Joint Gas Capacity Statement 2010

Commission for Energy Regulation
An Coimisiún um Rialáil Fuinnimh

Utility Regulator
ELECTRICITY GAS WATER

Contents

Foreword

The Joint Gas Capacity Statement 2010 (JCS) presents a summary of the analysis and of the impact of forecast gas supply and demand on the transmission systems for both Ireland and Northern Ireland over the next ten years. The analysis presented in the JCS has been principally prepared by Bord Gáis Networks (BGN) with input from the Transmission System Operators (TSOs) in each jurisdiction.[1]

The 2010 JCS is the second annual report produced as part of the Common Arrangements for Gas (CAG) project under the All-island Energy Market Development Framework. The Commission for Energy Regulation ('the CER') is required to publish this analysis, including a 7 year demand projection, under section 19 of the Gas (Interim) (Regulation) Act, 2002, as amended by the European Communities (Security of Natural Gas Supply) Regulations 2007 (S.I. No. 697 of 2007). The TSOs in Northern Ireland (NI) are obliged through their codes and licences to produce an annual pressure report/network forecast for presentation to the Northern Ireland Authority for Utility Regulation ('the Utility Regulator').

In April 2008, the CER and the Utility Regulator jointly published a Memorandum of Understanding on the development of the CAG project.[2] In establishing the CAG project, the CER and the Utility Regulator ('the Regulatory Authorities') aim to facilitate the operation of the natural gas market in Ireland and Northern Ireland on an all-island basis. As part of this objective, both Authorities are committed to a single approach to security of supply on the island which involves the production of a joint report on the island's expected gas supply and demand.

The 2010 JCS is the second such report to have been produced on an all-island basis. In previous years, an annual Pressure Report prepared by the Utility Regulator, and an annual Gas Capacity Statement, prepared by the CER, presented separate gas supply and demand in the transmission systems for Northern Ireland and Ireland respectively. The principal divergence from previous national reporting is that all flows are considered from the current and future Entry Points in Ireland and Northern Ireland to an integrated all-island system.

The 2010 JCS differs from that produced last year by extending the scope of the analysis to ten years. This change was undertaken in order to align the analysis of Ireland and Northern Ireland with that of the European 10-Year Network Development Plan produced by the European Network of Transmission System Operators for Gas every two years under EC Regulation N° 715 of 2009. The 2010 JCS therefore includes updated analysis and modelling of the impact of forecast gas supply and demand on the island's transmission systems for the period 2009/10 to 2018/19. The study provides the best estimate of the adequacy of the transmission system on the island to meet demand growth in the two jurisdictions.

This report examines the impact of gas storage at Larne on an all-island system as per last years' JCS, and takes into account flows through the South North Pipeline (SNP) to Ireland, the two subsea interconnectors, as well as the potential for reverse flows through the Scotland to Northern Ireland Pipeline (SNIP). The analysis also takes into account the potential introduction of other new gas supplies in the system, namely the delivery of Corrib gas, Shannon Liquefied Natural Gas, and increased gas from storage at the PSE Kinsale Energy facility (formerly known as Marathon Oil Ireland Limited). In light of these developments, three scenarios have been prepared in order to examine the capacity of the transmission systems on the island to function safely under various conditions.

The report shows that the high pressure transmission systems in Ireland and Northern Ireland have sufficient capacity for supplies to meet both forecast demand and severe winter 1-in-50 peak-day demand over the period.

---

[1] The following parties were involved in the preparation of this analysis: Bord Gáis Networks on behalf of Gaslink; Premier Transmission Limited & Belfast Gas Transmission Limited (both owned by Mutual Energy Limited); Bord Gáis Éireann (UK) Limited working with Bord Gáis Networks.
[2] The Memorandum of Understanding is available on both the websites of the CER and the Utility Regulator.

There is no requirement to reinforce the transmission system in either jurisdiction at the present time. However, this view is subject to a number of restrictions relating to the balance between the assumed new supply sources. If these restrictions are not viewed as acceptable further investment would be necessary in later years in order to accommodate potential increased west to east flows, south to north flows, as well as potential supplies from Northern Ireland to Ireland.

As regards the future outlook for Irish gas demand, while still positive, it is lower than forecasts published in previous years due to the impact of the economic downturn, as well as due to forecast lower electricity demand. Irish annual gas demand contracted by -3.1% in 2008/09 mainly as a result of the economic recession and is forecast to have decreased to 2006/7 levels by 2013/14 when demand is forecast to pick up. Irish peak day gas demand grew by 5.5% in 2008/09 due to favourable fuel prices and colder weather. Peak day gas demand is not expected to grow considerably in the medium term but is projected to increase significantly towards the end of the forecast period. It is also noted in the JCS that natural gas continues to be an important fuel for power generation, and is currently the fuel of choice for new thermal power station projects.

Demand in the Northern Ireland distribution market is forecast to grow at an annual rate varying between 2% to 6% over the period modelled. The year-on-year increase reflects the distribution companies' expected growth rates within the domestic and I/C sectors. Forecast growth rates have also been revised to take into account prevailing economic conditions, as well as the effect of energy efficiency measures across the sector. In addition, the JCS 2010 modelling also includes a new 430 MW CCGT which is planned to be built at the site of the existing Kilroot coal-fired power station. It is assumed that the Kilroot CCGT will commence commercial operation by 2015/16[3].

The Regulatory Authorities would like to thank all those who contributed to the development of this Joint Gas Capacity Statement, especially Bord Gáis Networks, Mutual Energy[4] and Gaslink. The Regulatory Authorities also acknowledges the assistance of many other parties in producing this Statement, including shippers, gas producers, power producers and large consumers, interested parties and industry observers.

We hope you will find the information it provides helpful.

---

[3] SONI, *Seven Year Generation Capacity Statement 2010-2016.*

[4] Mutual Energy Limited is the ultimate holding company for Premier Transmission Limited and Belfast Gas Transmission Limited, the owners and operators of the Scotland to Northern Ireland Pipeline and the Belfast Gas Transmission Pipeline respectively.

1 Introduction

1.1 Background

The JCS 2010 examines forecasts of customer demand for natural gas, the relevant sources of supply and the capacity of the gas transmission system on the island for the period 2009/10 to 2018/19. The JCS therefore provides up to date information to market participants, regulatory agencies and policy makers on the adequacy of the gas transmission network on the island to cater for demand growth, potential shortfalls in capacity and potential response measures.

The CER is obliged under Section 19 of the Gas (Interim) (Regulation) Act, 2002, as amended by the European Communities (Security of Natural Gas Supply) Regulations 2007 (S.I. No. 697 of 2007), to monitor and report on the security of supply of natural gas in Ireland. As part of this requirement, a gas capacity statement must be published each year and submitted to the European Commission. The CER also has safety functions set out in legislation[5] that govern the downstream and upstream gas industry in Ireland; these functions are not addressed in this document.

The Utility Regulator has previously published an annual Pressure Report which examines the future potential of the transmission network in Northern Ireland. The transmission system operators in Northern Ireland are obliged in their respective network codes and licences to jointly produce a pressure report based upon network analysis of relevant supply and demand scenarios. The publication of the JCS meets these requirements.

While the JCS fulfils the relevant statutory and licence requirements in both jurisdictions, the Regulatory Authorities Regulator are conscious of the importance of the JCS in developing a harmonised approach towards security of supply under the CAG project. The Regulatory Authorities also consider that the analysis of the transmission systems on an all-island basis will facilitate more efficient investment in gas infrastructure in the future.

1.2 Overview of Supply Demand and Analysis

The Regulatory Authorities and TSOs jointly developed future demand and supply forecasts based on a number of key assumptions and inputs.

For the demand forecast the Regulatory Authorities specified the inputs and assumptions relating to:

- economic growth forecasts supplied by the Economic and Social Research Institute (ESRI), which are used to forecast industrial and commercial customers' requirements for gas[6].
- projected new housing constructions also supplied by the ESRI, which are used to forecast residential demand for gas.
- sources for fuel and commodity prices as required inputs for a merit order electricity model run by BGN. Prevailing spot and forward prices for the UK National Balancing Point (NBP) have been used.[7]
- the gas-fired power stations assumed to be connected to the network in Ireland and Northern Ireland during the forecast period as provided by EirGrid.
- Irish forecast electricity demand in light of EirGrid's modelling results of their Median Base Scenario.[8]

---

[5] See the Energy (Miscellaneous Provisions) Act 2006 and the Petroleum (Exploration and Extraction) Safety Act 2010

[6] Economic and Social Research Institute, *Quarterly Economic Commentary, Winter 2009* (Dec 2009).

[7] It should be noted that fuel-price variations, which may create some additional uncertainty, have been taken into account as part of BGN's power generation forecasting model.

[8] EirGrid, *Generation Adequacy Report, 2010-2016* (Nov 2009).

- assessments of the likely impact on residential gas consumption of measures to improve energy efficiency from initiatives set out in the Irish Government's *National Energy Efficiency Action Plan 2009–20* (NEEAP).[9]

The supply and demand forecast is compiled from a number of data sources in addition to consultation with existing and potential market participants. The data sources include:

- A questionnaire from the Regulatory Authorities seeking information from industry participants related to current and projected levels of supply and demand;
- general economic and industry forecasts. In particular, the JCS used information provided from the ESRI about macro-economic factors and changes in the housing market; and
- the number of new load connection enquiries and the current year's operating experience as provided by BGN.
- meetings held with industry stakeholders in order to discuss plant operations and/or supply and demand forecasts.
- NI power and distribution demand forecasts provided as part of the postalised tariff arrangements.
- SONI, *Seven Year Generation Capacity Statement 2010-2016*

As regards Irish gas demand, key sources utilised in the preparation of Gaslink's *2010 Transmission Development Statement*[10] (e.g. GDP rate, energy efficiency, electricity demand) have also been used for this year's JCS.

In the preparation of the JCS, the Regulatory Authorities received information on the projected commencement dates of certain proposed developments.

- Gas from the Corrib field was taken as being available in Q4 2012.
- Gas from the salt cavity storage at Larne was taken as coming online in Q4, 2015.
- The proposed LNG importation facility at Shannon (Phase 1) was taken as coming into operation in Q4 2015.
- Supplies from the Kinsale Energy facility were examined both in terms of flows from the existing facility remaining available throughout the forecast period and in terms of additional storage capacity coming on-stream in 2014/15 when the Ballycotton facility is developed.

The proposed timings of these projects have been used to develop three supply scenarios. A single gas demand forecast was utilised for this year's JCS which includes a combined forecast for both Ireland and Northern Ireland. The impact of these three supply scenarios and of forecast demand on the transmission system was subsequently modelled using specialist network analysis software.

1.2.1 Supply Scenarios

The approach taken to address uncertainties associated with the timing of new indigenous gas sources or in the rates of demand growth was to model three supply scenarios and to conduct a full network analysis to assess the transmission network on the island over the subsequent ten years.

---

[9] *Maximising Ireland's Energy Efficiency - The National Energy Efficiency Action Plan 2009 - 2020* (May 2009).
[10] Gaslink, *Transmission Development Statement, For Period 2009/10 to 2018/19* (June 2010).

The three main supply scenarios discussed in the 2010 JCS are set out below:

Supply Source	1. Larne Supply Scenario	2. Shannon LNG Supply Scenario	3. Extended Kinsale Supply Scenario
Kinsale	Existing facility will continue to be available for all years.	Existing facility will continue to be available for all years.	Existing facility will continue to be available until October 2014 and extended storage facility is taken as coming online at this stage.
Corrib	October, 2012[11]	October, 2012	October, 2012,
Larne Storage	October, 2015	October, 2015	October, 2015
Shannon LNG	Unavailable	October, 2015	October, 2015

The aim of this scenario analysis is to examine whether the system is adequate to cope with a reasonable expectation of demand over the next ten years. The assumptions related to demand growth are present in Section 3 and specific results of the analysis are described in detail in Section 5.

The order of despatch for the various sources of supply varies for each of the scenarios and is based upon:

- indigenous gas production and indigenous stored gas being made available first according to the relevant scenario; and
- imported supplies via Moffat then being used to meet the projected balance of demand level as required.

The following despatch orders were agreed upon by the Regulatory Authorities:

Despatch Order	Larne Supply Scenario	Shannon LNG Supply Scenario	Extended Kinsale Supply Scenario
1	Corrib Production	Corrib Production	Corrib Production
2	Kinsale Production	Kinsale Production	Kinsale Production
3	Kinsale Storage	Kinsale Storage	Extended Kinsale Storage[1]
4	Larne Storage	Shannon LNG	Larne Storage
5	Moffat (GB Imports)	Larne Storage	Shannon LNG
6		Moffat (GB Imports)	Moffat (GB Imports)

[1]*Expanded Inch Storage Facility taken as operational from October 2014*

The Regulatory Authorities note that the despatch of the various sources of supply for the three scenarios has been ordered so as to focus on the impact of flows from particular infrastructure project(s) on the all-island system. It should be emphasised that these orders have been applied solely for demand/supply modelling and network analysis purposes. The actual orders in which supplies will be despatched will be determined by shipper nominations and the commercial arrangements between shippers and producers/suppliers at the various Entry Points.

The input assumptions for these scenarios were developed by a working group, which included the CER, the Utility Regulator, Gaslink, Mutual Energy Limited and BGN. The detailed demand modelling was then carried out by BGN

---

[11] A sensitivity of a 1 year delay to supplies from Corrib has also been included as part of the modelling for this scenario.

using the agreed input assumptions. In addition to the above modelling work and information provided by shippers, there were also extensive consultations with other relevant stakeholders, including the ESRI, EirGrid, power station developers and on the supply side, representatives of the offshore gas sector, the gas storage sector and the Liquefied Natural Gas (LNG) sector.

The Regulatory Authorities have sought not to take a view on the commercial viability of proposed projects. Instead where a developer has applied for the necessary consents and planning permissions, such projects have been included in the analysis. Projects at a very early stage of conception, such as the potential development of new gas fields that are currently being explored, have not been included.

