Northern Ireland

Gas Capacity Statement

2015/16 – 2024/25



About the Utility Regulator

The Utility Regulator is the independent non-ministerial government department responsible for regulating Northern Ireland's electricity, gas, water and sewerage industries, to promote the short and long-term interests of consumers.

We are not a policy-making department of government, but we make sure that the energy and water utility industries in Northern Ireland are regulated and developed within ministerial policy as set out in our statutory duties.

We are governed by a Board of Directors and are accountable to the Northern Ireland Assembly through financial and annual reporting obligations.

We are based at Queens House in the centre of Belfast. The Chief Executive leads a management team of directors representing each of the key functional areas in the organisation: Corporate Affairs; Electricity; Gas; Retail and Social; and Water. The staff team includes economists, engineers, accountants, utility specialists, legal advisors and administration professionals.

Our Mission	Value and sustainability in energy and water.
Our Vision	We will make a difference for consumers by listening, innovating and leading.

Our Values

Be a best practice regulator: transparent, consistent, proportional, accountable, and targeted.

Be a united team.

Be collaborative and co-operative.

Be professional.

Listen and explain.

Make a difference.

Act with integrity.

Abstract

The aim of the Northern Ireland Capacity Statement (NICS) is to provide an assessment of the ability of the Northern Ireland transmission network to meet forecast demands on the network over a ten year period.

The system is assessed by using network modelling on days of different demands over a number of different scenarios.

The modelling results for each of the scenarios and demand days are presented and discussed.

Audience

The paper is intended primarily for users of the gas transmission network in Northern Ireland. However we expect that it will also be of wider interest in terms of the security of gas supplies to Northern Ireland.

Consumer impact

The paper provides an assessment of the ability of the transmission network to flow gas over a number of potential future scenarios.

Contents

Executive Summary

The aim of the Northern Ireland Capacity Statement (NICS) is to provide an assessment of the ability of the Northern Ireland (NI) gas transmission to deliver gas over a number of potential scenarios within the next ten years.

The NI Transmission System Operators[1] carried out the assessment using modelling software to test the network's ability to meet three types of demand days (minimum summer demand, average winter demand and severe winter demand) for the following scenarios:

- Base Case scenario which assumes the existing gas transmission infrastructure and the proposed Gas to the West network extension for all years;
- Base Case scenario plus a proposed Compressed Air Energy Storage (CAES) project in Larne, Co. Antrim.

The modelling also considered the firm and interruptible demands for the severe winter demand day. The demand data was provided by the Northern Ireland power stations and distribution companies. When compared to actual values the forecast demands appear conservative in some instances.

This year's statement contains the same modelling assumptions to those used in last year's statement, specifically:

- a Minimum Operating Pressure of 12 barg at the exit points on the NI transmission system. This approach provides consistency with the TSOs' contractual requirements to provide a minimum pressure of 12 barg.

- different pressures at Twynholm for each of the demand days as this reflects actual pressure patterns experienced for the different demand days. For Severe Winter Peak Day modelling we have assumed a pressure level of 59.4 barg at Twynholm, which is based on the actual minimum pressure recorded during record peak flow events.

- a pressure level of 69 barg for Average Winter Peak Day and Average Summer Minimum Day scenario. This is based on the average of the actual

1 GNI(UK), Belfast Gas Transmission Ltd, Premier Transmission Ltd

minimum daily pressures observed during the last three winters.

We note that the Corrib gas field is anticipated to commence supplying gas in 2015/16 and that this. This is anticipated to reduce RoI gas demand at Moffat and consequently lower the overall demands on the SWSOS network. This year's modelling has not considered the impact of future Corrib flows on the SWSOS network and subsequently the impact to the pressures and flows on the downstream NI gas network.

The modelling results have shown that on the basis of the forecast demand data and assumptions set out in the paper the network could meet the firm demands for the average winter and minimum summer demands for all years for all scenarios.

Additionally the modelling has indicated the network could meet firm demand for the following years for severe winter peak demand for the following years:

- Base Case – from 2018/19 to 2023/24
- Base Case plus CAES - for 2018/19 only

Outside of the years above, the modelling has indicated that the network experiences low pressure issues and could not deliver the full gas demands modelled.

However, should the full gas demands arise modelling has shown that use of the South North pipeline can provide the necessary pressure to meet full demand. There are also arrangements to address low pressure issues on the network such as power stations switching to secondary fuels.

The capacity statement provides a ten year assessment up to and including 2024/25. However the Transportation Agreement between GNI(UK) and PTL which governs the provision of capacity from Moffat to Twynholm ends in 2021 unless it is extended. The TSOs are currently discussing an extension of the Transportation Agreement beyond 2021. Negotiations are at an early stage however we will update industry on progress at an appropriate stage in the discussions.

1. Introduction

Background information

1.1 The aim of the Northern Ireland Capacity Statement (NICS) is to provide an assessment of the ability of the Northern Ireland transmission network to meet forecast demands on the network over a ten year period based on certain scenarios and assumptions.

1.2 The Northern Ireland Transmission System Operators (TSOs) are obliged in their respective network codes and licences to produce a capacity report based upon network analysis of relevant supply and demand scenarios. This statement is based upon the information that the NI TSOs have provided under their respective licences.

Report Structure

1.3 This paper is set out as follows:

Section 2 provides an overview of the existing Northern Ireland transmission network and also future infrastructure projects that are currently being considered.

Section 3 provides information on historic and forecast gas demand for NI.

Section 4 sets out the scenarios that have been modelled in this year's NICS.

Section 5 sets out the modelling results.

Section 6 provides commentary on the results.

Appendix 1: Demand Forecasts

Appendix 2: Summary of System Modelling Assumptions

Appendix 3: Detailed Modelling Results

2. Transmission Network Overview

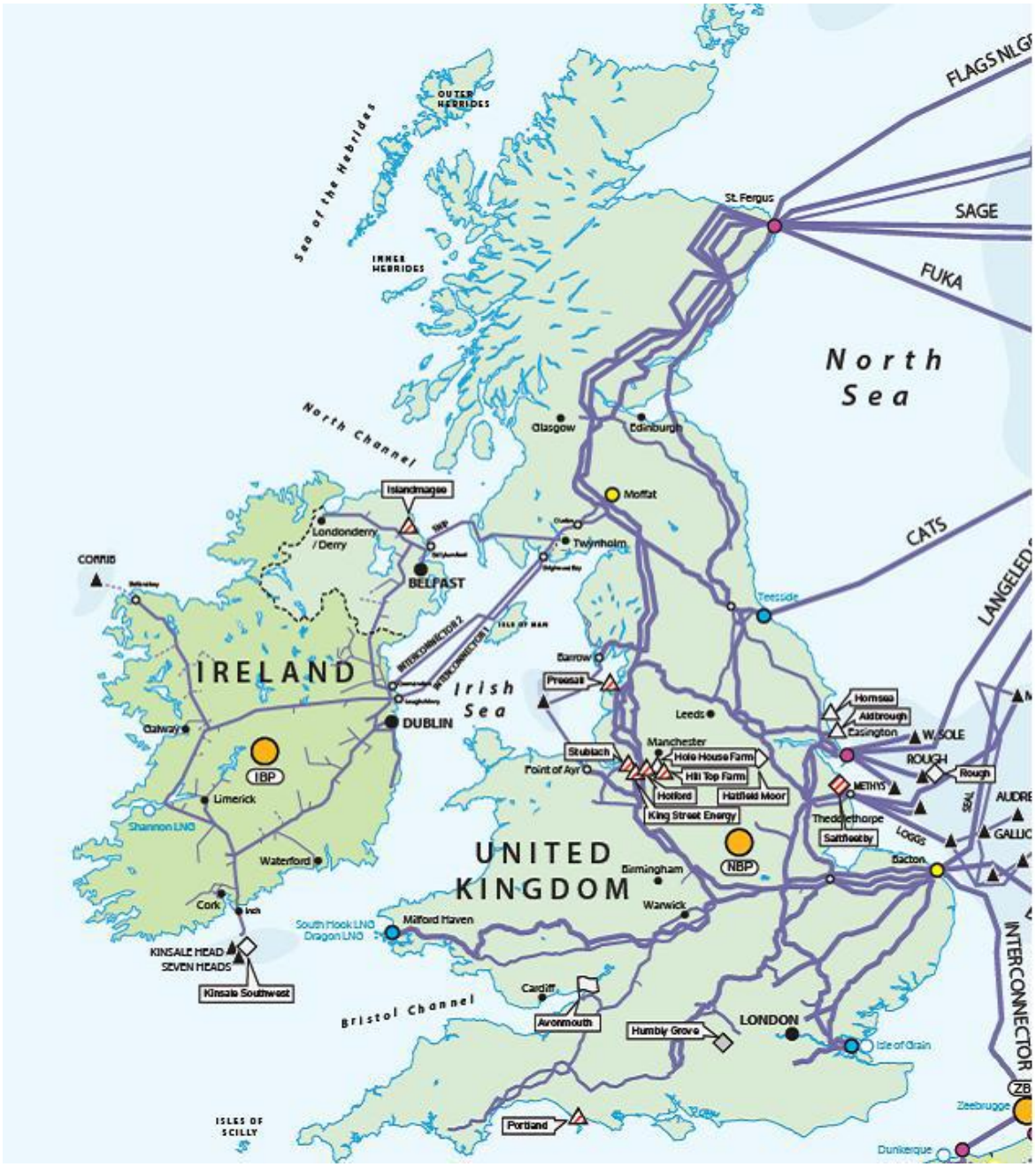
Scottish Onshore system and subsea system

2.1 The Moffat Entry Point connects the Northern Ireland and Ireland gas networks to National Grid's National Transmission System (NTS) in GB. This connection allows for the importation of GB gas to Ireland and Northern Ireland. From the connection with the National Grid system at Moffat, the Scottish onshore system (SWSOS) consists of a compressor station at Beattock, which is connected to Brighouse Bay by two pipelines from Beattock to Cluden and a single pipeline from Cluden to Brighouse Bay, all capable of operating at 85 barg.

2.2 A second compressor station at Brighouse Bay compresses the imported gas into the two sub-sea interconnectors to Ireland which can operate at pressures in excess of 140barg if required. Before reaching the Brighouse compressor station, an offtake station at Twynholm supplies gas to Northern Ireland via the SNIP. The SNIP pipeline has a maximum operating pressure of 75barg, although there is a minimum guaranteed supply pressure into this system which is currently 56barg.

2.3 A map of the UK/Ireland transmission network is presented in Figure 1.

Figure 1: UK/Ireland transmission network map



Northern Ireland transmission system

2.4 The Scotland to Northern Ireland 600mm pipeline (SNIP) connects to the GNI(UK) system at Twynholm in Scotland and has a maximum operating pressure 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.

2.5 The Belfast Gas Transmission Pipeline (BGTP) comprises a further 35kms of 600mm pipeline with a maximum operating pressure of 75 Barg and runs from Ballylumford via Carrickfergus to Belfast, where it supplies the Greater Belfast demand. The North-West Pipeline (NWP), extends a further 112km of 450mm pipeline from Carrickfergus to supply the power station at Coolkeeragh. The NWP, is owned and operated by GNI (UK) Ltd. The firmus energy distribution network also connects several towns to the NWP.

2.6 A 450mm pipeline connecting the Interconnector System to the NWP was built in 2006. This pipeline, called the South-North Pipeline (SNP), is 156kms long and extends from the IC2 landfall at Gormanston, Co. Meath in Ireland to Ballyalbanagh on the NWP, approximately 12km west of the Carrickfergus AGI. This pipeline facilitates supplies to towns and industries in the corridor from Newry to Belfast (also being developed by firmus energy) and in the longer term will be able to support the SNIP pipeline in meeting increased demand levels in Northern Ireland.

Northern Ireland distribution system

2.7 Northern Ireland has two existing gas distribution network companies and one gas distribution company currently developing their network: Phoenix Natural Gas Limited (PNGL), firmus energy (distribution) Limited (firmus) and Scotia Gas Networks (SGN) respectively.

2.8 PNGL own and operate the distribution network in the Greater Belfast and Larne areas. PNGL was awarded their conveyance licence in September 1996. Presently they have over 185,000 customers connected within the Greater Belfast and Larne licence area.

