis for the sensitivity analysis performed.

- "Power" is the aggregate of Ballylumford, Coolkeeragh and Kilroot Power Station demands.
- "Non-Power" is the aggregate of Phoenix, Firmus, Gas to the West, Haynestown and Stranraer demands.
- All volumes are presented in Giga Watt Hours/day.

1.5.1 Distribution Loads

Forecast information from NI Shippers for existing Exit Points on the NI Network, acquired for the Northern Ireland Gas Capacity Statement 2022/23 ("NIGCS"), have been used as the base case demand requirements. The aggregate Firm & Interruptible Gas Year 2023/24 forecasts for the Average Winter Peak ("AWP") have been used as the distribution load for all scenarios – see Table 1 below.

Table 5 – Average Winter Peak Distribution Demand Loads

Day	AWP 2023/24 (GWh/D)
3	52.226
5	52.226
7	52.226

1.5.2 SONI Power Sector Loads

Demand requirements for gas-fired generation provided by SONI as part of a stress analysis PLEXOS model have been used as the power station demand requirement. SONI provided the power sector demand in MWh and the subsequent gas required to supply this was calculated using the following efficiencies:

- B10 BLY – 43%
- B31 BLY – 44%
- B32 BLY – 44%
- C30 CPS – 51%
- Knew1 Kilroot – 33%
- Knew2 Kilroot – 33%

SONI provided a week of data for in 2024 which included their 'worst day' and of this, the peak three demand days were modelled. Therefore, a summary of the demands used can be found in Table 6

.

[39] Insofar as this is understood to relate to the physical dedicated NI transmission system, legally and commercially this begins at the Moffat IP Entry Point.

Table 6 – Power Sector Demand

Daily Flow Requirements (GWh/D)				
Day	**Ballylumford**	**Coolkeeragh**	**Kilroot**	**Total Power**
3	18.054	18.452	22.553	59.059
5	18.341	18.861	23.095	60.297
7	25.251	19.281	18.441	62.972

1.6 Network Analysis Results

The following section outlines the results of the network analysis carried out on the basis of the supplies and demands in Section 4.

Where two pressures are presented, they represent the minimum and maximum pressures in the 24 hour cycle.

Where results fall outside the target limits of the model scenario, the failed results shall be highlighted in red font. For scenarios which are seeking to achieve a minimum system pressure of 39barg and the minimum pressure results ranges from 35 – 39barg, the result has highlighted in orange font.

The following notes apply, as indicated in the table headings, to all network analysis result tables in this section:

(1) Pressures at Twynholm (SNIP) are the minimum and maximum inlet pressures in the diurnal cycle. The current Maximum Operating Pressure of the SNIP is 75barg, so with the 2.5barg design pressure drop across the station, the maximum permissible inlet pressure is 77.5barg.

(2) Pressures at Gormanston (SNP) are the minimum and maximum outlet pressures in the diurnal cycle. The current Maximum Operating Pressure of both the SNP is 75barg.

(3) Pressures at Ballylumford, Tullykeneye and Coolkeeragh are the minimum and maximum in the diurnal cycle and are those in the pipeline upstream of the AGI's.

(4) Pressures at the Carrickfergus inlet are those upstream of the AGI (i.e. on the Middle Division Offtake side) and those at the outlet are downstream of the AGI in the North West Pipeline.

(5) Velocities of flows were assessed at three locations in the NI transmission system, with the maxim being recorded and denoted with [i], [ii] or [iii] as below to indicate the location of the maximum velocity of flow.

- **[i]** Ballylumford Inlet
- **[ii]** Carrickfergus Outlet
- **[iii]** Coolkeeragh

Maximum permissible pipeline velocities as per the standards detailed in IGEM/TD13.

(6) Where Carrickfergus is modelled as "fully open", flow at Carrickfergus is the net flow through the AGI in the given day. A negative value indicates a net flow from NWP > BTP whereas a positive value indicates a net flow from BTP > NWP. The number of hours that the AGI operates in reverse flow is provided in brackets beside the net flow. Further details on the peak flow in either direction is provided after the results table.