1.2.2 Modelling

Hydraulic models of the combined Irish and NI transmission systems, which are utilised to analyse the three supply scenarios, simulate a 3 day 24 hour demand cycle of the all-island transmission system. Information related to measured daily pressures and profiles of consumption have been used to form this model, which was subsequently run for the ten years of the JCS and focused on insufficient capacity and on any resulting increases or decreases in operating pressures outside of acceptable parameters. The hydraulic models for 1-in-50 demand flows were calibrated by BGN in light of the record peak demand for the all-island's transmission system which occurred on the 7th of January 2010 (see Section 3.4). The network modelling assumes that the physical separation of the two jurisdictions' transmission networks is removed and that the necessary operational and commercial requirements are in place as part of the CAG project to facilitate the potential export of surplus gas from NI into Ireland and from Ireland into NI as required (i.e. a 'CAG open' configuration).

In relation to Irish demand, the individual market sectors have been combined to form annual demand projections, while as regards Northern Ireland, the demand projections are based upon a power and non power division. Corresponding peak-day demands are calculated for 1-in-50 winter peak-day conditions. Three sample demand type day scenarios were analysed for each supply scenario over the 10 year period from 2009/10 – 2018/19 inclusive as part of the modelling: a peak day 1-in-50 year, a peak day average year and a summer minimum day. These demand type days represent the best case scenario regarding maximum possible withdrawal rates on peak days and maximum possible injection rates on summer minimum days.

The Regulatory Authorities have jointly prepared the inputs to the demand forecasting model together with the TSOs in each jurisdiction and are satisfied that the most suitable and up to date information has been utilised to generate the appropriate gas demand forecasts. Having examined the modelling output of the various supply scenarios, discussions were also held between the Regulatory Authorities and the TSOs as part of the drafting of the JCS in order to assess possible 'pinch points' and any potential mitigation measures.

1.3 Report Structure

The remainder of the Statement is set out as follows:

Section 2 describes the transmission network in Ireland and Northern Ireland.

Section 3 provides information on historic and forecast gas demand for Ireland and Northern Ireland and in relation to the individual market sectors.

Section 4 discusses the current sources of gas supply on the island, the development of gas storage, the potential new sources, and the requirement for gas imports.

Section 5 describes the network simulation and supply-demand scenarios.

Section 6 sets out the conclusions and recommendations of the Regulatory Authorities arising from the analysis in previous sections.

Appendix 1 contains tables on peak-day demand forecasts in relation to the three supply scenarios.

Appendix 2 contains further information on the system modelling that has been undertaken.

Appendix 3 provides network schematics for each of the supply scenarios.

Appendix 4 sets out information on the Irish Government's energy efficiency savings targets and their assumed impact on Irish gas demand

Appendix 5 is a glossary of the terms used in the JCS

2 Transmission network

2.1 Overview of the gas transmission system in Ireland and Northern Ireland

Gas supply in Ireland is delivered via a network of c. 12,300km of pipelines. The integrated supply network is sub-divided into 2,368km of high pressure sub-sea and cross-country transmission pipe and in excess of 10,000km of lower pressure distribution pipe connecting customers to the system. The Bord Gáis Éireann (BGÉ) onshore high pressure transmission network consists of approximately 1,959km of pipe and the sub-sea interconnectors account for circa 409km of transmission pipeline.

Figure 2.1: The existing transmission network in Ireland, Northern Ireland and onshore Scotland

Source: BGN

Pipeline Key

Existing Pipelines *(BGÉ/BGÉ UK)*

S. N. I. P. *(PTL)* & BGTP (*BGTL*)

Pipelines Planned/Under Construction

The system conveys gas from two Entry Points at Inch in County Cork and Moffat in western Scotland to directly connected customers and distribution networks throughout Ireland, as well as to connected systems at exit points at Twynholm in Scotland (the Scotland to Northern Ireland Pipeline, 'SNIP'), and to the Isle of Man (IOM). The Moffat Entry Point, located onshore in Scotland, connects the Irish natural gas system to the National Grid system in GB, so that gas can be imported via the GB pipeline system to Ireland through two sub-sea interconnectors. The Inch Entry Point connects the Kinsale and Seven Heads gas fields and the Kinsale storage facility to the onshore network. The Irish system has three compressor stations: Beattock and Brighouse Bay in southwest Scotland, and Midleton in southern Ireland near Cork.

The Northern Ireland transmission network is made up of 438km of high pressure pipeline which connects the on-land system in Scotland with the two power stations in NI at Ballylumford and Coolkeeragh. Gas initially arrived in NI in 1996 with the completion of the SNIP and pipelines of Belfast Gas Transmission Limited (BGTL) which delivered gas to the Ballylumford power station and to the Phoenix distribution network in Greater Belfast. The North West (NWP) and South North (SNP) pipelines were completed in 2004 and 2006 respectively allowing the development of distribution networks in the ten towns along the pipelines which is owned and operated by firmus energy. The SNP also connects the NI system with the Irish system. Currently, all NI demand is supplied via the SNIP; however, arrangements are in place which facilitate the use of the SNP in the event of an emergency in either jurisdiction.

2.2 Scottish onshore system and Subsea system

The Moffat Entry Point connects the Irish natural gas system to that belonging to National Grid in GB, and allows for the importation of GB gas to Ireland and Northern Ireland via two sub-sea interconnectors and an onshore pipeline in Scotland. From the connection with the National Grid system at Moffat, the Scottish onshore system 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 85barg. A second compressor station at Brighouse Bay compresses the imported gas into the two sub-sea interconnectors 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.

From Brighouse Bay there are two pipelines connecting Ireland to the GB gas network. Interconnector 1 (IC1), which consists of 600mm pipe, has been in operation since 1993. Interconnector 2 (IC2), which was constructed using 750mm pipe, was completed in 2002 and has been operational since January 2003. There is a sub-sea spur connection to the Isle of Man from IC2 which first supplied gas to the island in May 2003. IC1 and IC2 are connected to the onshore Irish system north of Dublin at Loughshinny and Gormanston respectively.

2.3 Onshore Irish system

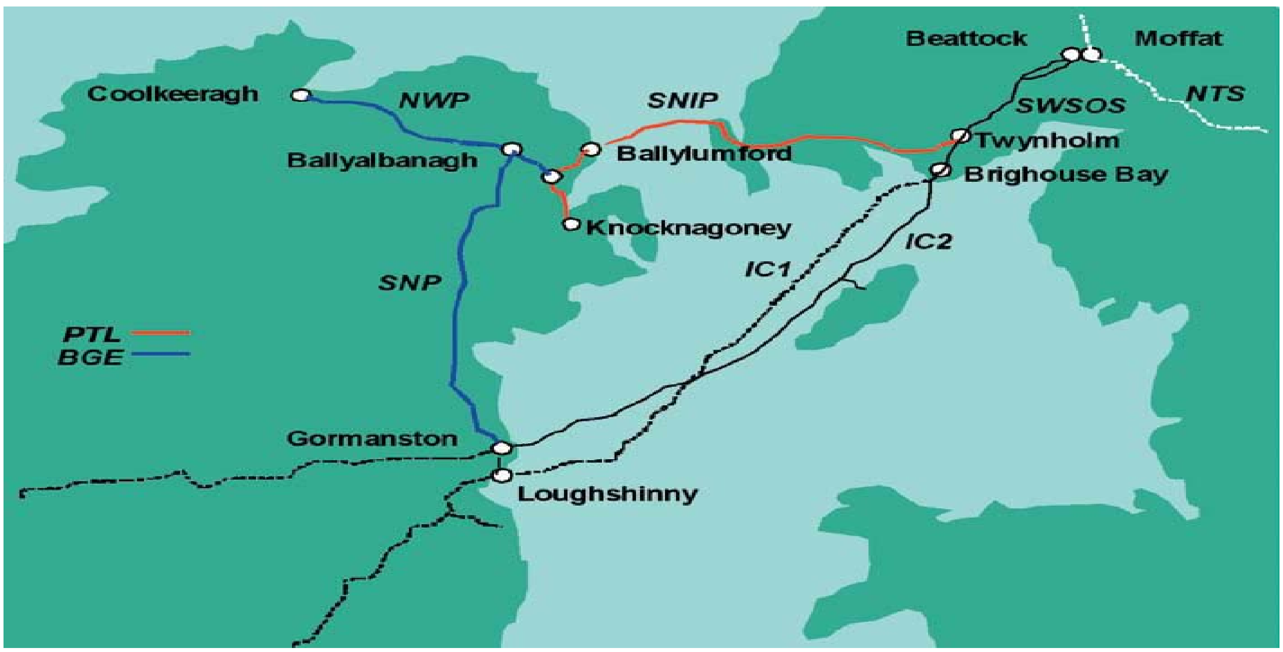
The onshore transmission system has been developed over a 25-year period and conveys gas from two Entry Points to customers supplied directly from the system and distribution networks throughout Ireland. The original part of the system was built in 1978 to supply the Cork area from the Kinsale Head gas field. The connecting subsea pipeline is owned and operated by PSE Kinsale Energy Ltd (formerly known as Marathon Oil Ireland Limited). The main Cork to Dublin trunk pipeline was built in 1982, with pipeline spurs constructed to intermediate locations. The onshore Irish system was expanded in 2002/3 by the completion of the Pipeline to the West which has a design pressure of 85barg. This created a ring main pipeline system which connects eastern, western and southern regions. The ring main pipeline contributes to continuity of supply by allowing customers to be supplied from an alternative direction, providing a more secure gas transportation system. It also provides some flexibility to cope with increased flows from the West coast of Ireland to demand centres in the East. The Inch entry terminal is connected directly to the Cork system and the only compressor station in the onshore Ireland system is at Midleton to boost the gas flow from Inch.

The Mayo to Galway pipeline links the Corrib gas field to the Irish market. The 149 km of 650mm diameter pipeline from Mayo to Galway connecting the onshore terminal in Bellanaboy Co. Mayo, into the Pipeline to the West at Craughwell in Co. Galway has been completed. The Mayo-Galway pipeline is fully operational and the majority of the Mayo towns from the New Towns Review (Phase I) are now receiving gas.

2.4 The Northern Ireland Gas Transmission System

The Scotland to Northern Ireland 600mm pipeline (SNIP) connects to the BGÉ 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, Island Magee. The SNIP is owned and operated by PTL.

Figure 2.2: The transmission network in Northern Ireland



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. From Carrickfergus 112km of 450mm pipeline extends to supply the power station at Coolkeeragh. This pipeline, the North-West Pipeline (NWP), is owned and operated by BGÉ (UK) Ltd. The firmus energy distribution network also connects several towns to the pipeline.

A 450mm pipeline connecting the Interconnector System to the North-West Pipeline was built in 2006. This pipeline, called the South-North Pipeline (SNP), is 166 km long and extends from the IC2 landfall at Gormanston, Co. Meath in Ireland to Ballyalbanagh on the North - West Pipeline, 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. The SNP was developed by BGÉ (UK) Ltd and is included in the NI postalised transmission system.

2.5 Planning the transmission system

In July 2008 Gaslink was formally established as the independent Transmission and Distribution System Operator, and BGÉ as the System Owner of the BGÉ transportation system under the European Communities (Internal Market in Natural Gas) (BGÉ) Regulations 2005, S.I. No. 760 of 2005. BGN carries out the day-to-day operations and maintenance of the system under the direction of Gaslink. The Operating Agreement sets out the relationship between System Operator and System Owner.

Under Condition 11 of Gaslink's Transmission System Operator Licence, Gaslink is required to produce a long term development plan for submission to the Commission each year. This Transmission Development Statement has been utilised by the Regulatory Authorities in the preparation of this year's JCS and also covers the period 2009/10 to 2018/19.[12]

Northern Ireland has three transmission system operators, namely PTL, BGTL and BGÉ (UK) Ltd. The transmission companies are required under their respective conveyance licences to prepare plans for the operation, development and maintenance of the transportation system. Additionally, the transmission companies are required under their respective network codes to jointly publish a Northern Ireland Capacity/Pressure Report each Gas Year.

2.6 Planned network components

2.6.1 Supply Sources

Three prospective projects still at an early stage of development, which may have a significant impact on the system, are the potential construction of gas storage in salt cavity layers at Larne, the proposed Liquefied Natural Gas (LNG) import terminal on the Shannon Estuary, and the proposed expansion of storage at the Ballycotton gas field by PSE Kinsale Ltd (see also Section 4.2).

Islandmagee Storage Limited (formerly Portland Gas NI Ltd) propose to develop a 500 mscm salt cavity storage facility under Larne Lough. Islandmagee Storage Limited have completed seismic testing and have successfully submitted a planning application to the relevant authorities in Northern Ireland. Islandmagee Storage plan gas operations to commence in 2015. The gas storage facility will be located adjacent to the SNIP and it is expected that no extensive pipeline development will be required to facilitate connection.[13]

BGÉ and Storengy (a GdFSuez company), as part of the North East Storage project, plan to develop a salt cavern underground gas storage facility to the southwest of Larne. A seismic survey and analysis of survey data was completed in Q1 2010 and a test drill will be carried out in early 2011 to complete the technical feasibility stage of the project. The North West Pipeline passes through the licensed area covered by the feasibility study.

The proposed LNG terminal, which is expected to be in operation by 2015, would be connected to the existing transmission system by c. 26km of pipeline. The construction of the terminal has received planning permission (subject to certain conditions), and the necessary consent for the pipeline to the transmission system was granted by the CER in December 2009.

---

[12] Gaslink, *Transmission Development Statement, For Period 2009/10 to 2018/19* (June 2010).

[13] It should be noted that data submitted by Islandmagee has been utilised for modelling purposes as it is the larger of the two storage projects at Larne and therefore constitutes the greater stress on the transmission systems in Ireland and Northern Ireland.