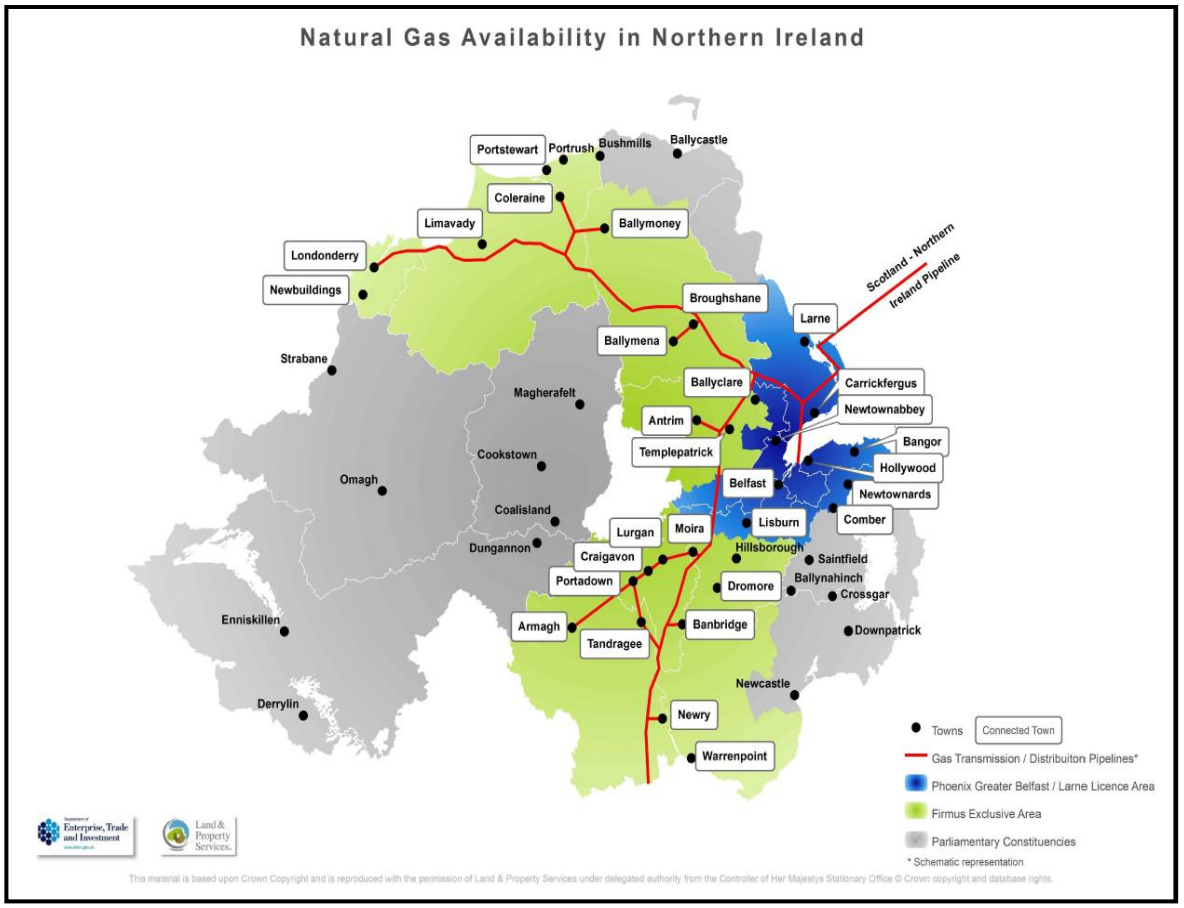
2.9 firmus own and operate the distribution network within the ten towns licence. This area covers a greater geographical area including Londonderry, Limavady, Coleraine (inc. Portstewart, and Bushmills), Ballymoney, Ballymena (Broughshane), Antrim (inc. Ballyclare and Templepatrick), Craigavon (inc. Portadown and Lurgan), Banbridge, Newry (Warrenpoint) and Armagh (Tandragee).

2.10 firmus was awarded their conveyance licence in March 2005 and have over 25,000 customers connected within the ten towns licence area.

2.11 A map outlining the PNGL and firmus distribution licence areas is shown in Figure 2.

2.12 The SGN distribution network is discussed under the Gas to the West section (from 2.14) further below.

Figure 2: Northern Ireland Distribution Network



Network extension – 'Gas to the West'

2.13 In March 2015 the Utility Regulator granted Mutual Energy and Scotia Gas Networks (SGN) conveyance licences to extend the natural gas network to the west of Northern Ireland. The project will bring gas to the towns of Strabane, Omagh, Enniskillen, Derrylin, Dungannon, Coalisland, Cookstown and Magherafelt with other areas yet to be finalised. The distribution network in the west of Northern Ireland will be owned and operated by SGN Natural Gas.

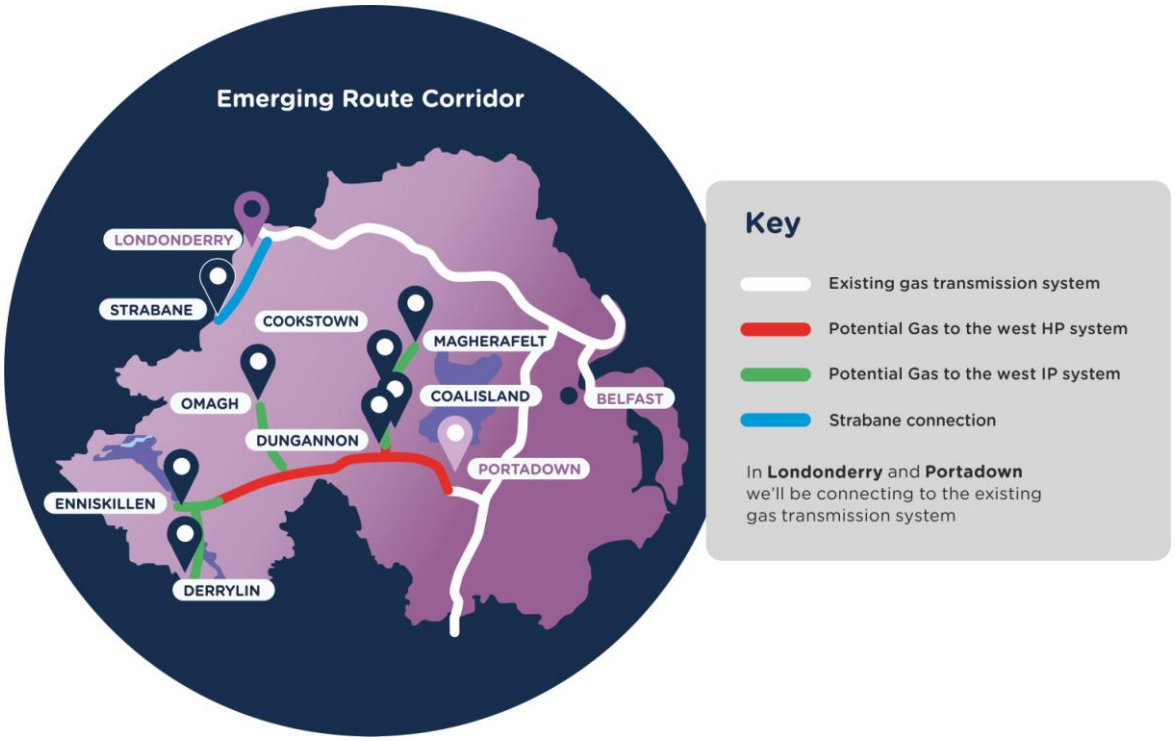
2.14 A map of the potential pipeline routing has been included in Figure 3. It is estimated that this project would connect up to 40,000 new business and

domestic consumers to natural gas in the West and North-West and has the potential to generate an additional £200 million of economic benefits, from energy savings and reduced greenhouse gas emissions.

2.15 Mutual Energy and SGN are progressing with the design and procurement of the new gas infrastructure, an emerging pipeline corridor has been developed, environmental impact surveys have commenced and will continue into 2016, work continues obtaining necessary easements and consents in advance of construction works commencing.

2.16 For the purpose of the network modelling we have assumed that connections will be available in gas year 2016-2017.

Figure 3: 'Gas to the West' Natural Gas Pipeline Emerging Route Corridor



Compressed Air Energy Storage

2.17 Gaelectric CAES NI ltd is currently developing a Compressed Air Energy Storage ("CAES") project in Larne, Co. Antrim. The project has been granted a mineral prospecting licence from DETI and has been designated as a Project of Common Interest (PCI) by the European Commission in October 2013. Gaelectric CAES NI ltd expects to submit a planning application in 2015, and is in discussions with SONI with respect to connecting the plant to the NI power system.

2.18 During off-peak hours, electricity from the grid powers compressors that drive air into the underground storage vessel which will be formed in salt caverns approximately 1400-1800m below ground level. When electricity demand increases, the air is released to the surface and heated with natural gas to increase its temperature. The air gas mixture is then used to run a turbine to generate 330 MW of power. Gaelectric CAES NI Ltd expects to commission the project post 2018.

2.19 The European Union has recently agreed to provide financing of up to €6.47 million for the CAES project. This EU financing will be used to meet the costs of an environmental impact assessment and planning activities, as well as front end engineering design for the project.

2.20 For the purpose of the network modelling we have assumed that the CAES project will be operational in 2018/19.

Gas Storage

2.21 Islandmagee Storage Limited (IMSL) is progressing plans to develop an underground natural gas storage facility which will have its above-ground facilities near Ballylumford, in County Antrim, Northern Ireland. Seven caverns with a total gas storage capacity of approximately 500 million cubic metres are planned within a layer of bedded salt greater than 200 metres thick located approximately 1,500 metres beneath Larne Lough.

2.22 The project has been granted planning permission, a gas storage licence from the Utility Regulator, draft marine construction licences from the Department of Environment and Northern Ireland Environment and a Mineral Licence from DETI. Further consents will also be needed before the project can proceed to full construction and operation.

2.23 The Islandmagee gas storage project was also designated as a PCI by the European Commission in October 2013. The Islandmagee gas storage project has been linked with the PTL SNIP Physical Reverse Flow project and Gaslink's Physical Reverse Flow project at Moffat to form a PCI group which reflects the interdependence between these projects.

2.24 IMSL recently completed the drilling of a salt core well in June 2015. The well was drilled to a depth of 1,753 metres to retrieve cores of the 250 million-year-old salt deposits. The cores of Permian salt will undergo laboratory analyses, including rock mechanical tests, to further define the design parameters and cost estimate for the project. The costs of the 2015 work programme are being funded 50% by the European Commission under their Connecting Europe Facility.

2.25 The Islandmagee Storage facility has not been included in this year's capacity statement as it has been modelled in previous years' statements so it would not add much explanatory value to re-run this scenario in this year's capacity statement. If readers are interested in the modelling results of scenarios including gas storage facility at Larne they are available in previous capacity statements.

3. Northern Ireland Gas Demand

Historic NI Annual Demand

3.1 The historic NI gas demand is summarised by sector in Table 1 and shown graphically in Figure 4 below. The distribution category includes the gas demand of Phoenix Natural Gas and firmus energy, while the power sector includes the Ballylumford and Coolkeragh powerstations.

Table 1 Historic NI Annual Demand

	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
ENERGY (GWh/y)									
Power	14,817	16,486	14,248	12,516	11,259	11,562	9,137	7,986	8,390
Distribution	3,194	3,210	3,665	3,984	4,487	4,834	5,008	5,603	5,377
Total NI	**18,011**	**19,697**	**17,913**	**16,500**	**15,746**	**16,396**	**14,145**	**13,589**	**13,767**
VOLUME (mscm/y)									
Power	1,341	1,492	1,290	1,133	1,019	1,047	827	723	759
Distribution	289	291	332	361	406	438	453	507	487
Total NI	**1,630**	**1,783**	**1,622**	**1,494**	**1,425**	**1,484**	**1,280**	**1,230**	**1,246**

3.2 The figures provided in Table 1 are the metered flows recorded by the TSOs for gas exiting their respective networks. In previous years we have presented figures that were provided by the power stations and distribution companies but these are slightly less accurate than metered flows.

3.3 The highest annual demand for NI was recorded in 2006/07. Since then there has been a general decrease in overall volumes driven by lower consumption from the power stations.