4.1.1.1 Twynholm Minimum Pressure 56barg, Min System Pressure 12bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	12 (Min)	12 (Min)	12 (Min)	42.01 (max)	12 (Min)	12 (Min)	12 (Min)	20 (max)
Day 3	89.274[1]	56.01 / 64.39	22.012	29.01 / 43.42	29.06 / 45.58	24.92 / 44.52	25.42 / 44.32	21.293	22.42 / 41.32	21.31 / 37.7	12.22 / 35.63	11.25[i]
Day 5	89.274[1]	56.02 / 62.97	23.250	29.58 / 42.04	29.1 / 43.18	24.97 / 42.26	25.48 / 42.07	20.475	22.48 / 39.07	21.31 / 35.89	12.09 / 33.05	11.18[i]
Day 7	89.274[1]	56.02 / 64.38	25.925	31.96 / 45.36	27.9 / 45.2	24.04 / 44.48	24.94 / 44.34	18.264	22.63 / 41.34	22.4 / 38.88	12.67 / 35.84	12.45[i]

Notes: [1] Maximum available capacity accounting for SGN Stranraer reserved capacity.

4.1.1.2 Maximum flow through Twynholm, Twynholm pressure as necessary, minimum system pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	**89.285 (Max)**	**77.5 (Max)**	**66.33 (Max)**	**75 (Max)**	**39 (Min)**	**39 (Min)**	**39 (Min)**	**42.01 (max)**	**39 (Min)**	**39 (Min)**	**39 (Min)**	**20 (max)**
Day 3	88.113*	67.81 / 77.51	23.172	47.38 / 61.29	48.53 / 62.97	46.25 / 62.34	46.5 / 62.22	20.132	43.5 / 59.22	42.74 / 57.39	39 / 55.92	6.58
Day 5	89.274[1]	68.24 / 76.4	23.239	47.38 / 59.55	48.68 / 60.99	46.35 / 60.4	46.61 / 60.28	20.486	43.61 / 57.28	42.72 / 55.68	39 / 53.89	6.56
Day 7	88.721*	67.97 / 77.51	26.478	48.86 / 62.18	47.92 / 62.54	45.82 / 62.1	46.29	17.667	43.47 / 59.01	43.11 / 57.81	39 / 55.8	7.04

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

[1] Maximum available capacity accounting for SGN Stranraer reserved capacity.

4.1.1.3 Twynholm Minimum Pressure 56barg, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	**89.285 (Max)**	**77.5 (Max)**	**66.33 (Max)**	**75 (Max)**	**39 (Min)**	**39 (Min)**	**39 (Min)**	**42.01 (max)**	**39 (Min)**	**39 (Min)**	**39 (Min)**	**20 (max)**
Day 3	69.926*	56.01 / 73.02	41.359	62.48 / 68.76	39.31 / 62.93	37.25 / 62.68	37.66 / 62.63	2.123	50.87 / 59.63	52.99 / 60.2	47.51 / 56.86	7.45[i]
Day 5	69.882*	56.01 / 70.9	42.630	62.17 / 67.48	39.67 / 60.27	37.63 / 60.08	38.04 / 60.05	1.238	49.7 / 57.05	51.93 / 58.23	46.18 / 54.16	7.15[i]
Day 7	72.801*	56.01 / 73.85	42.398	64.11 / 69.64	37.06 / 62.94	34.45 / 62.78	35.08 / 62.75	1.957	52.3 / 59.75	54.41 / 60.85	49 / 56.95	8.89[i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

4.1.1.4 Carrick sensitivity - Twynholm Minimum Pressure 56barg, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
Day 3	61.524*	56 / 68.11	49.761	62.6 / 72.21	43.53 / 59.45	42.19 / 59.31	42.58 / 59.28	-6.434 (16)	43.08 / 58.81	48.41 / 60.59	39 / 56.2	5.55[i]
Day 5	61.646*	56.01 / 66.45	50.867	63.23 / 71.53	43.63 / 57.36	42.29 / 57.26	42.69 / 57.24	-7.197 (16)	43.19 / 56.92	48.54 / 59.25	39 / 54.1	5.41[i]
Day 7	61.745*	56.01 / 68.06	53.454	65.31 / 74.59	43.07 / 59.19	41.79 / 59.12	42.38 / 59.11	-9.331	42.88 / 58.82	49.48 / 61.76	39 / 56.24	5.94[i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