PSE Kinsale Energy are undertaking engineering studies with a view to expanding their storage facilities by converting the nearly depleted Ballycotton reservoir to gas storage and by redeveloping its existing onshore terminal at Inch. This will result in increased storage capacity and increased withdrawal rates, with a possible start date of Q4 2014 (see also Section 4.2.2). A new pipeline will be required from the offshore reservoirs to the Inch terminal. A subsea conceptual study has been completed. A feasibility study will be carried out this year and all permits, consents and licences will be progressed during 2010 and 2011.

2.6.2 Gas Flows

Currently gas flows primarily from the East Coast in Ireland where the interconnectors reach Ireland and from the South coast through the Inch Entry Point to the main centres of demand in Dublin and Cork, and also to new towns along the Pipeline to the West. When gas flows from Corrib, as well as the other proposed projects, and displaces gas coming through the interconnectors, gas will flow from the West of Ireland to centres of demand in the East and the South and may also increasingly flow both from the South and Northern Ireland depending on the timing of the Larne and Kinsale projects. In NI all demands are currently supplied from Moffat via the SNIP. The supply and demand scenarios in the 2010 JCS have tested the implications of these potential major changes in the operation of the network and serve to indicate whether or not reinforcements or other mitigation measures will be needed to accommodate these flows. The supply and demand cases and the scenarios should also identify whether supplies from the major supply projects in Ireland would physically flow to NI and similarly, whether storage gas from Larne would flow south to Ireland.

2.6.3 Network Development

In April 2010, the CER approved the connection to the natural gas network of Kells in Co. Meath, Tipperary Town in Co. Tipperary and Kinsale and Innishannon in Co. Cork as part of the new Towns Analysis Phase 3.[14] The decision to proceed with connecting towns followed a detailed economic analysis based upon the criteria outlined in the CER's Connection Policy of April 2006. The new connection policy was designed to encourage new customer uptake to the gas network in a manner which would be economic, efficient and transparent, while at the same time minimising adverse impacts on gas network charges.

The Department of Enterprise Trade and Investment (DETI) are also working with the Utility Regulator on a study to consider possible extension to the Northern Ireland gas transmission network. This report is due in 2010 and the way forward will be considered in light of the report's conclusions.

2.6.4 Biogas Production and Supply

A number of parties have expressed interest in developing biogas generation facilities in Ireland which could connect to the gas network. The CER and Gaslink have met with some of these interested parties. While no application for connection has yet been received, the CER has commenced discussions with Gaslink on the technical rules and regulatory issues related to the introduction and transportation of biogas into the distribution network. The CER is mindful of the latest EU obligations[15] on Member States to ensure gas from renewable energy sources will have non-discriminatory access to the gas system, and of the potential need to extend existing gas network infrastructure to facilitate the integration of biogas. The CER in conjunction with Gaslink will examine arrangements on the connection of gas from renewable energy sources to the gas network with a view to introducing new requirements on renewable gas Entry Points in the Connections Policy. As regards gas quality requirements, the CER will also take into account the work of the European Committee for Standardization on behalf of DG TREN on the injection of biomethane into the gas grid.

---

[14] Full details on the New Towns Analysis – Phase 3 Report can be found on the Gaslink website at www.gaslink.ie

[15] See in particular Article 1.2 of Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC and Article 16 of Directive 2009/28/EC on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

2.7 Overview of the gas distribution systems in Ireland and Northern Ireland

Gas is delivered by the high pressure transmission network to above ground installations (AGIs) designed to reduce the pressure to a suitable level for delivery to the BGÉ distribution system. The entire distribution system comprises PE (polyethylene) pipe operating in two nominal pressure tiers of 4 bar and 75 mbar delivering gas to more than 600,000 customers' premises in towns and cities. Planning and development of the distribution system incorporates demand forecasts based on customer information and connection requests for individual residences and new housing schemes in addition to industrial and commercial (I&C) loads.

The distribution system design in Ireland is based on 1-in-50 winter criteria applied to a standard annual load by classification of domestic residence or to customer specific information for industrial and commercial loads.

The NI distribution system is comprised of two networks – the Phoenix Natural Gas network in the Greater Belfast and Larne area which has around 130,000 customers and the firmus energy network in the ten towns along the SNP and NWP which have about 6,000 customers. Both of the networks are entirely constructed using PE (polyethylene) pipe. The Phoenix distribution network operates in three nominal pressure tiers of 7bar, 4bar and 75mbar. The firmus distribution network operates in two nominal pressure tiers of 4bar and 75mbar. Planning and development of the distribution network is the responsibility of the respective Distribution System Operators with development and capacity obligations set out in the respective licences.

The NI distribution system design is based on 1-in-20 winter criteria applied to a standard annual load by classification of domestic residence or to customer specific information for industrial and commercial loads.

2.8 Exploration and production activity

There is a significant amount of ongoing and planned exploration and production activity in the seas around the two jurisdictions. This includes drilling by Island Oil and Gas in the Celtic Sea and planned drilling by Shell E&P Ireland Limited in the Atlantic Ocean. The nature of drilling of this type is that the prospects for finding commercially viable reserves of gas are very uncertain.

3 Gas Demand

3.1 Introduction

This chapter provides a review of both the historical and forecast annual gas demands for Ireland and Northern Ireland respectively. The review of the historical demand provides a breakdown of the overall demand by sector. Additionally, a review of the record peak gas demand experienced over the winter period 2009 – 2010 is presented. Similarly, the forecast gas demands for both Ireland and Northern Ireland are broken-down by sector for the 10 year period modelled in the JCS.

3.2 Historic Irish Annual Gas Demand

3.2.1 Overview

Irish annual gas demand contracted by -3.1% in 2008/09 with the largest reduction of -4.6% occurring in the Power Generation sector. It is forecast to have decreased to 2006/7 levels by 2013/14 when demand is forecast to pick up. Irish peak day gas demand grew by 5.5% in 2008/09 due to favourable fuel prices and colder weather. Peak day is not expected to grow considerably in the medium term but is projected to have increased significantly by 2018/19.

The contraction in annual gas demand may be attributed to the economic recession, which resulted in reduced electricity demand, and thus lower gas demand from the power generation sector. I/C gas demand also contracted -0.9%; however this was partially offset by residential demand growth +0.9% as a consequence of the colder weather in particular in January 2010.

Table 3.1 summarises Irish gas demand for the period 2002/03 to 2008/09. Despite demand contraction in 2008/09, Irish annual gas demand has grown by 3.0% p.a. over the seven year period. Most of this growth has come from the power generation sector and to a lesser extent from the residential sector:

- Power sector gas demand grew by 3.8% p.a. due to the growth in electricity demand and the construction of new gas-fired stations, e.g. the Aughinish Combined Heat & Power (CHP) plus the Tynagh and Huntstown II Combined Cycle Gas Turbine (CCGT) stations;

- Residential gas demand grew by 3.7% p.a., however, this was less than the corresponding growth in customer numbers, due to a combination of increasing energy efficiency, higher gas prices, smaller dwelling sizes and greater vacancy rates; *and*

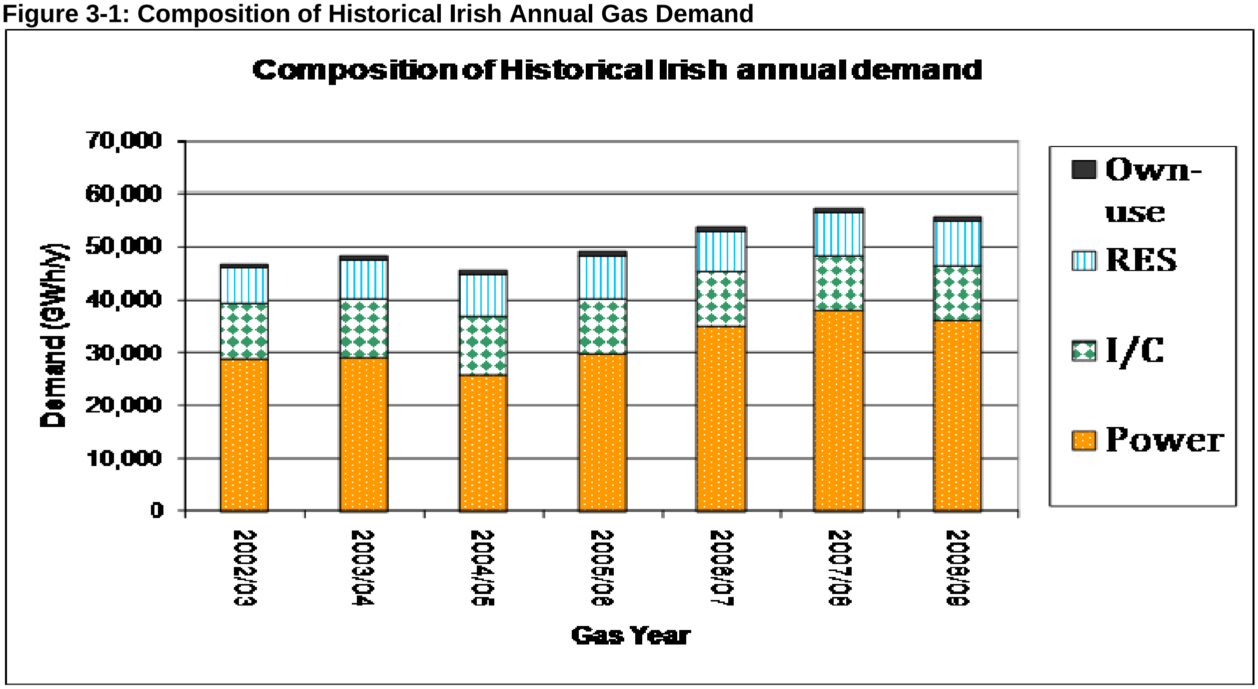
- The growth in I/C demand has been essentially flat over the period, with growth during the previous period of economic prosperity being offset by a combination of the current economic recession and a number of large I/C site closures, e.g. Irish Sugar.

Table 3-1: Historic Irish annual gas demand[1] expressed in volume (mscm/y) and energy (GWh/y)

	Unit	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
ENERGY								
Power[2]	GWh/y	28,775	28,845	25,630	29,775	34,688	37,758	36,007
I/C	GWh/y	10,538	11,154	11,127	10,352	10,486	10,507	10,415
RES	GWh/y	6,701	7,434	7,757	8,149	7,716	8,239	8,312
Own-use[3]	GWh/y	617	735	878	815	779	814	823
Total Irish	GWh/y	46,630	48,168	45,392	49,091	53,669	57,318	55,557
VOLUME								
Power	mscm/y	2,613	2,629	2,327	2,698	3,140	3,442	3,265
I/C	mscm/y	957	1,017	1,010	938	949	958	945
RES	mscm/y	608	678	704	738	699	751	754
Own-use	mscm/y	56	67	80	74	71	74	75
Total Irish	mscm/y	4,234	4,391	4,122	4,448	4,858	5,225	5,038
GCV								
Moffat		40.00	40.00	40.00	40.00	40.00	39.69	39.84
Inch		37.50	37.50	37.50	37.50	37.50	37.79	37.92

[1]Gas demand is summarised by "Gas Year", i.e. the period from 1st October to the following 30th September
[2]Power demand includes Aughinish CHP gas demand
[3]Own-use includes the gas consumed by the system, including fuel-gas for compressor stations & heaters

Figure 3-1: Composition of Historical Irish Annual Gas Demand



Natural gas continues to be a very important fuel for power generation and is currently the fuel of choice for new thermal power station projects. The power sector share of total gas demand has grown from 61.7% in 2002/03 to 64.8% in 2008/09 (see Figure 3-1).

The power sector's increasing share of total gas demand has primarily come at the expense of the I/C sector, whose share reduced from 22.6% in 2002/03 to 18.7% in 2008/09 (see Figure 3-1).

The residential sector share of total gas demand has remained relatively constant over the period at c. 15%.

3.2.2 Power Generation Gas Demand

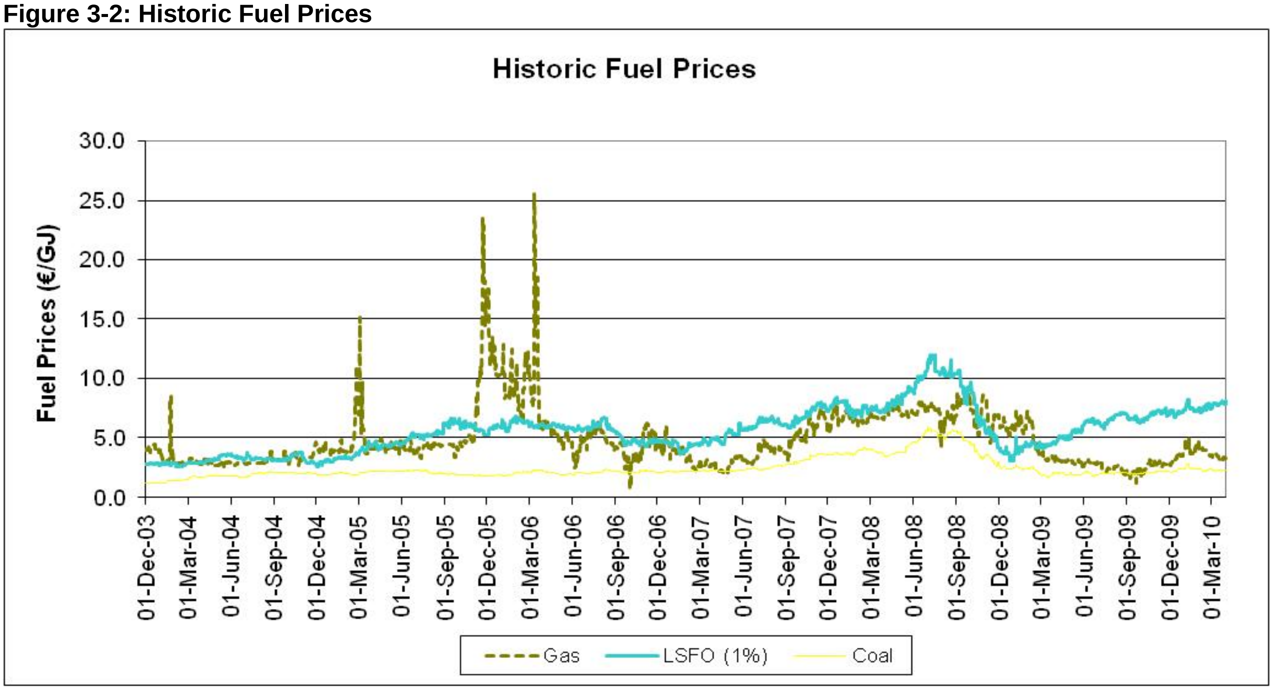
Despite power generation gas demand contracting by -4.6% in 2008/09, overall growth of 25.1% has been realised since 2002/03.