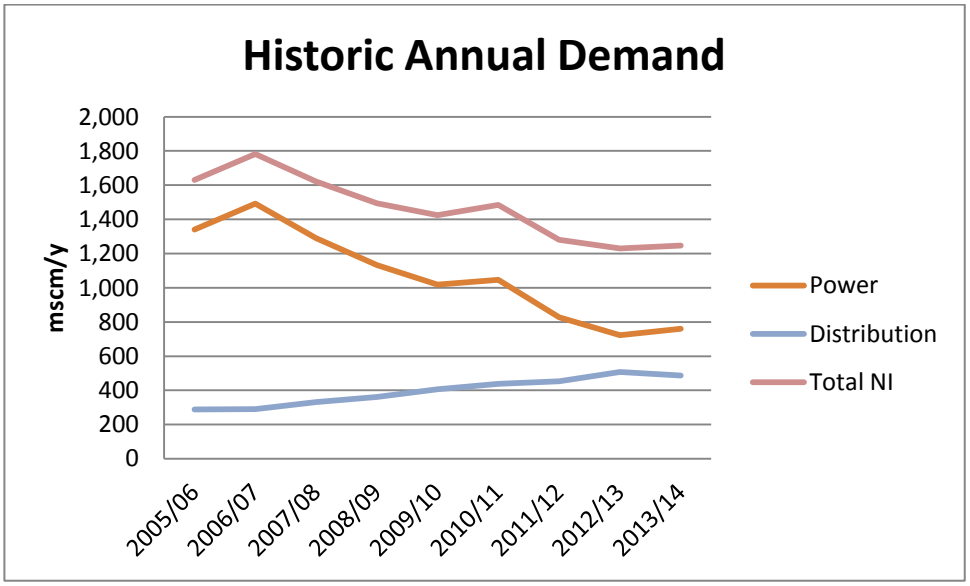
3.4 The general decrease in demand from the power sector is due to a number of factors. Lower coal prices and more efficient gas plant operating in the Republic of Ireland (RoI) has reduced Northern Ireland power stations' position in the Single Electricity Market (SEM) merit order. Consequently there is less electricity demand from the NI gas

fired power stations and therefore lower gas flows.

3.5 Increasing competition from wind powered generation has also reduced demand. Changes in volumes are also impacted by maintenance cycles for the generation units.

3.6 Whilst the power sector has experienced a general decrease in demand the distribution sector has increased up to 2012/13 reflecting the growth within the domestic and industrial/commercial sector. There has been a slight decrease in demand in the distribution sector comparing 2013/14 to 2012/13 however the figures remain at similar levels to recent years.

Figure 4 NI Historic Demand



Forecast NI annual demand

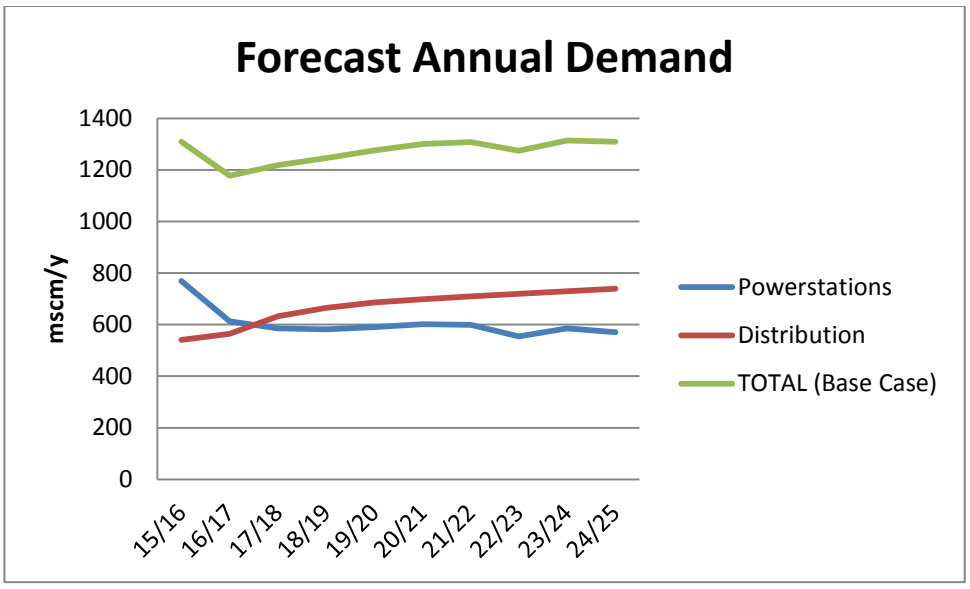
3.7 The power stations and distribution companies have provided their forecast annual gas demands for the next. The figures for the Base Case Scenario are summarised in Table 2 and presented in Figure 5 below.

Table 2: NI forecast demand for 2015/16 to 2024/25

Year	1	2	3	4	5	6	7	8	9	10
(mscm/y)	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25
Powerstations	769	613	586	581	590	602	599	554	585	570
Distribution	541	565	632	664	686	699	709	720	730	739
TOTAL (Base Case)	1310	1178	1218	1245	1276	1300	1308	1274	1315	1309

3.8 The overall ten year forecast indicates a changing demand profile over the period. Table 2 and figure 5 demonstrate the forecast changes for total demand and also the individual sectors for the years considered. The figures presented are for the Base Case and as such exclude demands arising from proposed CAES project. The following sections provide some further details on each of the sectors.

Figure 5: NI forecast demand for 2015/16 to 2024/25



Power Station

3.9 Forecast figures were provided by the two gas fired power stations,

Ballylumford and Coolkeeragh. The total power generation figures provided in Table 2 are the aggregated demand for the two sites.

3.10 The generators forecasts were based on a combination of an assessment of historic flows together with assumptions on future operating requirements. Future assumptions included an assessment of the coal-gas price differential, likely market running of the plant including the impact of higher efficiency plants operating in RoI plus future outage requirements. The expected increased capacity of the North/South electrical transmission tie-line expected in 2019 was also considered within the generators' assessments.

3.11 Since there are a number of competing factors there is a level of uncertainty in the forecast annual demand figures for the powerstations. This reflects the difficulties the powerstations face in predicting a 10 year profile. The forecasts are based upon the powerstations best estimates and latest assumptions but the changing nature of the competing factors should be taken into account when assessing the future demand figures.

3.12 The initial drop in powerstation demand from 2015/16 to 2016/17 is due to the assumption that the Moyle interconnector will be fully operational by the end of 2016. This will lower generation requirements on the NI gas fuelled power stations and in turn reduce their gas volumes. The powerstation demands are forecast to remain relatively stable for the remaining period.

Distribution

3.13 Forecast figures were provided by the three gas distribution companies, PNGL,firmus and SGN. The total distribution figures provided in Table 2 are the aggregated demand forecasts for all three distribution companies. Figures provided for the purposes of the NI capacity statement were based on the distribution companies own modelling forecasts which incorporated the expected growth rates within the domestic and I/C sectors over the 10 years modelled.

3.14 The connection and consumption forecasts and profiles for the Gas to the West project are still under development and as such figures have been provided on a best endeavours basis.

3.15 The distribution sector is forecast to grow by 37% over the ten year period. The year-on-year increase reflects the distribution companies' expected growth rates within the domestic and industrial/commercial sectors.

3.16 The forecast increase in distribution demand over the 10 year period replaces the reduction in power sector demand resulting in the total forecast demand in year 10 being similar to that in year 1. Notably the distribution demand is set to overtake the power sector demand in 2017/18.

Forecast NI Winter Peak-day gas demand

3.17 In order to assess the system on days of different demand patterns, three sample demand days are analysed for each scenario over the 10 year period modelled: 1-in-20 year winter peak day, average year winter peak day and average year summer minimum.

3.18 All of the demand data used for the modelling is presented in Appendix 1.

3.19 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 i.e. the severe winter peak day firm demand representing the demands expected in 1 out of 20 years and an average year peak day firm representing an average winter peak day demand.

1-in-20 Winter Peak Demand (Firm)

3.20 The figures for the base case 1-in-20 Winter Peak Demand are presented below in Table 3. The base case is the scenario which tests the forecast demand associated with the existing infrastructure i.e. no CAES project demands.

Table 3: 1-in-20 firm winter peak demand for base case scenario

Year	Severe Winter Peak Day Demands/Supplies (mscmd)				
	Power	Non-Power	GTW	Total	Twynholm
2015/16	5.06	3.19	0.00	8.25	8.25
2016/17	5.06	3.30	0.04	8.40	8.40
2017/18	5.06	3.38	0.12	8.56	8.56
2018/19	3.96	3.47	0.17	7.60	7.60
2019/20	3.96	3.55	0.21	7.72	7.72
2020/21	3.96	3.63	0.23	7.82	7.82
2021/22	3.96	3.71	0.24	7.91	7.91
2022/23	3.96	3.78	0.25	7.99	7.99
2023/24	3.96	3.84	0.27	8.07	8.07
2024/25	3.96	3.91	0.29	8.16	8.16

3.21 The 1-in-20 winter peak demand (firm) figures in table 3 above represent the combined total of the individual 1-in-20 peak demands for each of the power stations and distribution companies. These figures therefore represent a simultaneous firm demand for both sectors.

3.22 The tables show that there is a year-on-year increase in the 1-in-20 firm peak demand for the distribution sector. This trend reflects previous forecasts and the expected growth for the distribution sector.

3.23 The power sector demand is forecast at 5.06mscm for years 2015/16 – 2017/18 and drops to 3.96 mscm for the remaining years. This differs from last year's forecast which totalled 4.36 mscm for all years modelled.

3.24 The total firm demand figure of 5.06 mscm includes Ballylumford's

interruptible demand forecast. It also reflects the assumption that Ballylumford B station will not close until the end of 2018.Last year's forecast figures assumed B station closure in 2015/16.

3.25 As a result of these revised assumptions in respect of Ballylumford, the total firm demand figures are initially higher (until 2017/2018) compared to last year's firm demand figures.

3.26 The decrease in power sector peak winter demand to 3.96 mscm from years 2018/19 onwards is due to the closure of Ballylumford B station assumed at the end of 2018. For comparison the equivalent figure from last year's statement was higher, at 4.36 mscm.

3.27 The total forecast firm demand figures for the first three years modelled 2015/16, 2016/17 and 2017/18 are 8.25, 8.40 and 8.56 mscm respectively. These figures are higher than the actual winter peak demands that have been recorded. For example, the highest peak daily demand was 6.7 mscm/day on 7th January 2010. This was considered a severe winter although it should be noted that Coolkeeragh powerstation was temporarily off line for a short period that day so peak flows could have been higher. In the severe winter of 2010/2011 the peak was 6.6 mscm/day on the 8th, 21st, 22nd and 23rd December 2010. In the 2012/13 winter the peak recorded was 6.54 mscm/day.

3.28 Whilst the powerstations have individually recorded peak demands close to the forecast figures they have submitted, the peak demands for the powerstations and distribution companies have not occurred simultaneously. That is not to say that demands at this level may not occur however we consider that their likelihood is low. As such and in light of the actual figures, we consider that the modelling is taking a conservative approach.

Average Winter Peak Demand (Firm)

3.29 Again, the average winter peak demand figures (presented in Table 4)

represent the combined total of the individual average winter peak demands for each of the power stations and distribution companies.

3.30 It is difficult to pinpoint an ‘average’ year, however the forecast figures that have been provided are largely in line with the range of actual figures that have been recorded.

Table 4: Average winter peak demand for base case scenario

Year	Average Winter Peak Day Demands/Supplies (mscmd)				
	Power	Non-Power	GTW	Total	Twynholm
2015/16	3.20	1.94	0.00	5.14	5.14
2016/17	3.20	2.02	0.03	5.25	5.25
2017/18	3.20	2.06	0.10	5.36	5.36
2018/19	3.00	2.11	0.15	5.26	5.26
2019/20	3.00	2.15	0.18	5.33	5.33
2020/21	3.00	2.21	0.19	5.40	5.40
2021/22	3.00	2.24	0.20	5.44	5.44
2022/23	3.00	2.28	0.21	5.49	5.49
2023/24	3.00	2.32	0.21	5.53	5.53
2024/25	3.00	2.36	0.22	5.58	5.58

4. Modelling Scenarios

Modelling Approach

4.1 A hydraulic model of the NI transmission system was constructed using Pipeline Studio® software. Pipeline Studio® pipeline modelling software allows the user to configure and analyse the demand on the network for a number of scenarios.