	Carrickfergus AGI Flows	
	Peak Flow NWP > BTP (GWh)	Peak Flow BTP > NWP (GWh)
Day 3	0.941	0.511
Day 5	0.832	0.355
Day 7	1.081	0.335

4.1.1.5 Twynholm Maximum Pressure as per TA Maximum Pressure Cap, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
Day 3	69.926*	56.01 / 73.02	41.359	62.48 / 68.76	39.31 / 62.93	37.25 / 62.68	37.66 / 62.63	2.123	50.87 / 59.63	52.99 / 60.2	47.51 / 56.86	7.45 [i]
Day 5	69.882*	56.01 / 70.9	42.630	62.17 / 67.48	39.67 / 60.27	37.63 / 60.08	38.04 / 60.05	1.238	49.7 / 57.05	51.93 / 58.23	46.18 / 54.16	7.15 [i]
Day 7	72.801*	56.01 / 73.85	42.398	64.11 / 69.64	37.06 / 62.94	34.45 / 62.78	35.08 / 62.75	1.957	52.3 / 59.75	54.41 / 60.85	49 / 56.95	8.89 [i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

	PTL Flow (mscm/d)	GNI Flow (mscm/d)	Total IC1 (mscm/d)	Max Pressure Cap (barg)
Day 3	6.325	17	23.325	69.74
Day 5	6.321	17	23.321	69.75
Day 7	6.585	17	23.585	69.33

4.1.1.6 Carrick sensitivity - Twynholm Maximum Pressure as per TA Maximum Pressure Cap, Min System Pressure 39bar

Year	Twynholm (SNIP)		Gormanston		Ballylumford	Kilroot	Carrickfergus			Tullykeneye	Coolkeeragh	NI Tx System
	Flow	Pressure (1)	Flow	Pressure (2)	Pressure (3)	Pressure (3)	Inlet Pressure (4)	Flow	Outlet Pressure (4)	Pressure (3)	Pressure (3)	Maximum Velocity (5)
	(GWh/d)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(barg)	(GWh/d)	(barg)	(barg)	(barg)	(m/s)
Limits	89.285 (Max)	77.5 (Max)	66.33 (Max)	75 (Max)	39 (Min)	39 (Min)	39 (Min)	42.01 (max)	39 (Min)	39 (Min)	39 (Min)	20 (max)
Day 3	68.931*	58.59 / 69.87	42.354	57.55 / 68.29	44.01 / 59.58	42.39 / 59.33	42.76 / 59.28	0.962 (14)	43.26 / 58.78	46.34 / 59.22	39 / 55.98	5.95[i]
Day 5	72.646*	59.92 / 69.34	39.866	55.87 / 65.65	44.34 / 57.66	42.58 / 57.4	42.94 / 57.35	3.803 (14)	43.22 / 56.85	45.58 / 57.19	39 / 53.88	6.05[i]
Day 7	69.263*	58.6 / 69.83	45.936	59.98 / 70.31	43.56 / 59.31	42.05 / 59.18	42.62 / 59.16	-1.592 (14)	43.12 / 58.72	47.2 / 60.14	39 / 55.89	6.38[i]

Notes: *In order to achieve a compliant result, it was required for additional flows to be brought through Gormanston.