Gas demand from the power sector has been driven primarily by growth in the Irish demand for electricity (the Total Electricity Requirement has grown by 12.2% since 2002[16]) and the construction of new gas-fired stations. Gas-fired generation accounted for 40.5% of electricity production in 2002, increasing to 56.1% in 2009.

The contraction in gas demand during 2004/05 can be explained by the sector fuel-switching from gas to Low Sulphur Fuel Oil (LSFO) in response to high gas prices (see Figure 3-2). Demand recovered in 2005/06, despite record high gas prices, due to the construction of new gas fired stations at Aughinish and Tynagh.

A combination of lower gas prices and electricity demand growth resulted in gas demand growth for subsequent years until 2008/09, when gas demand contracted due to the fall-off in electricity demand by c. 4.7% (based on EirGrid's provisional 2009 Total Electricity Requirement).

Figure 3-2: Historic Fuel Prices



3.2.3 I/C Gas Demand

There were approximately 22,600 I/C customers connected to the Irish gas transmission and distribution systems at the end of the 2008/09 Gas Year. A breakdown of the total annual I/C gas demand by category is given in Table 3-2, in both energy and volume terms:

- TX DM I/C: The larger transmission connected Daily Metered (DM) I/C sites, which accounted for 33.8% of total I/C demand in 2008/09, and includes the larger factories and co-ops etc;
- DX DM I/C: The larger distribution connected DM I/C sites, which accounted for 27.2% of total I/C demand in 2008/09, and includes the smaller factories, hospitals, universities, prisons etc; *and*
- DX NDM I/C: The smaller distribution connected Non-Daily Metered (NDM) I/C sites, which accounted for 39.0% of total I/C demand in 2008/09, and includes shops, offices, schools and restaurants etc.

[16] This is based on the latest information available from EirGrid.

Table 3-2: Breakdown of the Historical Irish Annual I/C Gas Demand[1]

	Unit	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
ENERGY								
TX DM I/C	GWh/y	4,461	4,854	4,953	4,004	4,029	3,792	3,518
DX DM I/C[2]	GWh/y	107	1,682	2,468	2,597	2,827	2,830	2,835
DXNDM I/C	GWh/y	5,970	4,618	3,706	3,752	3,629	3,886	4,063
Total I/C	GWh/y	10,538	11,154	11,127	10,352	10,486	10,507	10,415
VOLUME								
TX DM I/C	mscm/y	405.0	442.4	449.8	362.8	364.7	345.6	319.0
DX DM I/C	mscm/y	9.7	153.3	224.1	235.3	255.9	257.9	257.1
DX NDM I/C	mscm/y	542.1	420.9	336.5	340.0	328.5	354.3	368.4
Total I/C	mscm/y	956.8	1,016.6	1,010.4	938.1	949.1	957.8	944.5

[1]*Actual annual gas demand, no weather correction applied*
[2]*Many of the larger distribution connected I/C sites were migrated from the DX NDM I/C sector to the DX DM I/C sector during 2002/03 and 2003/04 as part of the Market Opening process and, hence the movement in numbers*
[3]*Volumes have been derived from the energy values by assuming a weighted GCV. Details of the Inch and Moffat GCVs are detailed in table 3.1 for each of the respective years.*

It can be seen that the overall I/C contracted slightly over the period, with a 21.1% reduction in the transmission connected I/C demand being largely offset by a 13.5% increase in the distribution connected I/C demand.

The reduction in the transmission connected demand during the period is attributed to the structural changes in the Irish economy, as it moved away from manufacturing to other industries. Many of the commodity manufacturing based industries ceased during this period, e.g. IFI, Irish Steel, Irish Sugar and ADM.

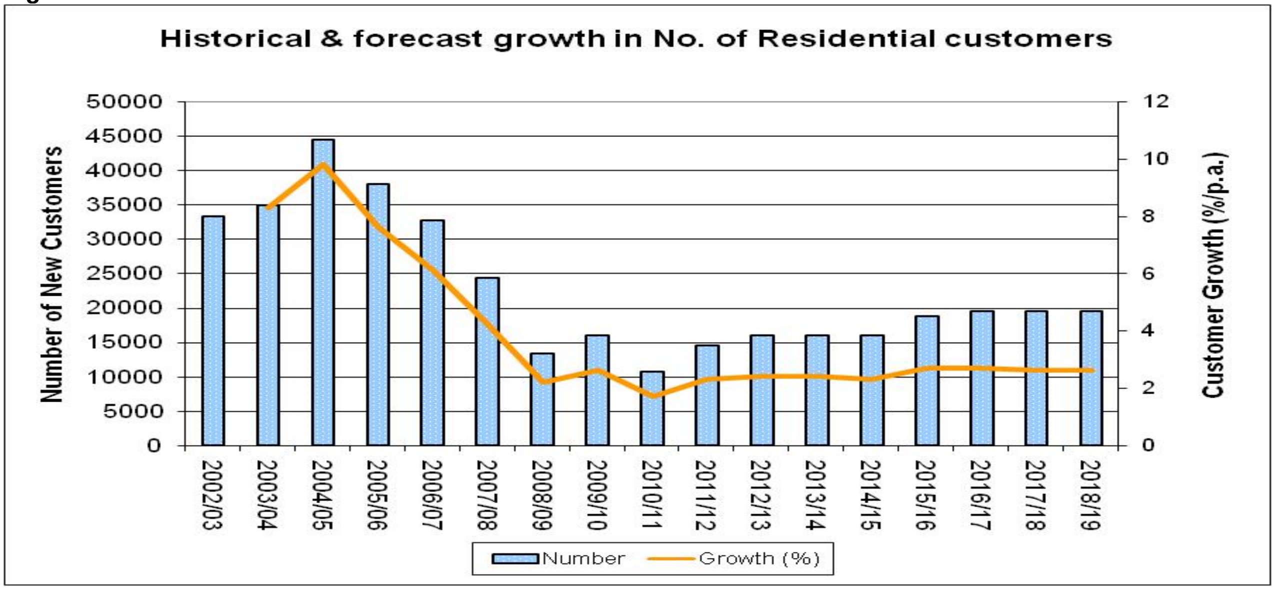
3.2.4 Residential Gas Demand

There were approximately 609,034 residential customers connected to the Irish distribution system at the end of the 2008/09 Gas Year. The total number of residential gas customers has increased substantially by 44.5% over the period (see Fig. 3-3), growing from 421,453 at the end of 2002/03 to 609,034 at the end of 2008/09.

The annual residential gas demand on the other hand only increased by 24.0% over the same period, growing from 6,700.6 GWh/y in 2002/03 to 8311.8 GWh/y in 2008/09. The discrepancy between the growth in customer numbers and residential gas demand has been attributed to a number of factors, including:

- Increasing energy efficiency;
- Construction of smaller dwellings (e.g. apartments etc);
- Response to higher gas prices over the period; *and*
- Reports of a substantial number of vacant residential properties.

Figure 3-3: Growth in New Residential Customer Numbers



3.3 Historic NI Annual Gas Demand

3.3.1 Overview

The historic NI gas demand is summarised by sector in Table 3-3 and shown graphically in Fig. 3-4. The distribution category includes the gas demand of Phoenix Natural Gas and firmus energy, while the power sector includes the Ballylumford and Coolkeeragh power stations. The total NI annual demand has grown by 31.7% over the period 2002/03 – 2008/09 (or 4.5% p.a.).

Figure 3-4: Historic NI Annual Gas Demand

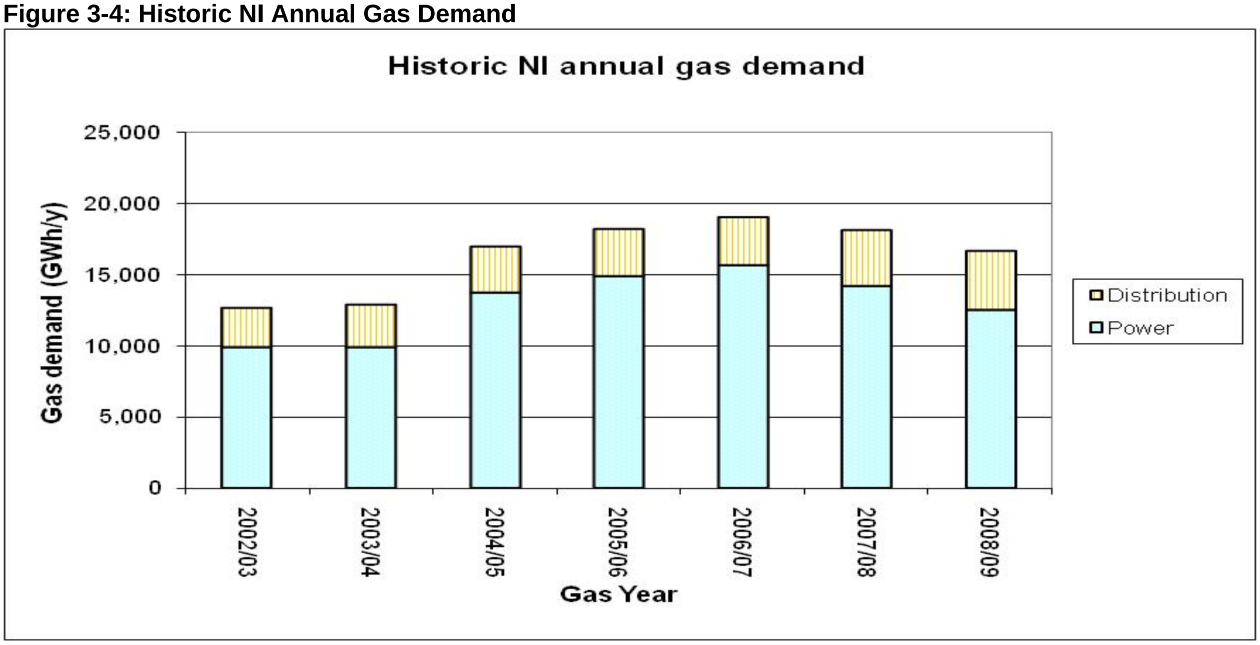


Table 3-3: Historic NI Annual Demand Summarised by Sector

	Unit	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
ENERGY								
Power	GWh/y	9,880.9	9,902.8	13,769.6	14,921.6	15,695.6	14,248.8	12,488.9
Distribution	GWh/y	2,766.2	3,040.4	3,208.8	3,326.9	3,393.8	3,923.3	4,161.3
Total NI	GWh/y	12,647.2	12,943.2	16,978.4	18,248.5	19,089.4	18,172.1	16,650.2
VOLUME								
Power	mscm/y[1]	889.3	891.2	1,239.3	1,342.9	1,412.6	1,292.4	1,128.4
Distribution	mscm/y	249.0	273.6	288.8	299.4	305.4	355.9	376.0
Total NI	mscm/y	1,138.3	1,164.8	1,528.1	1,642.3	1,718.0	1,648.3	1,504.4

[1]Volumes have been derived from the energy values by assuming a Moffat GCV of 40 MJ/m^3 for 2002/03 to 2006/07, 39.7 MJ/m^3 for 2007/08 and 39.8 MJ/m^3 for 2008/09

3.3.2 Power Generation Gas Demand

From 2002/03 – 2008/09 the power sector grew by 3.7% p.a. with the combined effect of the commissioning of one new CCGT at Coolkeeragh and the displacement of a 600MW open cycle generation turbine with a 600MW CCGT at Ballylumford. However, from 2006/07 to 2008/09 the NI Power demand has contracted by 10.2% p.a. as a result of the economic recession and lower despatch order at the Ballylumford power station.

3.3.3 Distribution Gas Demand

The distribution sector grew by 7.2% p.a. with the expansion of the Phoenix distribution system in the Greater Belfast area and the firmus distribution systems along the North West Pipeline (NWP). The historic distribution demand for the Phoenix Distribution system and firmus distribution system is summarised below;

- Phoenix Distribution - The distributed gas volume in the Phoenix Natural Gas Ltd (PNG) licensed area of greater Belfast has grown by 25%, averaging 3.9% p.a. over the period 2002/03 to 2008/09. Accounting for temperature correction (5 year average using degree day methodology), growth has been 22%, or an average of 3.4% p.a. Growth in the PNG licensed area has been driven primarily by the organic growth in consumers of natural gas, the majority of whom are domestic customers.
- Firmus Distribution – firmus energy started to supply natural gas in the firmus distribution Licensed Area[17], in 2005, increasing their sales significantly in the following years, mainly in the I&C sector.

3.4 Record Peak Gas Demand in January 2010

The all time record peak demand for the island's transmission system as whole (including onshore Scotland, onshore Ireland and Northern Ireland), as well as that for the onshore Irish system, occurred on the 7th of January 2010, as a result of the exceptionally cold weather conditions[18] experienced during the first week in January. Both gas supplies and the island's transmission and distribution systems were sufficient in meeting the peak demand requirement on the 7th of January.