4.2 The model was run for the ten years of the capacity statement from 2015/16 – 2024/25 inclusive, to determine if the existing Northern Ireland transmission system has the capacity to meet forecasted flow requirements.

4.3 As noted in the previous section, in order to assess the system on days of different demand patterns, three sample demand days were analysed for each scenario over the 10 year period: 1-in-20 year ("severe") winter peak day, average year winter peak day and average year summer minimum. Also, where it was appropriate, the analysis also modelled firm plus interruptible demand and firm demand only.

4.4 The following table summarises the suite of network modelling completed for the NI GCS 2015 (Note: 'F' – Firm, 'F & I' – Firm and Interruptible)

	Base Case	Base Case & Gaelectric
Scenario	1	2
Severe Winter Peak Day (F&I)	✓	✓
Severe Winter Peak Day (F)	✓	✓
Average Winter Peak Day (F&I)	✓	✓
Average Winter Peak Day (F)	✓	✓
Summer Minimum Day (F&I)	✓	✓
Summer Minimum Day (F)	✓	✓

4.5 The modelling considers the ability of the system to meet the peak or minimum daily demand within that day. It does not consider the ability of the system to respond to within day demand changes. The scenarios that have been modelled are presented in section 4.2. i.e. the analysis is based upon flat supply and profiled demand but within day changes such as renominations are not considered.

Modelling Assumptions

4.6 All modelling assumptions are in line with last year's NICS. A summary of key assumptions is set out in Table 5. Detailed modelling assumptions can be reviewed in Appendix 2.

Table 5: Summary of NICS 2015 key modelling assumptions

	2015
Twynholm Pressure	
Severe Winter Peak	59.4 barg
Average Winter & Summer Minimum	69 barg
Control Mode	Set flat at 1/24th per hour
AGI Pressure Drop	2.5 barg
Flow Profile	Flat
AGI Design Capacity	8.64 mscmd
Contractual Capacity	8.08 mscmd
Carrickfergus	
Control Mode	Free flow matching demand profile
Pressure Drop	2 barg
Gas to West	
Treatment of Network Extension	Point load off SNP and NWP
Pressure Requirements / Boundary Conditions	
Maximum Operating Pressure	75 barg
Minimum Operating Pressure	12 barg
Maximum Pipeline Velocities	20 m/s (Velocities exceeding 12 m/s to be noted)

Modelling Scenario Overview

4.7 Two scenarios were modelled for this year's NICS. The Base Case (Scenario 1) assumes the existing infrastructure for all years, and includes the extension of the network for the Gas to the West project[2]. The second scenario extends the Base Case to include the proposed CAES facility. The two scenarios are discussed further below.

Scenario 1 – Base Case

4.8 The Base Case assumes the existing infrastructure plus the proposed Gas to the West network extensions (Zones 1 and 2). It was considered appropriate to include the Gas to the West extensions within the Base Case this year since the project has progressed to a more mature stage with the grant of licences and pre construction activities underway.

4.9 The three demand days (sever winter, average winter peak and summer minimum) have been modelled for both firm only and firm and interruptible.

Scenario 2–Base Case and CAES

4.10 This scenario assumes the existing infrastructure, the Gas to the West extension as in the Base Case plus the proposed CAES facility. The modelling approach undertaken for this scenario assumed a point load on the network at Ballylumford since this exit point is close to the proposed site of the facility.

4.11 Again for this scenario, the three demand days (sever winter, average winter peak and summer minimum) have been modelled for both firm only and firm and interruptible.

---

2 The network model configuration employed for the network analysis included the proposed 'Gas to the West' network as a point load on the existing network rather than an extension of the NI transmission system. Point loads were modelled at Strabane and Derryhale AGI to represent the aggregate demands for the proposed Gas to the West distribution Zones 1 and 2 respectively. Strabane AGI represents the proposed connection point for Gas to the West on the NWP, and Derryhale AGI represents the proposed connection point for Gas to the West on the SNP.

5. Modelling Results

5.1 Based on the demand figures supplied and the modelling assumptions outlined in section 4, the network analysis demonstrates that:

- The Northern Ireland transmission network has sufficient capacity to meet summer minimum day and average winter peak day demands on a firm, and firm and interruptible basis for all years modelled.

- For the severe winter peak day firm demand basis, in three years (2016/17, 2017/18 & 2024/25), the Northern Ireland transmission network does not have the capacity to meet the full demand, based on minimum contractual pressure limits and upstream pressure assumptions. The use of capacity short fall measures or the use of the South-North pipeline (subject to the capacity being available upstream of the Gormanston entry point) would be required under such conditions to meet system demands[3].

- For the severe winter peak day firm & interruptible demand basis, in all years the Northern Ireland transmission network does not have the capacity to meet the full demand, based on minimum contractual pressure limits and upstream pressure assumptions. The use of capacity short fall measures or the use of the South-North pipeline (subject to the capacity being available upstream of the Gormanston entry point) would be required under such conditions to meet system demands[3].

- An additional demand scenario ('Gaelectric CAES' proposed new connection) representing a potential future demand connection was added to the Base Case. The Northern Ireland transmission network has sufficient capacity to meet the resulting summer minimum day and average winter peak day demands on a firm, and firm and interruptible

3 Network Analysis has determined that the Northern Ireland transmission network has the capacity to accommodate flows equivalent to the contractual capacity at Twynholm Entry Point (8.08 mscmd). Any flow requirement in excess of this capacity would need to be routed from the Gas Network Irelands (GNI) interconnector system via the Gormanston Entry Point and the South North pipeline.

basis for all years modelled.

- On a severe winter peak day, addition of the Gaelectric CAES demand increases the number of years where the minimum contractual pressure limits cannot be met for the firm demand.

- The addition of Gaelectric CAES demand, resulted in infeasible conditions in the model across all years for the firm & interruptible demand.

5.2 The following sections outline the results of the Network Analysis. The summary results are colour-coded as follows:


All Pressures within contractual limits


Pressures outside contractual limits and / or results unobtainable due to infeasible conditions in the model


Year not modelled

5.3 When a red (pressure violation) is flagged in the summary results tables, a further explanation is presented, and a complete results table detailing the pressures on the network included in Appendix 3.

5.4 Detailed network analysis using transient modelling[4] has not been carried out 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 Appendix 3 as 'Within Range'.

5.5 Likewise, where a scenario has failed to solve by association with a previous year, pressures and velocities are listed in the tables in Appendix 3 as 'FAIL'.

4 Transient modelling simulates the 24-hour demand cycle over a period of 3 days

5.6 In scenarios where the transient model has failed to solve due to infeasible conditions in the model (e.g. pressures reaching 0 barg), associated pressures and velocities are also listed as 'FAIL'. Transient modelling has not been attempted for the subsequent years on that scenario (provided the demand trend is increasing).

5.7 The results tables in Appendix 3.1 detail the conditions within Northern Ireland (SNIP, South-North and North-West Pipelines) for severe winter peak day firm & interruptible demands and severe winter peak day firm demands. Figures are coloured red in the pressure tables where they are below the minimum contractual pressure limits (12 bar).

Scenario 1 – Base Case

Severe Winter Peak Day (F&I)

5.8 Base Case analysis demonstrates that the Northern Ireland transmission network does not have sufficient pressure to meet severe winter peak day demands on a firm & interruptible basis in all years.

Gas Year	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25
Firm & Interruptible	1,2	1,2	1,2	1	1	1,2	1,2	1,2	1,2	1,2

Notes:

1. The existing contractual capacity of the Twynholm Entry point (8.08 mscmd) is exceeded
2. The design capacity of Twynholm AGI (8.64 mscmd) is exceeded

5.9 The results in Appendix 3.1 show that the pressure at the inlet to Coolkeeragh falls below the minimum contractual limit (12 bar) for all years modelled.

5.10 Network analysis results cannot be obtained for 2015/16 since pressures have fallen below zero at the inlet to the Coolkeeragh AGI (the most peripheral point on the NI system). This occurs at a demand of 8.87 mscm.

Notably the 8.08 contractual limit of the SNIP is surpassed in all years.

5.11 Notably, the forecast Northern Ireland Severe Winter Peak Day Firm & Interruptible demand is greater in the first 3 years (2015/16, 2016/17, 2017/18) than in subsequent years. This results from the scheduled closure of the Ballylumford 'B' Power Station at the end of 2018.

5.12 Network analysis was not attempted for 2016/17 and 2017/18 since the model failed to solve for 2015/16 when the demand was lower. Network analysis was not attempted for 2019/20 and subsequent years, since pressures have fallen below the minimum contractual limit (12 bar) at the inlet to Coolkeeragh AGI in 2018/19, and demands are greater in all subsequent years.

Severe Winter Peak Day (F)

5.13 Base Case analysis demonstrates that pressures are sufficient to meet severe winter peak day demands on a firm basis for the years 2018/19 – 2023/24 only.

Gas Year	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25
Firm	1	1	1							1

Notes:

1. The existing contractual capacity of the Twynholm Entry point (8.08 mscmd) is exceeded

5.14 The results in Appendix 3.1b show that pressure at the inlet to Coolkeeragh falls below the minimum contractual limit (12 bar) in 2015/16. This occurs at a demand of 8.25 mscmd. Network analysis was not attempted for 2016/17 and 2017/18 since the model failed to solve for 2015/16 when the demand was lower.

5.15 Network analysis demonstrated sufficient pressures to meet demand for the years 2018/19, 2019/20 and 2023/24. Network analysis was not completed for 2020/21 – 2022/23. Results were deemed 'Within Range' by association with results and demands for the adjacent years.

5.16 The analysis showed that pressures are anticipated to fall below the minimum contractual limit again in 2024/25. This occurs at a demand of 8.16 mscmd.

5.17 For the reasons explained in section 3 the 8.08 mscm contractual limit of the SNIP is surpassed in 2015/16, 2016/17, 2017/18 and again in 2024/25.

Average Winter Peak Day

5.18 Base Case analysis demonstrates that the Northern Ireland transmission network has sufficient pressure to meet average winter peak day demands on a firm, and firm & interruptible basis.

Gas Year	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25
Firm & Interruptible										
Firm										

5.19 The pressures at the key points on the NI transmission network are within the operating pressure limits of the system and can provide the pressure to deliver the gas flows demanded for all years modelled.

5.20 The results tables in Appendix 3.3 detail the conditions within Northern Ireland (SNIP and North-West Pipelines) for Average winter peak day firm & interruptible demands and Average winter peak day firm demands.

Summer Minimum Day

5.21 Base Case analysis demonstrates that the Northern Ireland transmission network has sufficient pressure to meet summer minimum day demands on a firm, and firm & interruptible basis.

Gas Year	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25
Firm & Interruptible										
Firm										

5.22 The pressures at the key points on the NI transmission network are within

the operating pressure limits of the system and can provide the pressure to deliver the gas flows demanded for all years modelled.

5.23 The results tables in Appendix 3.4 detail the conditions within Northern Ireland (SNIP and North-West Pipelines) for Summer minimum day firm & interruptible demands and Summer minimum day firm demands.

Scenario 2 – Base Case and Gaelectric CAES

5.24 The results tables in Appendix 3.2 detail the conditions within Northern Ireland (SNIP and North-West Pipelines), Base Case and Gaelectric CAES, for severe winter peak day, firm & interruptible demands and severe winter peak day firm demands.

Severe Winter Peak Day (F&I)

5.25 Base Case (with Gaelectric CAES) analysis demonstrates that the Northern Ireland transmission network does not have sufficient pressure to meet severe winter peak day demands on a firm and interruptible basis.

Gas Year	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25
Firm & Interruptible				1,2	1,2	1,2	1,2	1,2	1,2	1,2
Firm					1	1	1	1	1	1

Notes:

1. The existing contractual capacity of the Twynholm Entry point (8.08 mscmd) is exceeded
2. The design capacity of Twynholm AGI (8.64 mscmd) is exceeded

5.26 Pressures below zero at the inlet to the Coolkeeragh AGI result in infeasible conditions in the model in all years. Notably, the 8.08 mscm contractual limit of the SNIP is surpassed in all years.