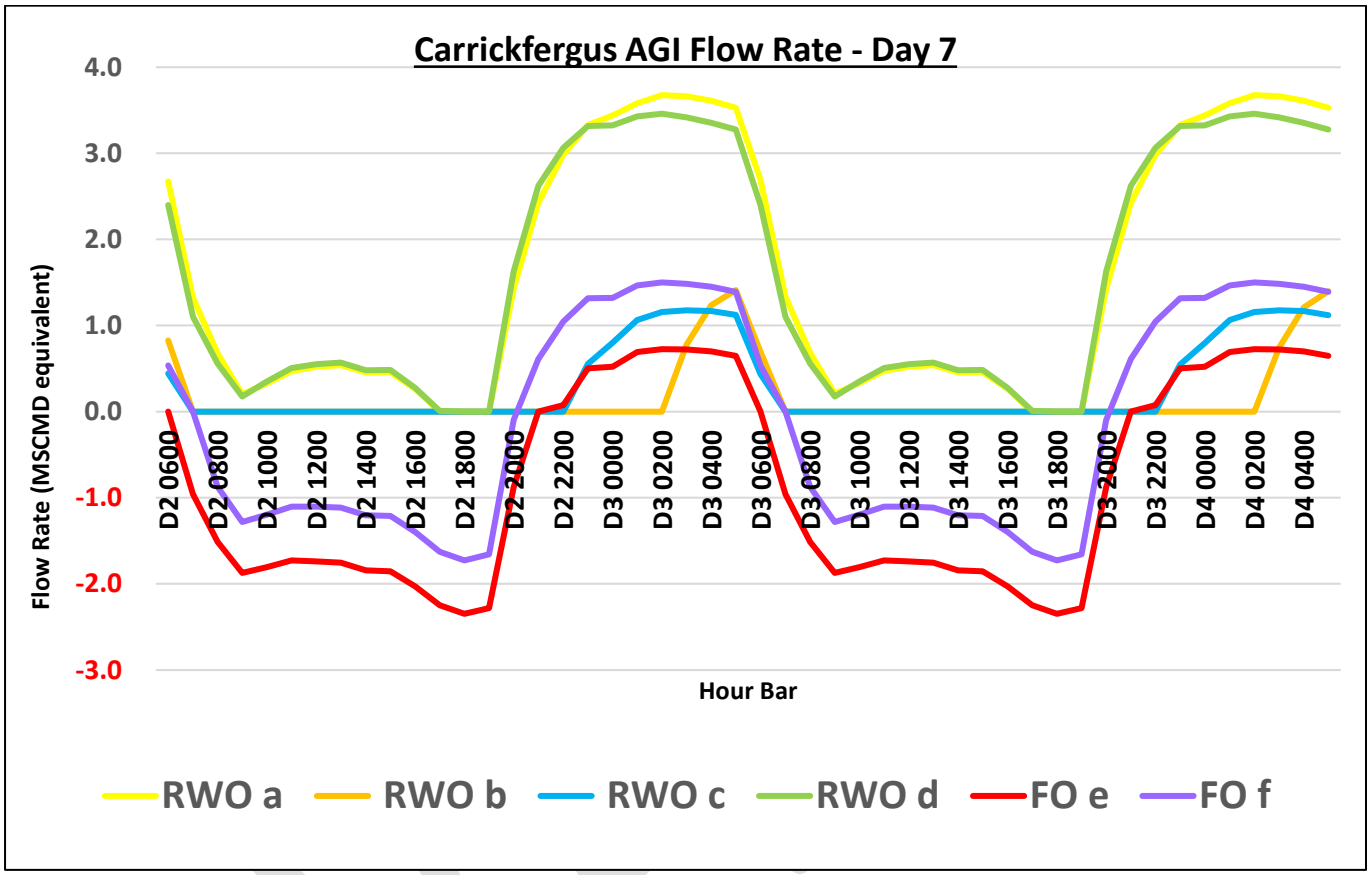
	Carrickfergus AGI Flows	
	Peak Flow NWP > BTP (GWh)	Peak Flow BTP > NWP (GWh)
Day 3	0.664	0.881
Day 5	0.415	0.889
Day 7	0.796	0.691

	PTL Flow (mscm/d)	GNI Flow (mscm/d)	Total IC1 (mscm/d)	Max Pressure Cap (barg)
Day 3	6.235	17	23.235	69.88
Day 5	6.571	17	23.571	69.35
Day 7	6.265	17	23.265	69.83