The system peak of 332.9 GWh/d (30.2 mscm/d) that occurred on the 7th of January is the sum of the Ireland, Northern Ireland (NI) and Isle of Man (IOM) demands, which were 252.9 GWh/d (23.0 mscm/d), 75.2 GWh/d (6.8 mscm/d) and 4.8 GWh/d (0.4 mscm/d) respectively.

[17] Antrim, Armagh, Ballymena, Ballymoney, Banbridge, Coleraine, Craigavon, L'Derry, Limavady and Newry.
[18] A 20.7 Degree Day temperature was recorded at Dublin Airport which has an average temperature of -5.2°C.

3.4.1 Record Peak Demand in Ireland

The system peak in Ireland of 252.9 GWh/d (23.0 mscm/d) coincided with a 20.7 Degree Day (DD) at Dublin Airport, slightly short of the 1-in-50 DD of 21.0.

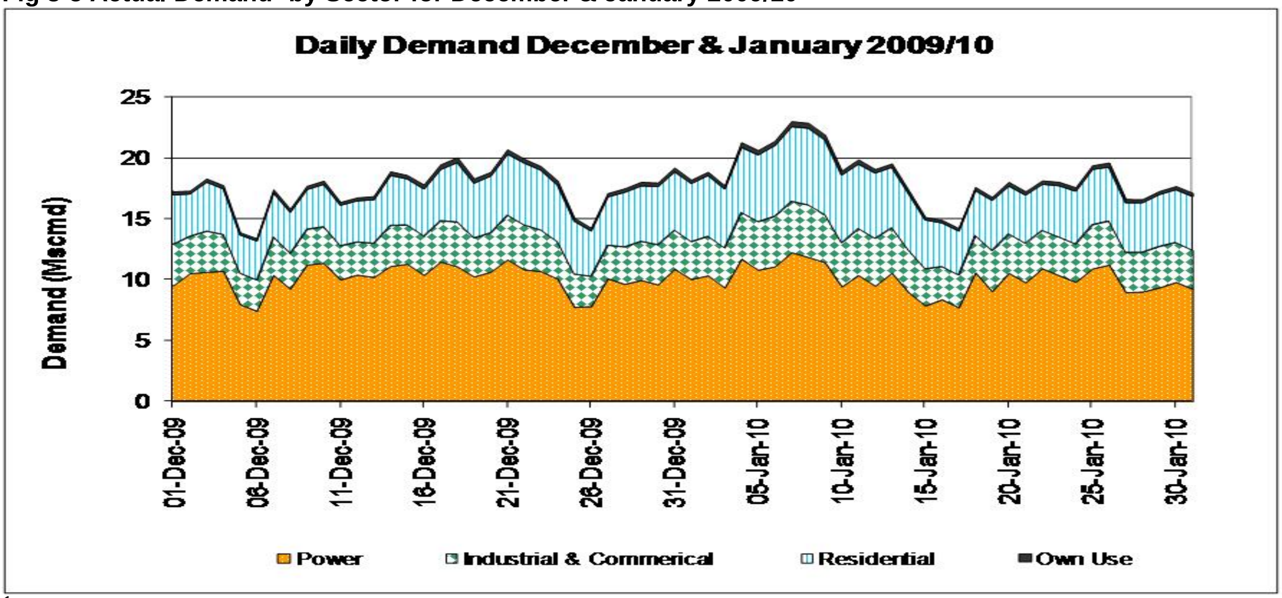
The electricity system in Ireland also recorded its highest ever system demand peak of 4,950 MW on the 7th of January. This high demand coincided with extremely low levels of wind generation (83 MW at the time of the system peak), and resulted in record power generation gas demand of 134.8 GWh/d (12.3 mscm/d).

Non Daily Metered (NDM) demand of 92.4 GWh/d (8.4 mscm/d) was reached on the 7th of January. However, this NDM demand record was exceeded and recorded its highest peak to date on the following day, 8th of January, at 95.2 GWh/d (8.7 mscm/d), despite slightly milder weather conditions. This may be explained by the lagged effect of cold weather, where heating systems are not immediately adjusted to coincide with improved weather conditions.

Daily Metered (DM) Industrial & Commercial (I/C) demand, of 20.8 GWh/d (1.9 mscm/d), was not as high as peak days from previous years, due to the current economic recession.

Gas flows through the subsea Inter-connector (IC) System on the 7th of January, of 218.1 GWh/d (19.7 mscm/d), exceeded the IC1 design capacity of 188.2 GWh/d (17.0 mscm/d). However, taking into account the design capacity of IC2 (22.33mscm/d), the IC system successfully provided for these peak flows into the Irish system.

Fig 3-5 Actual Demand[1] by Sector for December & January 2009/10



[1]Daily Residential demand is calculated by applying the Residential share of NDM monthly demand by the daily NDM demand for each of the respective months.

3.4.2 Recording Peak Demand in Northern Ireland

The NI gas consumption for power demand on the 7th January 2010 totalled 48.719GWh/d; this however was not the peak NI gas consumption for power demand. This occurred on the 6th October 2005 at peak of 63.153GWh/d.

Regarding the NI distribution companies, Phoenix Natural Gas recorded its highest ever daily system demand on Friday 8th January 2010. Demand on this day was 21.8 GWh and coincided with a 20.4 degree day at Aldergrove Airport. DM consumer demand accounted for 4.5 GWh (20.6%), whilst NDM consumers accounted for 17.3 GWh (79.4%).

Firmus energy recorded its highest peak day to date on 7th January of 4.719 GWh/d. This consisted of I&C demand circa, 4.389 GWh/d, and residential circa 0.330 GWh/d.

3.4.3 Gas Market Response in Ireland, NI and GB

As regards security of supply requirements in the Irish market, domestic (Non Daily Metered) shippers in Ireland are required by means of the Code of Operations to reserve capacity to meet the 1 in 50 peak day demand (the highest demand that can be expected on the coldest day that occurs only once every 50 years). During the cold weather period NDM shippers were forced to call back this spare '1 in 50' exit capacity that had been transferred to other shippers. These other shippers therefore had to reserve short-term daily capacity to replace capacity transfers. Ultimately, the market arrangements worked successfully during this period. It should also be noted that overall, there was very close agreement between the outturn and BGN's forecast 1 in 50 peak-day demand (23.0 versus 22.4 mscm/d).

NI shippers are also required to book capacity to meet a 1-in-20 peak day demand as per licence conditions. There was sufficient capacity available on the system for the distribution markets in NI to meet the peak day demand over the winter period.

In terms of supplies from GB via the Moffat Entry Point, no difficulties were experienced as regards the sale and transfer of these supplies and as regards the operation of the Irish market. There was sufficient gas available at all times from GB to satisfy demand on the island. National Grid in GB was forced to issue four Gas Balancing Alerts in January due to the high demand and unplanned losses in Norwegian gas supplies. The Gas Balancing Alerts did not indicate an emergency situation. The Alerts rather served as a notification to GB shippers both to bring additional gas supplies on to the GB transmission system and to large energy users to reduce gas demand where possible. The GB gas market responded to these Alerts accordingly and the availability of gas supplies in GB was never brought into question. This was achieved in part by some generators switching from gas-fired to coal-fired power stations, while other producers increased flows into Britain.[19]

3.5 The Irish Gas Demand Forecast

3.5.1 Introduction

A single gas demand forecast was developed for the 2010 JCS, which includes a combined forecast for both Ireland and Northern Ireland. The methodologies used to develop the relevant components of the demand forecast in this year's JCS are consistent with last year's JCS, and may be briefly summarised as follows:

- The gas demands for the different sectors of the Irish economy were modelled separately using a combination of historic gas demand, information provided by shippers and other stakeholders, future expectations of economic growth, new housing construction, electricity demand and fuel-prices*.*
- The future gas demand for NI was derived from information primarily provided by shippers as part of the "Postalised" tariff arrangements As part of the JCS, the postalised demand figures were reviewed and updated to reflect the distribution companies' expected connection profiles for the period modelled. Similarly, demand forecasts for the power generation sector were reviewed and updated to reflect their latest modelling assumptions.

3.5.2 Irish gas demand forecast methodology

Separate gas demand forecasts have been prepared for the Power Generation, I/C and residential sectors, since each sector has quite different gas demand drivers. These individual forecasts have then been aggregated together to give the overall gas demand forecast for Ireland. The methodology used to generate the forecast for each sector may be briefly summarised as follows:

- The gas demand for the power sector was generated using a simple "merit-order" stack-model to determine how power stations would be dispatched to meet the forecast hourly electricity demand, and to calculate the daily gas demand of the despatched stations;
- The historic weather adjusted I/C demand is assumed to grow (or contract) at 80% of 'Real' Gross Domestic Product (GDP)[20], i.e. it is assumed to grow or contract in line with economic growth or recession, after adjustment for energy efficiency; *and*

---

[19] For more information see the National Grid, *Winter Consultation Report 2010/11*.
[20] See Section 3.5.4 below.

- The historic weather adjusted residential gas demand is assumed to grow in line with increasing customer numbers, after including adjustments for energy efficiency.

The underlying assumptions for the above modelling work in terms of future electricity demand, the level of new housing construction, GDP growth and energy efficiency were agreed by the Regulatory Authorities and TSOs in Ireland and NI. Many of these inputs were sourced from external sources such as the ESRI and EirGrid.

The detailed demand modelling was then carried out by BGN using the agreed inputs. A more detailed description of both the modelling methodology for each sector, and the associated inputs are given in the following sections.

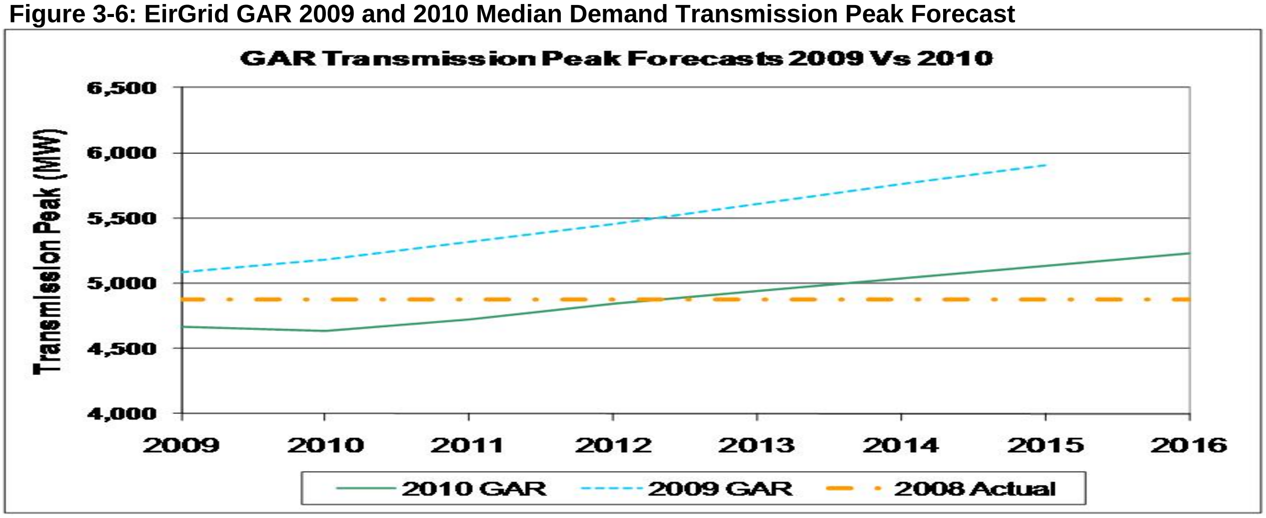
Please note that volumes presented as part of the forecast annual demand data have been derived from the energy values by assuming a weighted GCV based on the Larne supply scenario unless otherwise stated.

3.5.3 Power sector demand

The future gas demand from the power generation sector is determined by a number of factors, including the overall demand for electricity, the level of renewable generation, the level of electrical interconnection with Great Britain (GB), the construction of new gas-fired power stations and the order in which power stations are despatched to meet demand (i.e. the generation merit-order).

The latest EirGrid *Generation Adequacy Statement, 2010 – 2016* (GAR) illustrates significant downward revision on the previous year's GAR forecast as a result of the impact of the current economic recession (see Figure 3-6) EirGrid anticipate that electricity demand will not return to 2008 levels until 2013.

Figure 3-6: EirGrid GAR 2009 and 2010 Median Demand Transmission Peak Forecast



The latest EirGrid GAR (2010 – 2016) median forecast was considered to be most appropriate for modelling purposes. The historic and forecast annual Total Electricity Requirement (TER)[21] is shown in Figure 3-7 together with the corresponding growth rates.

The GAR Median Case scenario assumes electricity demand will initially contract but slowly recover to 2008 levels by 2013, with continued growth at c. 2% per annum post 2013. The annual Irish TER grew at an average rate of 2.1% p.a. between 2001 and 2009, despite the TER contracting by 4.7% in 2009 (based on EirGrid's provisional 2009 TER).

The level of future renewable generation construction has also been taken from the latest GAR, based on the scenario that assumes 40% of electricity will be produced from renewable sources by 2020. This assumes that the installed wind-powered generation in Ireland will increase from 1,396 MW in 2009 to c. 4,300 MW by the end of 2019.