Severe Winter Peak Day (F)

5.27 Base Case (with Gaelectric CAES) analysis demonstrates that on a firm basis, the network does not have sufficient pressure to meet severe winter

peak day demands from 2019/20.

Gas Year	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25
Firm					1	1	1	1	1	1

Notes:

1. The existing contractual capacity of the Twynholm Entry point (8.08 mscmd) is exceeded
2. The design capacity of Twynholm AGI (8.64 mscmd) is exceeded

5.28 The results show that pressure at the inlet to Coolkeeragh falls below the minimum contractual limit (12 bar) from 2019/20. Network analysis was not attempted for 2020/21 and subsequent years since pressures have fallen below the minimum contractual limit (12 bar) at the inlet to the Coolkeeragh AGI in 2019/20, and demand is greater in all subsequent years.

5.29 Notably, the 8.08 mscm contractual limit of the SNIP is surpassed in 2019/20 and all subsequent years.

Average Winter Peak Day

5.30 Base Case (with Gaelectric CAES) analysis demonstrates that the Northern Ireland transmission network has sufficient pressure to meet average winter peak day demands on a firm, and firm & interruptible basis.

Gas Year	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25
Firm & Interruptible										
Firm										

5.31 The pressures at the key points on the NI transmission network are within the operating pressure limits of the system and can provide the pressure to deliver the gas flows demanded for all years modelled.

5.32 The results tables in Appendix 3.3 detail the conditions within Northern Ireland (SNIP and North-West Pipelines) for Average winter peak day firm & interruptible demands and Average winter peak day firm demands.

Summer Minimum Day

5.33 Base Case (with Gaelectric CAES) analysis demonstrates that the Northern Ireland transmission network has sufficient pressure to meet summer minimum day demands on a firm, and firm & interruptible basis.

Gas Year	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24
Firm & Interruptible										
Firm										

5.34 The pressures at the key points on the NI transmission network are within the operating pressure limits of the system and can provide the pressure to deliver the gas flows demanded for all years modelled.

5.35 The results tables in Appendix 3.4 detail the conditions within Northern Ireland (SNIP and North-West Pipelines) for Summer minimum day firm & interruptible demands and Summer minimum day firm demands.

Additional Modelling

Gormanston Balancing Flows

5.36 The TSOs carried out further modelling to utilise the Gormanston entry point to the NI system to supply balancing flows into the South-North pipeline. Balancing flows were applied to the level required in order to achieve the minimum contractual pressure limit of 12 bar at the inlet to the Coolkeeragh AGI.

5.37 The following Severe Winter Peak Day Demand Scenarios were analysed, these being the highest demand scenarios observed over the period of the NICS:

- 2024/25; Base Case + Gaelectric CAES; Firm & Interruptible (Total Demand: 9.45 mscmd)
- 2024/25; Base Case + Gaelectric CAES; Firm (Total Demand:

8.64 mscmd)

5.38 The results of the additional modelling showed that for 2024/25, balancing flows through Gormanston entry point were required as follows, in order to maintain the minimum contractual pressure limit of 12 barg at the inlet to Coolkeeragh AGI:

Demand Scenario	Gormanston Balancing Flow	Twynholm Flow	Coolkeeragh Min Inlet Pressure
Firm & Interruptible	1.34 mscmd	8.11 mscmd	12.0 barg
Firm	0.43 mscmd	8.21 mscmd	12.3 barg

5.39 The results indicate the system can accommodate this level of balancing flows. The complete results showing pressure conditions on the network are shown in Appendix 3.5.

Notes:

1. The 8.08 mscm contractual limit of the SNIP is surpassed in both demand scenarios. An additional balancing flow through Gormanston entry point could be utilised (subject to the capacity being available upstream of the Gormanston entry point) to reduce the flow on the SNIP to within the contractual limit but this was not considered in this analysis.

2. Twynholm flows remain below the 8.64 mscm design capacity in both cases.

System Pressure required to achieve 27 bar at Coolkeeragh AGI

5.40 The analysis completed on the Base Case scenario showed that the pressures on the network are insufficient to meet severe winter peak day demands forecast for the coming winter 2015/16.

5.41 Further modelling was carried out in order to assess the system pressure required at the inlet to Twynholm AGI, to achieve 27 barg at Coolkeeragh AGI; this being the minimum pressure required for the power station to operate on gas.

5.42 The following Severe Winter Peak Day Demand Scenarios were analysed:

- 2015/16; Base Case; Firm & Interruptible (8.87 mscm)
- 2015/16; Base Case; Firm (8.25 mscm)

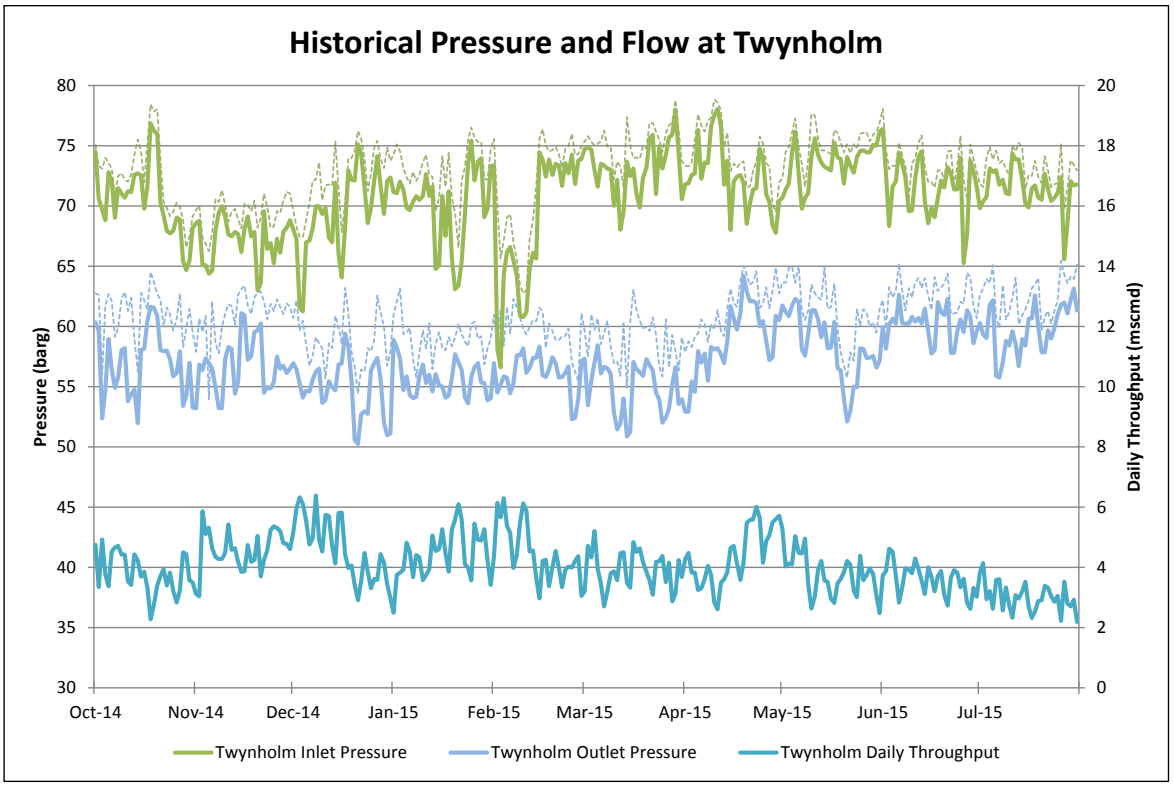
5.43 The results of the additional modelling showed that the following minimum system pressure was required at the inlet to Twynholm AGI, in order to maintain a minimum inlet pressure of 27 barg at Coolkeeragh AGI:

Demand Scenario	Twynholm Inlet Pressure	Coolkeeragh Min Inlet Pressure
Firm & Interruptible	69.5 barg	27.5 barg
Firm	66.5 barg	26.8 barg

The complete results showing pressure conditions on the network are shown in Appendix 3.5.

5.44 Figure 6 provides a record of the historical pressure levels at Twynholm from October 2014 to July 2015.

Figure 6: Historical pressures recorded at Twynholm AGI



5.45 The daily minimum (solid line) and average (dashed line) pressure is plotted at the Twynholm inlet (green) and outlet (blue) for the period 1st October 2014 – 31st July 2015. Some key points on the data supporting the graphs are provided below:

i. The minimum inlet pressure recorded at Twynholm over the period was 56.6 barg. All other minimum pressures recorded were above 60 barg.
ii. The minimum outlet pressure recorded at Twynholm over the period was 50.2 barg (not coincident with the minimum inlet pressure recorded)
iii. The average inlet pressure at Twynholm varied between a minimum of 62.75 and a maximum of 78.84 barg over the period
iv. The average outlet pressure at Twynholm varied between a minimum of 53.96 and a maximum of 65.45 barg over the period

5.46 Notably the minimum inlet pressure level at Twynholm recorded over the

period was 56.6 barg. This is below the minimum system pressure required at the inlet to Twynholm AGI outlined in the modelling (66.5 barg) required to maintain an inlet pressure of 27 barg at Coolkeeragh AGI to deliver the forecasted firm demand of 8.25 mscm.

5.47 However the 56.6barg was for an hour and did not adversely impact outlet pressures as shown in the plotted blue lines. Subsequently there were no low pressure issues on the NI network. Whilst the drop in pressure to 56.6 barg at Twynholm is considered to be an outlier within the pressures observed, it does demonstrate that pressures can occasionally approach the 56 bar minimum contractual inlet pressure at Twynholm.

5.48 The average inlet pressure at Twynholm varies between a minimum of 62.75 and a maximum average of 78.84 barg over the period. Whereas the modelling has indicated that the minimum inlet pressure at Twynholm to deliver the forecasted firm demand and maintain 27 barg at Coolkeeragh is 66.5 barg. This indicates that if a demand of 8.25 mscm had occurred on days where pressure at the Twynholm inlet were below 66.5 barg then the system may not have been able to maintain the pressures required to deliver the full gas demand to Coolkeeragh.

5.49 However the modelled demand of 8.25 represents a high demand when considered against the record peak demands which have been observed. The lower line graph in Figure 6 shows the level of flows which were accommodated during the period. Maximum flow through Twynholm of 6.4 msmc/d occurred on the 8th December 2014. It should also be noted that the total booked exit capacity for 15/16 gas year is significantly lower than 8.25 and is in fact 6.69 mscm.

System Pressure required to achieve 12 bar at Coolkeeragh AGI

5.50 The TSOs also considered what system pressure would be required at the inlet to Twynholm AGI, in order to achieve the minimum contractual pressure limit at the inlet to the Coolkeeragh AGI (12 bar).

The following Severe Winter Peak Day Demand Scenarios were analysed:

- 2015/16; Base Case; Firm & Interruptible (8.87 mscm)
- 2015/16; Base Case; Firm (8.25 mscm)

5.51 The results of the additional modelling showed that the following minimum system pressure was required at the inlet to Twynholm AGI, in order to maintain a minimum inlet pressure of 12 barg at Coolkeeragh AGI:

Demand Scenario	Twynholm Inlet Pressure	Coolkeeragh Min Inlet Pressure
Firm & Interruptible	63.5 barg	12.7 barg
Firm	60 barg	12.5 barg

The complete results showing pressure conditions on the network are shown in Appendix 3.5.

6. Commentary

6.1 The modelling results have indicated that on the basis of the demands modelled and the assumptions used the transmission network could meet the firm demands for the average winter and minimum summer demands for all years for all scenarios.

6.2 Additionally the network could meet severe winter peak firm demand for the following years:

- Base Case – from 2018/19 to 2023/24
- Base Case plus CAES - for 2018/19 only

6.3 The network has been built to meet firm demands. Therefore the key results are those which indicate the ability of the network to meet firm demands.

6.4 The modelling assumptions are the same as last year. The only change between this year's analysis and that of last year are the demand figures that have been provided by the powerstations and distribution companies.