1.7 Key Observations

- On Day 7 (the peak day for gas-fired generation) of the demand scenario (115.20 GWh/d total demand), in order to maintain 39barg minimum system pressure whilst facilitating maximising flows via Twynholm, up to the capacity to be made commercially available to NI shippers (i.e. 89.285GWh/d) less capacity to be reserved so Stranraer (being 0.931 GWh/d MSCMD), so 88.356 GWh/d), plus Stranraer demand (so a total of 89.274 GWh/d in Gas Year 2023/24), 67.97 – 77.51barg diurnal Twynholm inlet pressure is required with 88.721GWh/d being supplied via Twynholm and 26.478 GWh/d being required via Gormanston and the South North IP Entry Point (0.553 GWh/d of Twynholm capacity not utilised and instead flow diverted to Gormanston).
    - On this same flow basis but where diurnal Twynholm inlet pressures to range from 56–64.38barg on the peak day, minimum system pressures of only 12.67 barg could be maintained.
    - Were the higher Twynholm inlet pressures required to maximise Moffat IP Entry Point flows unavailable and the system was limited to 56barg minimum diurnal Twynholm inlet, with Carrickfergus was operating in pressure control mode, it would not be possible to maintain 39barg minimum system pressure on any of the days. It is also not possible to maintain 39barg by utilising the TA pressure request, as the pressures required are in excess of those available under the TA maximum pressure cap. In this scenario it is infeasible to flow via Gormanston up to the capacity commercially available (66.33GWh/d) as demand downstream of Carrickfergus (c. 42.4GWh/d on day 7) is less than that commercially available at Gormanston, and all demand upstream of Carrickfergus cannot access supply flows from Gormanston due to the unidirectional flow requirements of the site. Therefore, Gormanston capacity is limited to the total demand downstream of Carrickfergus as opposed to the commercial capacity.
    - In the same scenario as above but with Carrickfergus fully open, maintaining 39barg minimum system pressure can be achieved by utilising greater South North IP Entry Point flows. On Day 7, 56 – 68.06barg diurnal Twynholm inlet pressure is required with 61.745GWh/d being supplied via Twynholm and 53.454 GWh/d being required via Gormanston and the South North IP Entry Point (27.529 GWh/d of Twynholm capacity not utilised and instead flow diverted to Gormanston). In such instances, reverse flow at Carrickfergus is required for 16hrs with a peak reverse flow of 1.081GWh.
    - When elevated pressures above 56barg diurnal Twynholm inlet are available (i.e TA pressure request as per TA maximum pressure cap) and Carrickfergus is fully open, diurnal Twynholm inlet pressures of 58.6 – 69.83barg are required with 69.263GWh/d being supplied via Twynholm and 45.936 GWh/d being required via Gormanston and the South North IP Entry Point (20.011 GWh/d of Twynholm capacity not utilised and instead flow diverted to Gormanston). In such instances, reverse flow at Carrickfergus is required for 14hrs with a peak reverse flow of 0.796GWh.
    - Noting the need for reverse flow capability at Carrickfergus AGI (in the absence of the necessary Twynholm inlet pressure to maximise physical use of Moffat IP Entry Point

flows, increased South North IP Entry Point flows being required instead), the required flow rate at Carrickfergus AGI in each of the various scenarios on Day 7 is shown in the figure below;



g) Carrickfergus Regulator Wide Open: Maximising flows through Twynholm up to the capacity commercially available to NI shippers (89.274GWh/d) with 56barg minimum diurnal Twynholm inlet pressure

h) Carrickfergus Regulator Wide Open: Maintaining 39barg minimum system pressure with 56barg minimum diurnal Twynholm inlet pressure (scenario failed)

i) Carrickfergus Regulator Wide Open: Maximum diurnal Twynholm inlet pressure as per TA maximum pressure cap, maintain 39barg minimum system pressure (scenario failed)

j) Carrickfergus Regulator Wide Open: Maximising flows through Twynholm up to the capacity commercially available to NI shippers (89.274GWh/d) , maintain 38barg minimum system pressure

k) Carrickfergus Fully Open: Maintaining 39barg minimum system pressure with 56barg minimum diurnal Twynholm inlet pressure

l) Carrickfergus Fully Open: Maximum diurnal Twynholm inlet pressure as per TA maximum pressure cap, maintain 39barg minimum system pressure

1.8 General

Further engagement with SONI will be required to determine the likelihood and frequency of the above scenario and the TSO's and UR will need to work together proactively to determine suitable solutions required to meet NI Network demand, should this demand basis occur regularly.