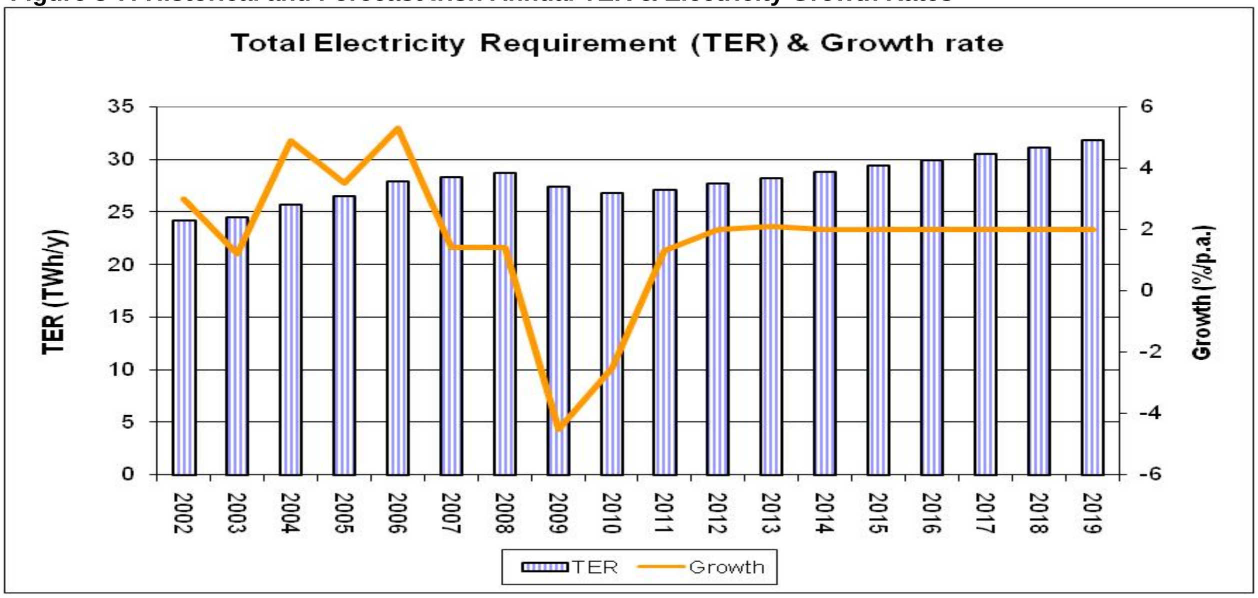
---

[21] EirGrid's GAR converts total electricity sales at the customer level for a 52-week year to TER by bringing the figure to export level (applying loss factor of 8.3%) and adding an estimate of self-consumption.

Wind is obviously an intermittent resource, and the average annual Load Factor (LF) of wind-powered generation is c. 31.5%. This means that there will continue to be a substantial requirement for conventional thermal generation to back-up the wind generation, particularly on calm days.

Since gas-fired CCGT and OCGT generation currently appears to be the technology of choice for new power station projects, most of the new generation capacity required to back-up the wind-powered generation is likely to be gas-fired.

Figure 3-7: Historical and Forecast Irish Annual TER & Electricity Growth Rates



It is assumed that the 500 MW East/West (E/W) electricity inter-connector with GB will be fully operational by 2012/13. The assumptions in relation to both the construction of new power stations and the retirement of existing power stations are tabulated in Table 3-4, and may be briefly summarised as follows:

- The 430 MW Aghada CCGT has recently commenced commercial operation, the 445 MW Whitegate CCGT is on target to commence full commercial operation by July 2010;
- An OCGT in Edenderry, which is anticipated to use gas-oil is due to commence operation in the final quarter of 2010;
- It is assumed that ENDESA will construct both a 420 MW CCGT at Great Island and a 300 MW Open Cycle Gas Turbine (OCGT) at Tarbert in 2013 (converting to a 430 MW CCGT in 2016/17), and also retire the existing on-site oil-fired stations once the new gas-fired stations are fully commissioned;
- It is assumed a 445 MW CCGT in Co. Louth and the 430 MW Kilroot CCGT in NI will be operational by 2013/14 and 2015/16 respectively; *and*
- The forecast also includes provision for two new 100 MW OCGTs to provide the necessary flexibility to back-up all of the additional renewable generation that is forecast to come on stream.
- The Poolbeg steam station was retired in March of this year and Marina CCGT converted to an OCGT in February 2010.

In aggregate the JCS 2010 forecast assumes that 2,820 MW of new gas-fired CCGT and OCGT capacity and the 111 MW Edenderry OCGT (Gas-oil) will be commissioned on the island over the forecast period. This additional generation will be required to meet the future growth in electricity demand, and to replace 1,266 MW of dual and oil-fired capacity (which is expected to retire over the period).

Table 3-4: Summary Assumptions for Build of New Power Stations & Retirement of Old Stations

Name	Type	Location	Export Capacity (MW)	Start/Close Date
NEW STATIONS				
Aghada	CCGT	Cork	430	May-10
Whitegate	CCGT	Cork	445	July-10
Edenderry[2]	OCGT	Offaly	111	Sep-10
Tarbert	OCGT	Kerry	300 (430)[1]	Oct-13
Great Island	CCGT	Wexford	440	Mar-13
Other CCGT	CCGT	Louth	445	Oct-13
Other OCGT	OCGT	Various	2 x 100	Oct-12+
Kilroot	CCGT	Belfast	430	Oct 15
Total			2,931	
RETIREMENTS				
Poolbeg	Dual-fuel	Dublin	461	Oct-09
Great Island	Oil	Wexford	216	Oct-12
Tarbert	Oil	Kerry	589	Oct-12
Total			1,266	

[1]*Assumed to be converted into 430MW CCGT by 2016/17*
[2]*OCGT is expected to use gas-oil*

A simple merit-order stack approach was used to model the order in which power stations are likely to be despatched to meet electricity demand in Ireland. This approach assumes that power stations will be despatched in order of increasing Short Run Marginal Cost (SRMC), until the hourly electricity demand is satisfied.

The process in which power stations are stacked in order of increasing SRMC is illustrated in Figure 3-8, which shows the generation "Price/Quantity" curve, i.e. the total quantity of generation available at a given shadow price (i.e. the SRMC excluding start-up costs). The JCS forecast assumes the following peak-day merit-order, based on the current forward fuel price curves for the winter period:

- Renewables, hydro and peat will be despatched first on a must-run basis;
- Followed by coal-fired generation;
- Followed by new gas-fired CCGTs;
- Followed by older gas-fired CCGTs;
- Followed by oil-fired, i.e. Low Sulphur Fuel Oil (LSFO) power stations; *and*
- Followed by gas fired OCGTs;

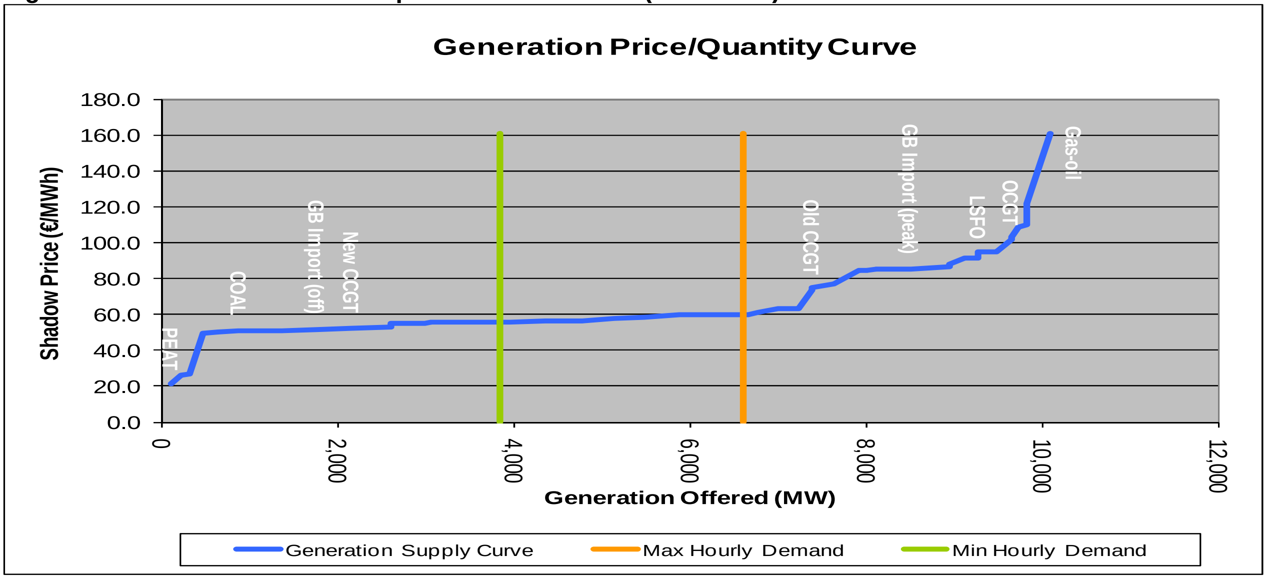
The generation merit-order is obviously very sensitive to the forward fuel-price assumptions, and on the basis of the current outlook there is little difference between the SRMC of coal-fired and modern gas-fired CCGT generation (with coal-fired generation predicted to be marginally cheaper during the winter).

Electricity imports from GB were also included in the merit-order, using the British Electricity Trading Transmission Arrangements (BETTA) forward prices for the off-peak and peak-periods as a proxy for their SRMC cost. Again the level of future electricity imports is very sensitive to future fuel-prices.

Fig. 3-9 shows the order in which power stations are assumed to be despatched over the 24-hour period on the peak-day, summarised by fuel-type. This shows that gas demand from the power sector is already effectively "saturated", i.e. there is already more than sufficient existing peat, coal and gas-fired power stations to meet the baseload electricity demand.

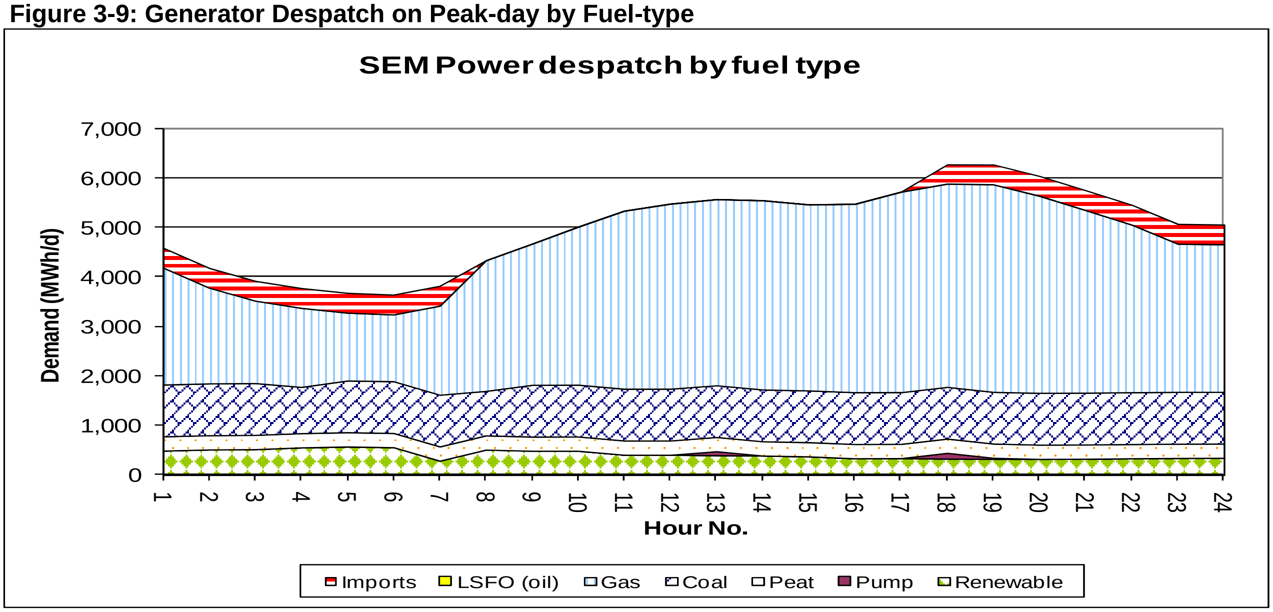
It can also be seen from Fig. 3-9, that some existing gas-fired stations are already turned-down at night due to insufficient electricity demand. The additional gas demand from new gas-fired power stations is likely to be offset, therefore, by reduced gas demand from the older and less efficient gas-fired stations (which will be forced further up the generation merit-order and despatched less frequently).

Figure 3-8: All Island Generation price duration curve (2010-2011)



Daily demand is based on EirGrid and SONI electricity demand forecasts.

Figure 3-9: Generator Despatch on Peak-day by Fuel-type

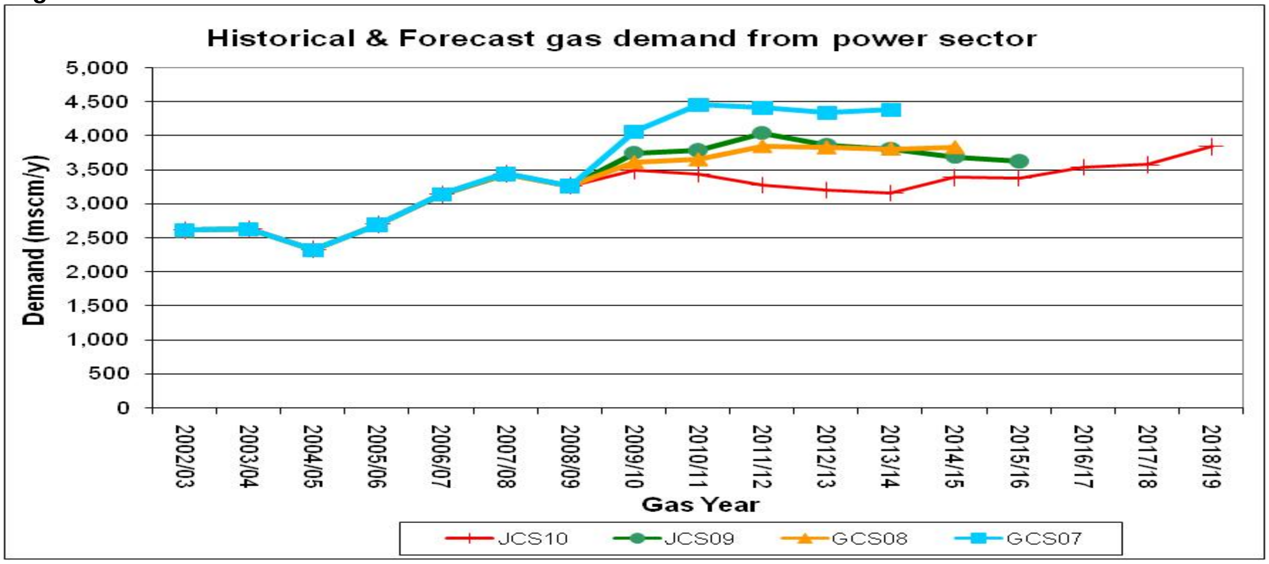


The 2010 JCS forecast annual gas demand of the power sector is presented in Table 3-5 in both energy and volume terms, together with the corresponding forecasts from the 2009 JCS and both the 2008 and 2007 GCS. The historical and forecast annual gas demand of the sector is shown in Fig. 3-10.