6.5 Total NI demands up to 2017/18 for a severe winter peak day are higher than comparable years in last year's statement. These higher demands are primarily driven by powerstation forecasts. As noted in section 3 it is difficult to forecast power station demand accurately due to the number of competing factors which must be considered. Power sector demand forecasts are therefore likely to be conservative. We note that the forecasts for power sector demand up to 2017/18 are higher than the peak record demands that have been recorded. We also note that the figure for total forecast booked exit capacity for 15/16 gas year forecast in June is in fact 6.69 mscm, significantly lower than the 8.25 forecast figure previously forecast for the capacity statement.

6.6 Following 2017/18 the total NI severe winter peak forecast demand reduces, due to lower power station demand, and then gradually increases due to a growing distribution demand.

6.7 The results indicate, on the basis of the demands modelled and the assumptions used, that the network could accommodate a maximum demand of 8.07 mscm and retain the minimum contractual pressure of 56 bar at Twynholm and 12 bar at Coolkeeragh[5].

6.8 We understand that 27 barg at the Coolkeeragh AGI is the minimum pressure required for Coolkeeragh power station to operate on gas. The practice of the TSOs has been to provide pressure in excess of the 12 barg contractual level where it is available but it is not guaranteed. If a power station wishes to guarantee pressure at a particular level they currently have the right to request and pay for enhanced pressure under their relevant network codes.

6.9 Where the modelling has indicated potential low pressure issues flip-flop arrangements are in place or suppliers to the power stations could bring gas to the SNP using the Irish interconnector system assuming capacity is available for them to book in that system.

6.10 Regarding the CAES scenario, the modelling has indicated that on a firm basis, the network does not have sufficient pressure to meet severe winter peak day demands from 2019/20. This results in pressure levels lower than 12 bar at Coolkeeragh power station.

6.11 Under these circumstances, additional demand can be accommodated via the SNP. Modelling has indicated that that a total NI demand of 9.45 mscm/day (8.11 mscm via SNIP and 1.34 mscm via Gormanston) can be met when using the SNIP and SN whilst maintaining 12 bar contractual pressure at Coolkeeragh This is the maximum demand that has been modelled in this year's analysis and would meet firm and interruptible demand for the Base Case plus the CAES scenario up to and including 2024/25.

6.12 Use of the SN pipeline is also required in the Base Case scenario for the years when demands exceed 8.08 mscm. As noted above the SNP can facilitate these demands.

5 See Appendix 3.b Base Case Severe Winter Peak Day (Firm) modelling result for year 2022/23

6.13 Commercial arrangements are in place to accommodate flows from Gormanston. Shippers wishing to bring gas to the SNP will need a licence from CER to ship gas and also be a signatory to the CER approved Gaslink and GNI network codes. The applicable tariffs will also need to be paid.

6.14 There are a number of infrastructure developments that will impact flows of gas to the Northern Ireland gas transmission network.

6.15 The Corrib gas field is anticipated to commence supplying gas in 2015/16[6]. Corrib flows are anticipated to reduce RoI gas demand at Moffat and consequently lower the overall demands on the SWSOS network. This year's modelling has not considered the impact of future Corrib flows on the SWSOS network and subsequently the impact to the pressures and flows on the downstream NI gas network.

6.16 However the TSOs will monitor the impact of Corrib flows over the course of the next gas year and we will be in a position to provide an update on the impact to the downstream NI gas network in next year's capacity statement.

6.17 Additionally the twinning of Southwest Scotland onshore system between Cluden and Brighouse Bay is planned to be completed by 2017[7]. Gas Networks Ireland is currently considering the planned operating regime for the system in Scotland.

6.18 Two electricity infrastructure developments are also anticipated to impact future gas flows to Northern Ireland – Mutual Energy is planning to restore the damaged Moyle electricity interconnector to its full capacity by early 2016[8].

6.19 Also EirGrid and SONI (System Operator for Northern Ireland) have submitted their planning application for the proposed South-North electricity Interconnector to connect the electricity networks of Ireland and Northern Ireland[9]. The proposal is undergoing review by the relevant authorities.

6 http://www.cer.ie/docs/000138/CER15204%20GNI%202015%20Network%20Development%20Plan%20Final.pdf
7 http://www.cer.ie/docs/000138/CER15204%20GNI%202015%20Network%20Development%20Plan%20Final.pdf
8 http://www.mutual-energy.com/moyle-link-to-be-restored-ahead-of-schedule/
9 http://www.eirgridprojects.com/projects/northsouth400kvinterconnectiondevelopment/overview/

6.20 We expect to provide an update on the progress of these infrastructure projects in next year's capacity statement.

6.21 The capacity statement has provided an assessment of the network up to and including 2024/25. However the Transportation Agreement between GNI(UK) and PTL which governs the provision of capacity from Moffat to Twynholm ends in 2021 unless it is extended. The TSOs are currently discussing an extension of the Transportation Agreement beyond 2021. Negotiations are at an early stage however we will update industry on progress at an appropriate stage in the discussions.

Appendix 1: Northern Ireland Demand Forecast

Severe Winter Peak Day

Firm

Year	Severe Winter Peak Day Demands/Supplies (mscmd)				
	Power	Non-Power	GTW	Total	Twynholm
2015/16	5.06	3.19	0.00	8.25	8.25
2016/17	5.06	3.30	0.04	8.40	8.40
2017/18	5.06	3.38	0.12	8.56	8.56
2018/19	3.96	3.47	0.17	7.60	7.60
2019/20	3.96	3.55	0.21	7.72	7.72
2020/21	3.96	3.63	0.23	7.82	7.82
2021/22	3.96	3.71	0.24	7.91	7.91
2022/23	3.96	3.78	0.25	7.99	7.99
2023/24	3.96	3.84	0.27	8.07	8.07
2024/25	3.96	3.91	0.29	8.16	8.16

Firm & Interruptible

Year	Severe Winter Peak Day Demands/Supplies (mscmd)				
	Power	Non-Power	GTW	Total	Twynholm
2015/16	5.06	3.81	0.00	8.87	8.87
2016/17	5.06	3.92	0.04	9.02	9.02
2017/18	5.06	4.00	0.25	9.31	9.31
2018/19	3.96	4.08	0.35	8.39	8.39
2019/20	3.96	4.17	0.41	8.54	8.54
2020/21	3.96	4.25	0.43	8.64	8.64
2021/22	3.96	4.33	0.44	8.73	8.73
2022/23	3.96	4.40	0.45	8.81	8.81
2023/24	3.96	4.46	0.47	8.89	8.89
2024/25	3.96	4.52	0.49	8.97	8.97

Average Winter Peak Day

Firm

Year	Average Winter Peak Day Demands/Supplies (mscmd)				
	Power	Non-Power	GTW	Total	Twynholm
2015/16	3.20	1.94	0.00	5.14	5.14
2016/17	3.20	2.02	0.03	5.25	5.25
2017/18	3.20	2.06	0.10	5.36	5.36
2018/19	3.00	2.11	0.15	5.26	5.26
2019/20	3.00	2.15	0.18	5.33	5.33
2020/21	3.00	2.21	0.19	5.40	5.40
2021/22	3.00	2.24	0.20	5.44	5.44
2022/23	3.00	2.28	0.21	5.49	5.49
2023/24	3.00	2.32	0.21	5.53	5.53
2024/25	3.00	2.36	0.22	5.58	5.58

Firm & Interruptible

Year	Average Winter Peak Day Demands/Supplies (mscmd)				
	Power	Non-Power	GTW	Total	Twynholm
2015/16	3.20	2.39	0.00	5.59	5.59
2016/17	3.20	2.46	0.03	5.69	5.69
2017/18	3.20	2.50	0.22	5.92	5.92
2018/19	3.00	2.55	0.31	5.86	5.86
2019/20	3.00	2.60	0.36	5.96	5.96
2020/21	3.00	2.65	0.37	6.02	6.02
2021/22	3.00	2.68	0.38	6.06	6.06
2022/23	3.00	2.72	0.39	6.11	6.11
2023/24	3.00	2.76	0.39	6.15	6.15
2024/25	3.00	2.80	0.40	6.20	6.20

Summer Minimum Day

Firm

Year	Summer Minimum Day Demands/Supplies (mscmd)				
	Power	Non-Power	GTW	Total	Twynholm
2015/16	1.90	0.41	0.00	2.31	2.31
2016/17	1.90	0.42	0.01	2.33	2.33
2017/18	1.90	0.42	0.03	2.35	2.35
2018/19	1.90	0.44	0.04	2.38	2.38
2019/20	1.40	0.45	0.04	1.89	1.89
2020/21	1.40	0.46	0.05	1.91	1.91
2021/22	1.40	0.46	0.05	1.91	1.91
2022/23	1.40	0.47	0.05	1.92	1.92
2023/24	1.40	0.48	0.05	1.93	1.93
2024/25	1.40	0.48	0.05	1.93	1.93

Firm & Interruptible

Year	Summer Minimum Day Demands/Supplies (mscmd)				
	Power	Non-Power	GTW	Total	Twynholm
2015/16	1.90	0.53	0.00	2.43	2.43
2016/17	1.90	0.54	0.01	2.45	2.45
2017/18	1.90	0.54	0.07	2.51	2.51
2018/19	1.90	0.55	0.09	2.54	2.54
2019/20	1.40	0.56	0.10	2.06	2.06
2020/21	1.40	0.57	0.11	2.08	2.08
2021/22	1.40	0.57	0.11	2.08	2.08
2022/23	1.40	0.58	0.11	2.09	2.09
2023/24	1.40	0.59	0.11	2.10	2.10
2024/25	1.40	0.59	0.11	2.10	2.10

Severe Winter Peak Day + Gaelectric CAES

Firm

Year	Severe Winter Peak Day Demands/Supplies (mscmd)					
	Power	Non-Power	GTW	Gaelectric	Total	Twynholm
2015/16	5.06	3.19	0.00	0.00	8.25	8.25
2016/17	5.06	3.30	0.04	0.00	8.40	8.40
2017/18	5.06	3.38	0.12	0.00	8.56	8.56
2018/19	3.96	3.47	0.17	0.48	8.08	8.08
2019/20	3.96	3.55	0.21	0.48	8.20	8.20
2020/21	3.96	3.63	0.23	0.48	8.30	8.30
2021/22	3.96	3.71	0.24	0.48	8.39	8.39
2022/23	3.96	3.78	0.25	0.48	8.47	8.47
2023/24	3.96	3.84	0.27	0.48	8.55	8.55
2024/25	3.96	3.91	0.29	0.48	8.64	8.64

Firm & Interruptible

Year	Severe Winter Peak Day Demands/Supplies (mscmd)					
	Power	Non-Power	GTW	Gaelectric	Total	Twynholm
2015/16	5.06	3.81	0.00	0.00	8.87	8.87
2016/17	5.06	3.92	0.04	0.00	9.02	9.02
2017/18	5.06	4.00	0.25	0.00	9.31	9.31
2018/19	3.96	4.08	0.35	0.48	8.87	8.87
2019/20	3.96	4.17	0.41	0.48	9.02	9.02
2020/21	3.96	4.25	0.43	0.48	9.12	9.12
2021/22	3.96	4.33	0.44	0.48	9.21	9.21
2022/23	3.96	4.40	0.45	0.48	9.29	9.29
2023/24	3.96	4.46	0.47	0.48	9.37	9.37
2024/25	3.96	4.52	0.49	0.48	9.45	9.45

Average Winter Peak Day + Gaelectric CAES

Firm

Year	Average Winter Peak Day Demands/Supplies (mscmd)					
	Power	Non-Power	GTW	Gaelectric	Total	Twynholm
2015/16	3.20	1.94	0.00	0.00	5.14	5.14
2016/17	3.20	2.02	0.03	0.00	5.25	5.25
2017/18	3.20	2.06	0.10	0.00	5.36	5.36
2018/19	3.00	2.11	0.15	0.39	5.65	5.65
2019/20	3.00	2.15	0.18	0.39	5.72	5.72
2020/21	3.00	2.21	0.19	0.39	5.78	5.78
2021/22	3.00	2.24	0.20	0.39	5.83	5.83
2022/23	3.00	2.28	0.21	0.39	5.88	5.88
2023/24	3.00	2.32	0.21	0.39	5.92	5.92
2024/25	3.00	2.36	0.22	0.39	5.97	5.97

Firm & Interruptible

Year	Average Winter Peak Day Demands/Supplies (mscmd)					
	Power	Non-Power	GTW	Gaelectric	Total	Twynholm
2015/16	3.20	2.39	0.00	0.00	5.59	5.59
2016/17	3.20	2.46	0.03	0.00	5.69	5.69
2017/18	3.20	2.50	0.22	0.00	5.92	5.92
2018/19	3.00	2.55	0.31	0.39	6.25	6.25
2019/20	3.00	2.60	0.36	0.39	6.34	6.34
2020/21	3.00	2.65	0.37	0.39	6.40	6.40
2021/22	3.00	2.68	0.38	0.39	6.45	6.45
2022/23	3.00	2.72	0.39	0.39	6.50	6.50
2023/24	3.00	2.76	0.39	0.39	6.54	6.54
2024/25	3.00	2.80	0.40	0.39	6.59	6.59

Summer Minimum Day + Gaelectric CAES

Firm

Year	Summer Minimum Day Demands/Supplies (mscmd)					
	Power	Non-Power	GTW	Gaelectric	Total	Twynholm
2015/16	1.90	0.41	0.00	0.00	2.31	2.31
2016/17	1.90	0.42	0.01	0.00	2.33	2.33
2017/18	1.90	0.42	0.03	0.00	2.35	2.35
2018/19	1.90	0.44	0.04	0.16	2.53	2.53
2019/20	1.40	0.45	0.04	0.13	2.01	2.01
2020/21	1.40	0.46	0.05	0.16	2.07	2.07
2021/22	1.40	0.46	0.05	0.17	2.07	2.07
2022/23	1.40	0.47	0.05	0.19	2.10	2.10
2023/24	1.40	0.48	0.05	0.21	2.14	2.14
2024/25	1.40	0.48	0.05	0.20	2.13	2.13

Firm & Interruptible

Year	Summer Minimum Day Demands/Supplies (mscmd)					
	Power	Non-Power	GTW	Gaelectric	Total	Twynholm
2015/16	1.90	0.53	0.00	0.00	2.43	2.43
2016/17	1.90	0.54	0.01	0.00	2.45	2.45
2017/18	1.90	0.54	0.07	0.00	2.51	2.51
2018/19	1.90	0.55	0.09	0.16	2.70	2.70
2019/20	1.40	0.56	0.10	0.13	2.19	2.19
2020/21	1.40	0.57	0.11	0.16	2.24	2.24
2021/22	1.40	0.57	0.11	0.17	2.25	2.25
2022/23	1.40	0.58	0.11	0.19	2.28	2.28
2023/24	1.40	0.59	0.11	0.21	2.32	2.32
2024/25	1.40	0.59	0.11	0.20	2.31	2.31

Appendix 2: Summary of System Modelling Assumptions

General Assumptions

- All entry points are modelled on a flat flow basis, unless otherwise indicated.
- The systems upstream and downstream of the NI Transmission System have not been considered in this analysis, notwithstanding the assumption regarding the 59.4 barg inlet pressure at Twynholm.
- Unless otherwise stated, Twynholm is the only source of supply utilised in the models.
- The SNIP, North-West and South-North Pipelines are assumed to have a maximum operating pressure of 75 barg.
- All scenarios simulate the 24 hour demand cycle of the NI transmission system repeated over a three day period to obtain steady consistent results.
- All demands are modelled as energy flows. Volumetric flow is determined from energy flow and local gas calorific value.
- A minimum system pressure limit of 12 barg is assumed for all off-takes on the NI system, barg in line with the TSOs contractual commitments at the various Exit Points on the NI transmission system.

Demand Assumptions

- Forecasted annual and peak NI demands are taken from information provided to the Northern Ireland Regulator by system shippers in NI.
- Information on the proposed Gaelectric Compressed Air Energy Storage connection was provided by Gaelectric CAES NI Ltd.
- The hourly gas demand of the NI power stations is based on historic diurnals.
- The hourly demand for all other AGI off-takes is derived from their historic contribution to peak-day and minimum day demands. Diurnal demand curves are from actual peak and minimum days.

- Gas flow volumes are derived from supplied energy demand values by assuming a Moffat Gas Calorific Value of 39.77 MJ/m^3 (measured historical value)
- NI Shippers have provided separate figures for firm and interruptible demands. Where applicable, models are run for both firm and firm & interruptible demands.

Network Operation / Pressure Assumptions

Twynholm

- The ANOP at Twynholm AGI is assumed to be 59.4 barg for severe winter peak days and 69 barg for both average winter peak days and summer minimum days.
- 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.
- The design capacity of Twynholm AGI is 8.64 mscmd; and the contractual capacity at the Twynholm exit point (on the BGÉ UK system) is 8.08 mscmd. Flows are not limited in the model, but where flows in excess of the contractual or design capacity are encountered, they are noted.

Carrickfergus

- Carrickfergus AGI is modelled in flow control mode, whereby the hourly flow through Carrickfergus equals the sum of the hourly downstream demands on the BGE NI system.
- The outlet pressure at Carrickfergus is determined by the inlet pressure at the station less an assumed pressure drop across the station of 2 barg.

Future Network Development Assumptions

- The modelling has not considered the impact of Corrib with regards to demands on the SWSOS network and the resulting impact to pressures available to the NI network.

- The analysis undertaken includes the Gas to the West demand as a point load at Derryhale AGI, the proposed connection point on the SNP for the

‘Gas to the West’. The point load at Derryhale is equal to the aggregate demand for the proposed off-takes along this route. Similarly, the proposed network extension to Strabane was reflected as a point load on the NWP.

- The analysis taken for the CAES scenario assumed a point load at the Ballylumford exit point as this was the most appropriate place on the network to model the demand.

Appendix 3: Detailed Modelling Results

The tables in Appendix A3.1 and A3.2 below detail the conditions within Northern Ireland (SNIP, South-North and North-West Pipelines) for

(a) severe winter peak day firm & interruptible demands
and
(b) severe winter peak day firm demands

for the Base Case, and Base Case + Gaelectric CAES scenarios respectively.

Results for Average Winter Peak Day demand are contained in Appendix 3.3, with Summer Minimum Day demand results contained in Appendix 3.4.

Results of additional analysis carried out for the Severe Winter Peak Day demand scenario are contained in Appendix 3.5.

System Pressures at Coolkeeragh and Ballylumford must remain above 12 barg through the diurnal cycle in order to meet minimum system pressures. As noted in Section 4 these are the minimum pressure limits the transporter will maintain, as set out in the Shipper's Network Exit Parameter Schedule in respect of each Exit Point on the system.

Pressures below zero at the inlet to Coolkeeragh AGI (the most peripheral point on the NI system), result in infeasible conditions in the model.

Figures are coloured red in the pressure tables where they are below the minimum contractual pressure limits (12 bar).

A3.1 Base Case

a. Severe Winter Peak Day (F&I)

Year	Twynholm (SNIP)		Carrickfergus	Coolkeeragh		B'lumford
	Flow	Pressure [1]	Pressure [2]	Pressure [3]	Velocity [4]	Pressure [5]
	(mscmd)	(barg)	(barg)	(barg)	(m/s)	(barg)
Limits	8.08 / 8.64	75 (Max)	12 (Min)	12 (Min)	20 [6] (Max)	12 (Min)
2015/16	8.87	FAIL	FAIL	FAIL	FAIL	FAIL
2016/17	9.02	FAIL	FAIL	FAIL	FAIL	FAIL
2017/18	9.31	FAIL	FAIL	FAIL	FAIL	FAIL
2018/19	8.39	56.9 / 52.8	31.0 / 19.9	18.5 / 5.5	12.9	35.8 / 25.4
2019/20	8.54	FAIL	FAIL	FAIL	FAIL	FAIL
2020/21	8.64	FAIL	FAIL	FAIL	FAIL	FAIL
2021/22	8.73	FAIL	FAIL	FAIL	FAIL	FAIL
2022/23	8.81	FAIL	FAIL	FAIL	FAIL	FAIL
2023/24	8.89	FAIL	FAIL	FAIL	FAIL	FAIL
2024/25	8.97	FAIL	FAIL	FAIL	FAIL	FAIL

Notes:

1. Pressures at Twynholm (SNIP) are the maximum and minimum in the diurnal cycle at the outlet of Twynholm AGI.
2. Pressures at the Carrickfergus AGI are the maximum and minimum in the diurnal cycle, and are those downstream of the AGI in the North West pipeline.
3. Pressures at Coolkeeragh are the maximum and minimum in the diurnal cycle and are those in the pipeline upstream of the AGI.
4. Velocities at Coolkeeragh are the maximum in the diurnal cycle and are those in the inlet pipeline to the AGI.
5. Pressures at Ballylumford are the maximum and minimum in the diurnal cycle and are those in the pipeline.
6. Maximum pipeline velocities as per the standards detailed in IGEM/TD13

b. Severe Winter Peak Day (F)

Year	Twynholm (SNIP)		Carrickfergus	Coolkeeragh		B'lumford
	Flow	Pressure [1]	Pressure [2]	Pressure [3]	Velocity [4]	Pressure [5]
	(mscmd)	(barg)	(barg)	(barg)	(m/s)	(barg)
Limits	8.08 / 8.64	75 (Max)	12 (Min)	12 (Min)	20 [6] (Max)	12 (Min)
2014/15	8.25	56.7 / 52.3	32.8 / 21.7	22.6 / 10.8	8.1	36.8 / 25.6
2015/16	8.40	Fail	Fail	Fail	Fail	Fail
2016/17	8.56	Fail	Fail	Fail	Fail	Fail
2017/18	7.60	56.7 / 52.5	36.6 / 27.6	27.4 / 18.5	5.2	40.4 / 31.6
2018/19	7.72	56.7 / 52.5	35.8 / 26.5	26.4 / 17.0	5.6	39.7 / 30.7
2019/20	7.82	Within Range	Within Range	Within Range	Within Range	Within Range
2020/21	7.91	Within Range	Within Range	Within Range	Within Range	Within Range
2021/22	7.99	Within Range	Within Range	Within Range	Within Range	Within Range
2022/23	8.07	56.7 / 52.6	33.3 / 23.1	22.9 / 12.2	7.4	37.6 / 27.9
2023/24	8.16	56.7 / 52.6	32.7 / 22.2	22.0 / 10.8	8.1	37.1 / 27.2

Notes:

1. Pressures at Twynholm (SNIP) are the maximum and minimum in the diurnal cycle at the outlet of Twynholm AGI.
2. Pressures at the Carrickfergus AGI are the maximum and minimum in the diurnal cycle, and are those downstream of the AGI in the North West pipeline.
3. Pressures at Coolkeeragh are the maximum and minimum in the diurnal cycle and are those in the pipeline upstream of the AGI.
4. Velocities at Coolkeeragh are the maximum in the diurnal cycle and are those in the inlet pipeline to the AGI.
5. Pressures at Ballylumford are the maximum and minimum in the diurnal cycle and are those in the pipeline.
6. Maximum pipeline velocities as per the standards detailed in IGEM/TD13

A3.2 Base Case and Gaelectric CAES

The additional Gaelectric CAES demands are forecast to flow from 2018/19. The pressures from 2015/16 to 2024/25 are therefore unchanged from the base case scenario and are not included in the tables.