Table 3-5: Forecast Annual Gas Demand of Power Sector in Ireland

	Unit	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19
ENERGY											
JCS10	TWh/y	38.4	37.9	36.1	34.3	33.8	36.4	36.5	38.4	38.9	42.0
VOLUME											
JCS10	mscm/y	3,491	3,439	3,274	3,200	3,155	3,389	3,379	3,541	3,573	3,842
JCS09	mscm/y	3,750	3,784	4,037	3,861	3,803	3,691	3,624			
GCS08	mscm/y	3,615	3,654	3,845	3,826	3,808	3,830				
GCS07	mscm/y	4,064	4,454	4,413	4,337	4,379					

Figure 3-10: Annual Historical and Forecast Gas Demand for the Power Sector



As regards the overall outlook for the power sector, future gas demand is being reduced by lower electricity demand forecasts, continued investment in renewable electricity production, increasing electricity interconnection with GB and rising gas prices.

As a result of these factors the power sector gas demand is forecast to contract between 2009/10 and 2013/14, however recovery is expected from 2014/15 due to;

- Increasing Electricity Demand;
- Increasing Carbon prices results in gas fired generation becoming more competitive in the thermal generation mix.

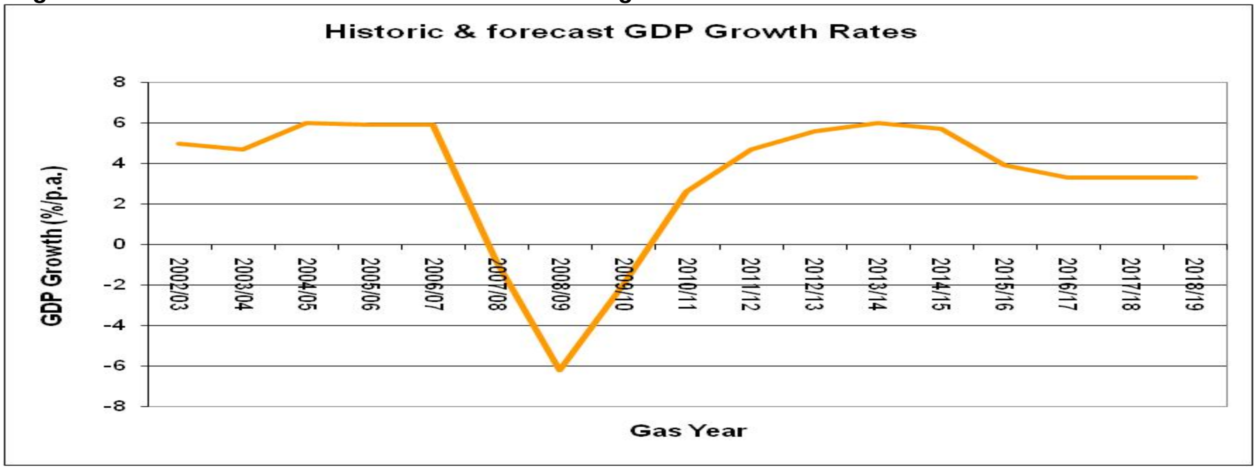
3.5.4 Irish Industrial/Commercial (I/C) gas demand

The drivers of I/C gas demand are complex and range from macro factors such as the overall level of economic growth to micro factors that are unique to individual industrial sectors.

It has been assumed for modelling purposes that the overall I/C annual gas demand will broadly grow (or contract) at 80% of the overall economic growth rate, as measured using 'Real' GDP. Real GDP is calculated using constant prices whereas nominal GDP is calculated using current prices. Formerly a 50% growth rate, based on 'Nominal' GDP was utilised. This has been revised to 80% of Real GDP by BGN in light of recent regression analysis.

The underlying GDP projections are shown in Fig. 3-11. However, some of this growth will be offset by increasing energy efficiency measures assumed for the I/C sector.

Figure 3-11: Historic and Forecast Irish 'Real' GDP growth rates



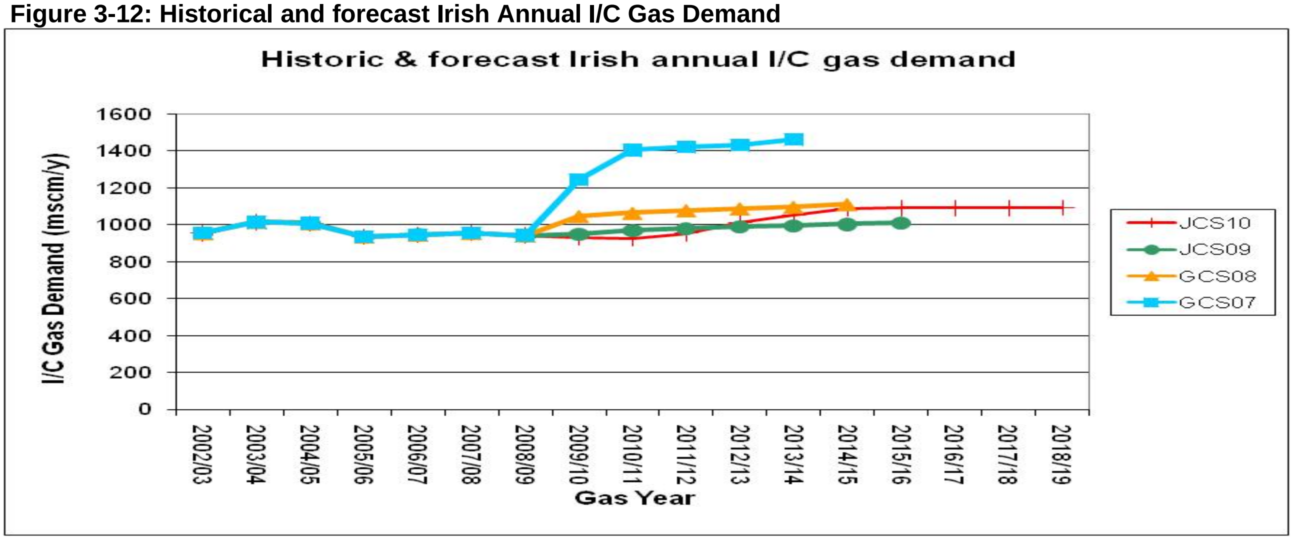
The starting point for the GDP forecast was the ESRI Quarterly Economic Commentary (QEC) for Winter 2009, which assumed that the Irish GDP would shrink by -7.25% in 2009 and -0.25% in 2010. Though the Winter QEC did not give any guidance beyond 2010, the ESRI have recently published a forecast indicating economic recovery in 2011 of +2.5%. This recently published forecast is reasonably similar to the +3.5% assumed for 2011 in this report.

A pragmatic approach was adopted to counter the absence of any updated GDP forecast beyond 2011, following consultation with the ERSI. The forecast assumes strong economic recovery in 2012, when GDP is anticipated to increase to and maintain average growth c.5.5% each year up to 2015, and revert to its long-term growth potential of c. 3.3% p.a. from 2015. The resultant I/C demand forecasts are summarised in Table 3-6, together with the corresponding forecasts published in previous the JCS and GCS (see also Fig. 3-12).

Table 3-6: Forecast annual gas demand of the Irish I/C sector

	Unit	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19
ENERGY											
JCS10	TWh/y	10.3	10.2	10.5	10.6	11.3	11.7	11.8	11.9	11.9	12.0
VOLUME											
JCS10	mscm/y	933	929	956	1,014	1,053	1,093	1,094	1,093	1,094	1,096
JCS09	mscm/y	951	972	982	992	997	1,005	1,014			
GCS08	mscm/y	1,049	1,066	1,080	1,090	1,099	1,113				
GCS07	mscm/y	1,245	1,407	1,424	1,434	1,464					

Figure 3-12: Historical and forecast Irish Annual I/C Gas Demand



The annual I/C gas demand is now forecast to continue to fall in both 2009/10 and 2010/11 due to the economic recession, before beginning to recover again in 2011/12. Relatively strong growth is anticipated to occur from 2012/13 to 2015/16; however, growth from 2015/16 onwards is expected to be offset by a significant increase in energy efficiency measures

Most of the I/C energy efficiency savings outlined in the National Energy Efficiency Action Plan (NEEAP) for Ireland, are assumed to take place post 2016. The JCS 2010 assumes annual energy efficiency savings of 65 GWh/y up to 2015/16, and 266GWh/yr from 2015/16 onwards (equivalent to 0.6% and 2.6% respectively of annual I/C gas demand in 2008/09). The assumptions in relation to the I/C energy efficiency savings are explained in more detail in Appendix 4.

The latest JCS forecast of I/C demand, though lower in the early years than that presented in the previous 2009 JCS, is more optimistic from 2013/14. This is explained by the fact that the 2009 JCS anticipated a more modest rate of economic recovery during the 2012 to 2015 period(c. 3.3%) than is being assumed in the current forecast (c. 5.5%).

3.5.5 Irish Residential Gas Demand

The growth in residential gas demand will be driven by both the number of new residential customers and also the Government's planned energy efficiency initiatives. The forecast of new residential gas connections is based on 'New Build' Housing numbers provided by the ESRI and the assumption that 38% of 'New Build' will be gas connected, as provided by BGN.[22]

Table 3-7: 'New Build' Housing numbers

	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19
New Builds	10000 (forecast)	20000	30000	30000	30000	30000	38000	38000	38000	38000
Assumed New Connections	3800	7600	11400	11400	11400	11400	14440	14440	14440	14440

The forecast assumes that the number of new residential connections will fall-off substantially in 2010, given the current state of the economy and the construction sector in particular. 'New Build' residential connections are therefore taken as being 3,800 in 2009/10 before climbing again to 14,440 p.a. by the end of the period.

The incremental demand from each new connection is also expected to reduce over the period due to enhanced building regulations, which are designed to reduce the typical energy consumption of a new home by c. 40% of 2005/06 levels and this is assumed to increase to 60% and take effect in 2012/13.[23]

The proposed standards for more efficient boilers, Home Energy Saving Scheme etc are designed to improve the energy efficiency for the existing housing stock. It is estimated these measures could lead to an annual reduction of -1.8% p.a. to the existing residential gas demand. The energy efficiency assumptions made in the JCS forecast are based on the NEEAP and are described in more detail in Appendix 4.

It should be emphasised that there is still uncertainty surrounding the rollout and implementation of the energy efficiency initiatives for existing housing. Taking this into account, BGN re-modelled the 1 in 50 winter peak day demand forecast and incorporated data which assumed that the efficiency factor of new residential builds remains at 40% post 2010 (as opposed to 60% in 2012 as originally examined). The results indicated that total demand for the island would be circa 3GWh/d higher by 2018/19. See Section 3.5.7 for further information on the peak day demand analysis.

---

[22] Statistical analysis previously undertaken by Bord Gáis Networks determined approximately 38% of new dwellings are connected to the gas network. It is assumed that 50% of these will be apartments and 50% will be made up of residential houses.

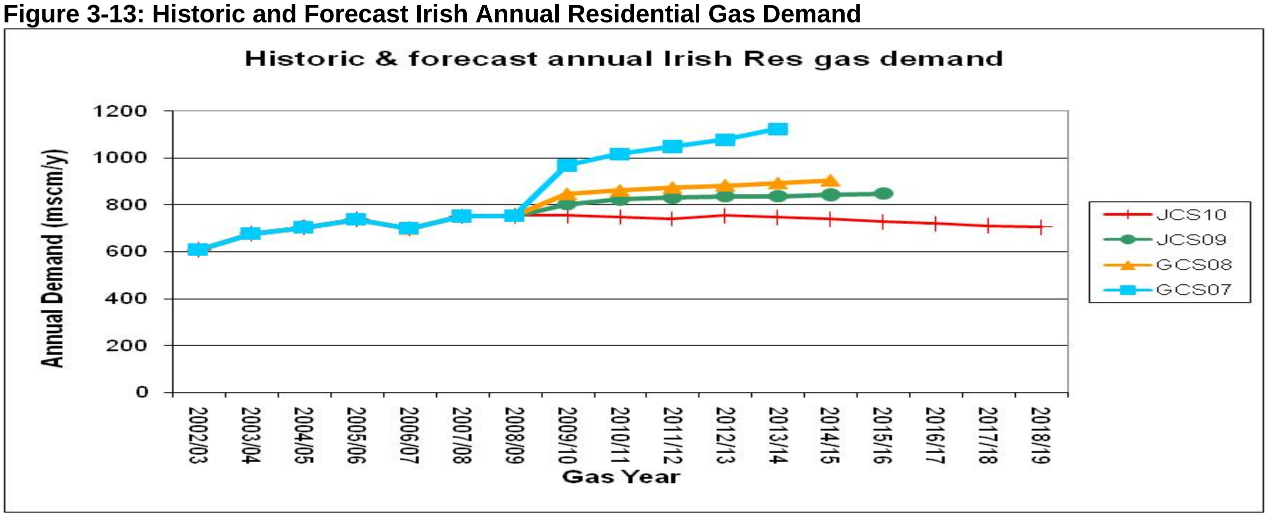
[23] The 40% target is based on requirements set out in the 2008 Building Regulations (S.I. No. 854 of 2007). The 60% target is noted in the NEEAP as taking effect under planned 2010 building regulations. The Gas Year 2012/13 has been used as it is presumed that the energy efficiency gains from these planned 2010 requirements would not be immediately evident. See Appendix 4.