The Gaelectric CAES Offtake is modelled at Ballylumford AGI.

a. Severe Winter Peak Day (F&I)

Year	Twynholm (SNIP)		Carrickfergus	Coolkeeragh		B'lumford (Gaelectric)
	Flow	Pressure [1]	Pressure [2]	Pressure [3]	Velocity [4]	Pressure [5]
	(mscmd)	(barg)	(barg)	(barg)	(m/s)	(barg)
Limits	8.08 / 8.64	75 (Max)	12 (Min)	12 (Min)	20 [6] (Max)	12 (Min)
2018/19	8.87	FAIL	FAIL	FAIL	FAIL	FAIL
2019/20	9.02	FAIL	FAIL	FAIL	FAIL	FAIL
2020/21	9.12	FAIL	FAIL	FAIL	FAIL	FAIL
2021/22	9.21	FAIL	FAIL	FAIL	FAIL	FAIL
2022/23	9.29	FAIL	FAIL	FAIL	FAIL	FAIL
2023/24	9.37	FAIL	FAIL	FAIL	FAIL	FAIL
2024/25	9.45	FAIL	FAIL	FAIL	FAIL	FAIL

Notes:

1. Pressures at Twynholm (SNIP) are the maximum and minimum in the diurnal cycle at the outlet of Twynholm AGI.
2. Pressures at the Carrickfergus AGI are the maximum and minimum in the diurnal cycle, and are those downstream of the AGI in the North West pipeline.
3. Pressures at Coolkeeragh are the maximum and minimum in the diurnal cycle and are those in the pipeline upstream of the AGI.
4. Velocities at Coolkeeragh are the maximum in the diurnal cycle and are those in the inlet pipeline to the AGI.
5. Pressures at Ballylumford are the maximum and minimum in the diurnal cycle and are those in the pipeline.
6. Maximum pipeline velocities as per the standards detailed in IGEM/TD13

b. Severe Winter Peak Day (F)

Year	Twynholm (SNIP)		Carrickfergus	Coolkeeragh		B'lumford (Gaelectric)
	Flow	Pressure [1]	Pressure [2]	Pressure [3]	Velocity [4]	Pressure [5]
	(mscmd)	(barg)	(barg)	(barg)	(m/s)	(barg)
Limits	**8.08 / 8.64**	**75 (Max)**	**12 (Min)**	**12 (Min)**	**20 [6] (Max)**	**12 (Min)**
2018/19	8.08	54.4 / 52.8	33.0 / 24.2	23.0 / 13.8	6.7	37.1 / 28.7
2019/20	**8.20**	56.4 / 52.9	32.1 / 23.0	**20.7 / 10.8**	8.1	36.4 / 27.8
2020/21	**8.30**	**FAIL**	**FAIL**	**FAIL**	**FAIL**	**FAIL**
2021/22	**8.39**	**FAIL**	**FAIL**	**FAIL**	**FAIL**	**FAIL**
2022/23	**8.47**	**FAIL**	**FAIL**	**FAIL**	**FAIL**	**FAIL**
2023/24	**8.55**	**FAIL**	**FAIL**	**FAIL**	**FAIL**	**FAIL**
2024/25	**8.64**	**FAIL**	**FAIL**	**FAIL**	**FAIL**	**FAIL**

Notes:

1. Pressures at Twynholm (SNIP) are the maximum and minimum in the diurnal cycle at the outlet of Twynholm AGI.
2. Pressures at the Carrickfergus AGI are the maximum and minimum in the diurnal cycle, and are those downstream of the AGI in the North West pipeline.
3. Pressures at Coolkeeragh are the maximum and minimum in the diurnal cycle and are those in the pipeline upstream of the AGI.
4. Velocities at Coolkeeragh are the maximum in the diurnal cycle and are those in the inlet pipeline to the AGI.
5. Pressures at Ballylumford are the maximum and minimum in the diurnal cycle and are those in the pipeline.
6. Maximum pipeline velocities as per the standards detailed in IGEM/TD13

A3.3 Average Winter Peak

Average Winter Peak Day Scenarios were analysed using transient modelling for the extreme supply and demand scenarios only, ranging from a minimum of 5.14 mscmd (2015/16; Base Case; Firm) to a maximum of 6.59 mscmd (2024/25; Base Case + Gaelectric CAES; Firm & Interruptible)

Year	Demand	Twynholm (SNIP)		Carrickfergus	Coolkeeragh		B'lumford
		Flow	Pressure [1]	Pressure [2]	Pressure [3]	Velocity [4]	Pressure [5]
		(mscmd)	(barg)	(barg)	(barg)	(m/s)	(barg)
Limits		8.08 / 8.64	75 (Max)	12 (Min)	12 (Min)	20 [6] (Max)	12 (Min)
2015/16	F	5.14	66.3 / 62.8	58.5 / 54.1	53.8 / 49.4	1.6	61.0 / 56.4
2015/16	F&I	5.59	66.3 / 62.5	57.3 / 52.3	52.4 / 47.5	1.7	59.9 / 54.8
2024/25	F	5.97	66.1 / 61.9	56.1 / 50.3	51.0 / 45.4	1.7	58.7 / 52.9
2024/25	F&I	6.59	66.0 / 61.4	53.9 / 47.2	48.5 / 41.9	1.9	56.8 / 50.1

Notes:

1. Pressures at Twynholm (SNIP) are the maximum and minimum in the diurnal cycle.
2. Pressures at the Carrickfergus AGI are the maximum and minimum in the diurnal cycle, and are those downstream of the AGI in the North West pipeline.
3. Pressures at Coolkeeragh are the maximum and minimum in the diurnal cycle and are those in the pipeline upstream of the AGI.
4. Velocities at Coolkeeragh are the maximum in the diurnal cycle and are those in the inlet pipeline to the AGI.
5. Pressures at Ballylumford are the maximum and minimum in the diurnal cycle and are those in the pipeline.
6. Maximum pipeline velocities as per the standards detailed in IGEM/TD13

Pressures and flows on the Northern Ireland system remain within maximum and minimum limits across the range of scenarios, indicating that pressures and flows on the Northern Ireland system remain within maximum and minimum limits for all scenarios, for all years.

A3.4 Summer Minimum Day

Summer Minimum Day Scenarios were analysed using transient modelling for the extreme supply and demand scenarios, ranging from a minimum of 1.89 mscmd (2019/20; Base Case; Firm) to a maximum of 2.70 mscmd (2018/19; Base Case + Gaelectric CAES; Firm & Interruptible).

Year	Demand	Twynholm (SNIP)		Carrickfergus	Coolkeeragh		B'lumford
		Flow	Pressure [1]	Pressure [2]	Pressure [3]	Velocity [4]	Pressure [5]
		(mscmd)	(barg)	(barg)	(barg)	(m/s)	(barg)
Limits		8.08 / 8.64	75 (Max)	12 (Min)	12 (Min)	20 [6] (Max)	12 (Min)
2019/20	F	1.89	66.5 / 65.6	63.8 / 62.9	60.0 / 59.0	1.0	65.9 / 65.0
2019/20	F&I	2.06	66.5 / 65.4	63.6 / 62.5	59.7 / 58.6	1.0	65.7 / 64.6
2018/19	F&I	2.70	66.4 / 64.6	63.0 / 61.0	59.0 / 57.1	1.0	65.1 / 63.1
2024/25	F&I	2.31	66.4 / 65.1	63.4 / 61.9	59.4 / 58.0	1.0	65.5 / 64.0

Notes:

1. Pressures at Twynholm (SNIP) are the maximum and minimum in the diurnal cycle.
2. Pressures at the Carrickfergus AGI are the maximum and minimum in the diurnal cycle, and are those downstream of the AGI in the North West pipeline.
3. Pressures at Coolkeeragh are the maximum and minimum in the diurnal cycle and are those in the pipeline upstream of the AGI.
4. Velocities at Coolkeeragh are the maximum in the diurnal cycle and are those in the inlet pipeline to the AGI.
5. Pressures at Ballylumford are the maximum and minimum in the diurnal cycle and are those in the pipeline.
6. Maximum pipeline velocities as per the standards detailed in IGEM/TD13

Pressures and flows on the Northern Ireland system remain within maximum and minimum limits across the range of scenarios, indicating that pressures and flows on the Northern Ireland system remain within maximum and minimum limits for all scenarios, for all years.

A3.5 Additional Modelling

a. Gormanston Balancing Flows

The following table summarises the condition within Northern Ireland (SNIP, South-North and North-West pipelines).

Year / Demand Scenario	Twynholm (SNIP)		Gormanston		Coolkeeragh		B'lumford
	Flow	Pressure [1]	Flow	Pressure [2]	Pressure [3]	Velocity [4]	Pressure [5]
	(mscmd)	(barg)	(mscmd)	(barg)	(barg)	(m/s)	(barg)
Limits	**8.08 / 8.64**	**75 (Max)**	**-**	**75 (Max)**	**12 (Min)**	**20 [6] (Max)**	**12 (Min)**
2024/25 (F & I)	**8.11**	56.9 / 52.4	1.34	34.6 / 26.4	23.7 / 12.0	7.6	37.4 / 27.5
2024/25 (F)	**8.21**	56.9 / 52.9	0.43	31.1 / 22.6	22.7 / 12.3	7.3	36.8 / 27.7

Notes:

1. Pressures at Twynholm (SNIP) are the maximum and minimum in the diurnal cycle at the outlet of Twynholm AGI.
2. Pressures at Gormanston are the maximum and minimum in the diurnal cycle at the outlet of Gormanston AGI.
3. Pressures at Coolkeeragh are the maximum and minimum in the diurnal cycle and are those in the pipeline upstream of the AGI.
4. Velocities at Coolkeeragh are the maximum in the diurnal cycle and are those in the inlet pipeline to the AGI.
5. Pressures at Ballylumford are the maximum and minimum in the diurnal cycle and are those in the pipeline.
6. Maximum pipeline velocities as per the standards detailed in IGEM/TD13

b. System Pressure required to achieve 27 bar at Coolkeeragh AGI

The following table summarises the condition within Northern Ireland (SNIP, South-North and North-West pipelines).

Year / Demand Scenario	Twynholm (SNIP)			Carrickfergus	Coolkeeragh		B'lumford
	Flow	Inlet Pressure	Outlet Pressure [1]	Pressure [2]	Pressure [3]	Velocity [4]	Pressure [5]
	(mscmd)	(barg)	(barg)	(barg)	(barg)	(m/s)	(barg)
Limits	8.08 / 8.64		75 (Max)	12 (Min)	12 (Min)	20 [6] (Max)	12 (Min)
2015/16 (F & I)	8.87	69.5	67.0 / 62.0	45.6 / 35.2	37.6 / 27.5	3.7	49.3 / 38.8
2015/16 (F)	8.25	66.5	64.0 / 58.7	43.9 / 34.2	36.2 / 26.8	3.7	47.3 / 37.5

Notes:

1. Outlet Pressures at Twynholm (SNIP) are the maximum and minimum in the diurnal cycle at the outlet of Twynholm AGI.
2. Pressures at the Carrickfergus AGI are the maximum and minimum in the diurnal cycle, and are those downstream of the AGI in the North West pipeline.
3. Pressures at Coolkeeragh are the maximum and minimum in the diurnal cycle and are those in the pipeline upstream of the AGI.
4. Velocities at Coolkeeragh are the maximum in the diurnal cycle and are those in the inlet pipeline to the AGI.
5. Pressures at Ballylumford are the maximum and minimum in the diurnal cycle and are those in the pipeline.
6. Maximum pipeline velocities as per the standards detailed in IGEM/TD13

c. System Pressure required to achieve 12 bar at Coolkeeragh AGI

The following table summarises the condition within Northern Ireland (SNIP, South-North and North-West pipelines).

Year / Demand Scenario	Twynholm (SNIP)			Carrickfergus	Coolkeeragh		B'lumford
	Flow	Inlet Pressure	Outlet Pressure [1]	Pressure [2]	Pressure [3]	Velocity [4]	Pressure [5]
	(mscmd)	(barg)	(barg)	(barg)	(barg)	(m/s)	(barg)
Limits	8.08 / 8.64		75 (Max)	12 (Min)	12 (Min)	20 [6] (Max)	12 (Min)
2015/16 (F & I)	8.87	63.5	61.0 / 56.1	35.2 / 23.4	24.9 / 12.7	7.2	39.5 / 27.7
2015/16 (F)	8.25	60.0	57.5 / 52.8	33.8 / 22.8	24.0 / 12.5	7.2	37.7 / 26.7

Notes:

1. Outlet Pressures at Twynholm (SNIP) are the maximum and minimum in the diurnal cycle at the outlet of Twynholm AGI.
2. Pressures at the Carrickfergus AGI are the maximum and minimum in the diurnal cycle, and are those downstream of the AGI in the North West pipeline.
3. Pressures at Coolkeeragh are the maximum and minimum in the diurnal cycle and are those in the pipeline upstream of the AGI.
4. Velocities at Coolkeeragh are the maximum in the diurnal cycle and are those in the inlet pipeline to the AGI.
5. Pressures at Ballylumford are the maximum and minimum in the diurnal cycle and are those in the pipeline.
6. Maximum pipeline velocities as per the standards detailed in IGEM/TD13