The JCS residential annual demand forecast is summarised in Table 3.8 and illustrated in Fig. 3.13 together with the corresponding JCS and GCS forecasts from previous years.

Table 3-8: Forecast Annual Gas Demand of the Irish Residential Sector

	Unit	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19
ENERGY											
JCS10	TWh/y	8.3	8.2	8.2	8.1	8.0	7.9	7.9	7.8	7.8	7.7
VOLUME											
JCS10	mscm/y	753	747	740	754	747	738	727	718	711	704
JCS09	mscm/y	801	823	831	836	836	842	847			
GCS08	mscm/y	846	861	873	883	892	904				
GCS07	mscm/y	969	1,016	1,049	1,078	1,123					

Figure 3-13: Historic and Forecast Irish Annual Residential Gas Demand



The latest JCS forecast is lower than that published in the 2009 JCS, being c. 14.2% lower by 2015/16. Again this can be largely explained by the lower forecast for new residential connections (arising from the ongoing economic recession and the associated slump in new housing construction), and increased savings from energy efficiency measures.

3.5.6 Total Irish Annual Gas Demand

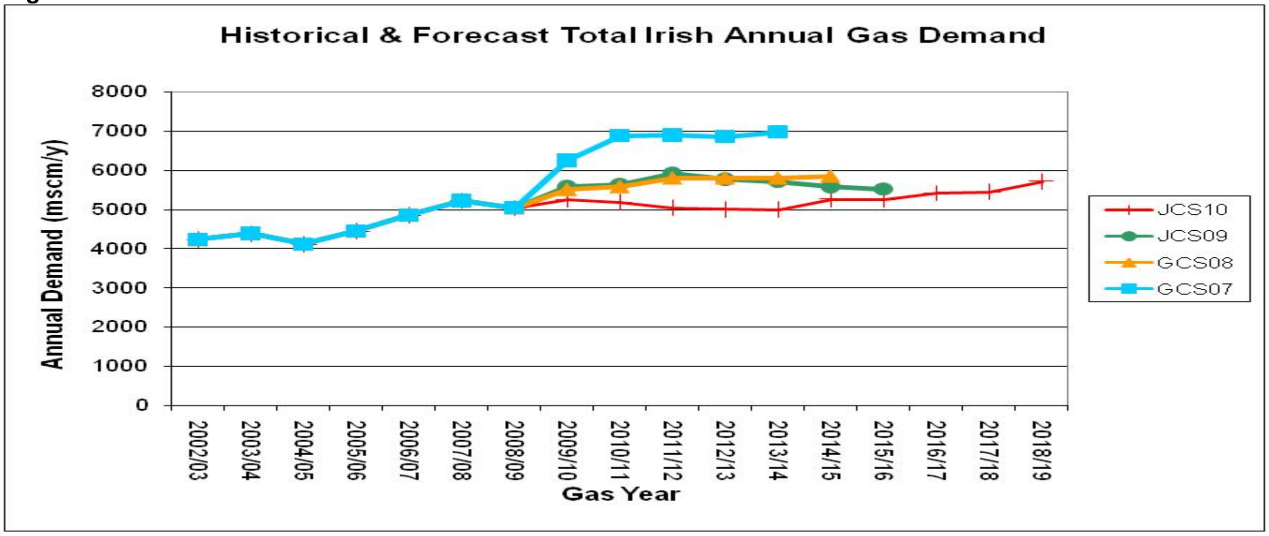
The forecast total Irish annual gas demand is summarised in Table 3.9 and illustrated in Fig. 3.14, together with the corresponding forecast published in previous versions of the JCS. The total Irish annual gas demand is forecast to grow at an average rate of 0.9% p.a. over the period.

The latest forecast figures for Ireland used in the JCS 2010 are lower than those presented in the 2009 JCS. The main reasons for this are the ongoing economic recession, and also the forecast of lower electricity demand (which obviously has a follow-on impact on the power sector gas demand).

Table 3-9: Forecast Total Irish Annual Gas Demand

	Unit	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19
ENERGY											
JCS10	TWh/y	57.8	57.1	55.5	53.6	53.5	56.5	56.8	58.8	59.3	62.4
VOLUME											
JCS10	mscm/y	5,250	5,187	5,041	5,005	4,994	5,264	5,251	5,413	5,443	5,714
JCS09	mscm/y	5,580	5,642	5,920	5,769	5,706	5,583	5,523			
GCS08	mscm/y	5,509	5,582	5,798	5,799	5,799	5,847				
GCS07	mscm/y	6,249	6,877	6,886	6,849	6,966					

Figure 3-14: Historic & Forecast Total Irish Annual Gas Demand



3.5.7 Irish Peak-day Gas Demand

In addition to the forecast of total Irish annual demand, it is also necessary to produce a forecast of Irish peak-day demand in order to access the adequacy of the Irish transmission system. Two peak days are modelled as part of this process, 1-in-50 winter peak day representing a severe winter peak day demand and an average year peak day representing an average winter peak day demand.

The Irish peak-day demand forecasts are summarised by sector in Appendix A, together with the corresponding sources of supply.

3.6 The NI Gas Demand Forecast

3.6.1 NI gas demand forecasting methodology

The NI shippers and power generators are required to provide an estimate of their future capacity requirements and commodity throughput, as part of the "Postalised" tariff arrangements. As part of the JCS, the postalised demand figures were reviewed by the distribution companies and updated to reflect their latest demand forecasts for the period modelled. Similarly demand forecasts for the power generation sector were reviewed by the power stations and updated to reflect their latest modelling forecasts.

3.6.2 NI forecast of annual gas demand

The forecast NI annual demand is summarised is Table 3.10. The forecasts have been taken from information provided to the Utility Regulator by Power Generation and Distribution system shippers in Northern Ireland.

Table 3-10: Forecast NI annual gas demand

	Unit	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19
ENERGY											
Power	TWh/y	11.92	12.35	12.80	13.69	13.53	13.53	19.28	19.28	19.28	19.28
Distribution	TWh/y	4.21	4.44	4.59	4.70	4.84	5.01	5.14	5.26	5.38	5.49
Total NI	TWh/y	16.13	16.79	17.39	18.39	18.37	18.54	24.42	24.54	24.66	24.77
VOLUME											
Power	mscm/y	1,079	1,118	1,159	1,240	1,225	1,225	1,746	1,746	1,746	1,746
Distribution	mscm/y	381	402	416	425	438	453	466	476	487	497
Total NI	mscm/y	1,460	1,520	1,575	1,665	1,663	1,678	2,212	2,222	2,233	2,243

Power Generation

Forecast figures were provided by the two gas fired power stations, Ballylumford and Coolkeeragh. The total power generation figures provided in Table 3-10 are the aggregated demand for the two sites. Figures provided were from the generators own demand modelling forecasts based on a number of assumptions including the power stations' expected growth rates in electricity demand, the impact of planned generator units and the expected dispatch order under SEM. Forward commodity prices and the influence of other fuel sources were also included in the modelling inputs.

Gas demand within the power generation sector is forecast to grow for the period 2009/10 until 2012/13 at a rate of 3.7% p.a. This level of growth is expected to plateau in the years 2013/14 to 2014/15. Following this, NI is forecast to experience a significant increase in gas demand from 2015/16 onwards with the addition of a new 430 MW CCGT by AES at the site of their existing Kilroot coal-fired power station.

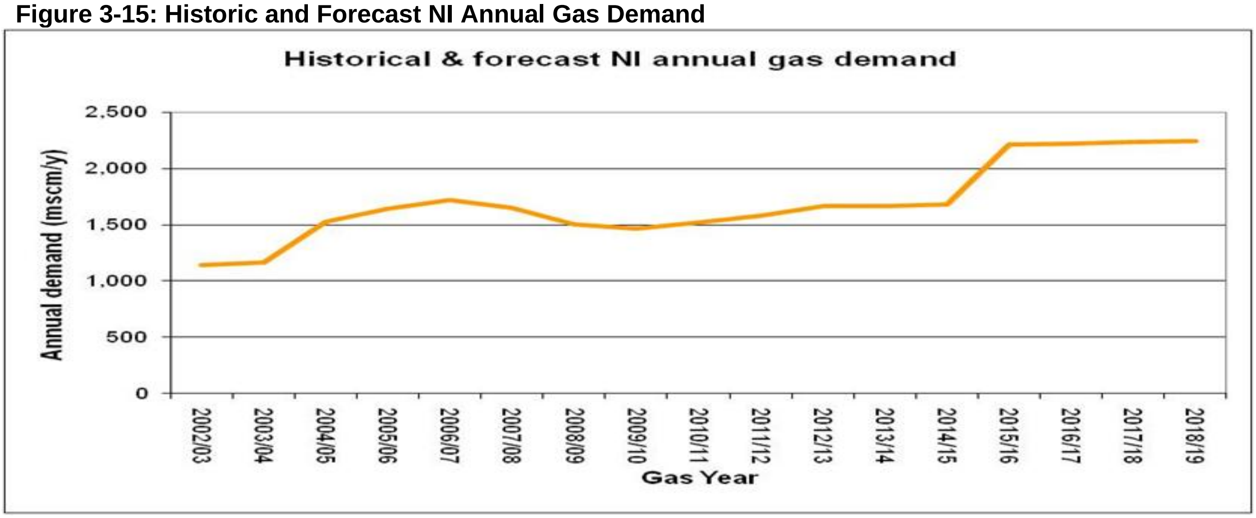
Distribution

Forecast figures were provided by the two gas distribution companies, Phoenix Natural Gas Ltd and firmus energy Ltd. The total distribution figures provided in Table 3-10 are the aggregated demand forecasts for both distribution companies. Again figures provided for the purposes of the JCS 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.

Demand in the Northern Ireland distribution market is forecast to grow at an annual rate of between 2% to 6% over the period modelled. The year-on-year increase reflects the distribution companies' expected growth rates within the domestic and I/C sectors. Forecast growth rates have also been revised to take into account prevailing economic conditions, as well as the effect of energy efficiency measures across the sector.

The forecasted demand within the PNG licensed area is driven primarily by the continued organic growth of natural gas consumers, the majority of whom are domestic consumers. Firmus energy have based their forecasts on their expected connections profile, c. 2,000 new connections per annum.

Figure 3-15: Historic and Forecast NI Annual Gas Demand



4 Gas Supplies

4.1 Overview

The majority of the gas demand in Ireland and all gas demand in Northern Ireland are currently supplied by GB gas imports from Moffat, with the remainder being supplied from Inch with Kinsale production and storage gas. GB imports from Moffat are also supplied through the Inch Entry Point to help refill the Kinsale storage facility during the summer (supplementing the offshore production).

In the short term to medium term, the majority of the island's demand will continue to be met from GB imports through the Moffat Entry Point. This supply outlook is likely to change significantly from 2012/13 and particularly from 2015 with a number of new supply projects forecast to come online which are at various stages of development. These include:

- The Corrib gas field off the West Coast is currently being developed by the Corrib Gas Partners (i.e. Shell (Operator), Statoil and Vermillion) and is expected to commence commercial production in the Gas Year 2012/13;
- Islandmagee Storage and the North East Storage project partners (BGE and Storengy) are looking into the commercial feasibility of developing salt-cavity gas storage in the Larne area in NI; and;
- Shannon LNG have received planning permission to develop a LNG re-gasification plant near Ballylongford in Co. Kerry *and*
- PSE Kinsale Energy is investigating the commercial feasibility of developing the Ballycotton field as a storage facility in the Celtic Sea.

These projects have been included within the supply scenarios that have been modelled in the 2010 JCS and are further detailed below. The specific supply scenarios used in the modelling are outlined in Section 4.3.

4.2 Sources of supply

4.2.1 Indigenous production

Kinsale Production

Production from the Kinsale Head gas field in the Celtic Sea was initially brought ashore at Inch in 1978. This was subsequently supplemented with production from two satellite fields, namely the Ballycotton and South West Lobe (SWL) gas fields (see Fig. 4.1). The SWL gas-field has since been depleted, and is now operated as a seasonal gas storage facility.

In 2003 the adjacent Seven Heads gas field was tied into the offshore Kinsale infrastructure, and Seven Heads gas was brought ashore at Inch. Production from the Kinsale and Seven Heads gas field is now in decline, and is small relative to total demand.

Corrib Gas

The main source of future indigenous production will be the Corrib gas field, which is currently being developed by the Corrib Gas Partners. Work is almost completed on the construction of the Bellanaboy terminal in Co. Mayo, which will process the gas from the Corrib field. Operational qualification testing of the terminal facilities using gas from the BGÉ network is due to start during the autumn of 2010. At the Corrib field, five wells are completed and ready for production, while the 83km long offshore pipeline was completed during 2009. A planning application for the infrastructure required to connect the final onshore section of the pipeline from its landfall at Glengad to the Bellanaboy terminal is currently before An Bord Pleanála. Subject to full planning approval, the Corrib gas field is expected to commence commercial operations in the Gas Year 2012/13.

Commercial production of Corrib gas will improve the Irish security of supply situation. Corrib gas is expected to meet 41.0% of the forecast 1 in 50 peak-day demand, and 72.9% of the Irish annual demand in 2012/13.

The production profile provided by the Corrib partners, however, declines quite quickly and reduces to approximately 53.0% of its peak-production within 6 years. The Irish dependence on GB imports will begin to rise again as Corrib production declines, unless new sources of supply are brought on stream.

Potential Gas Supply Sources

A number of other potential gas prospects have also been identified in the Celtic Sea, which are currently being evaluated by a number of different developers for their technical and commercial viability.

Other potential prospects have been identified to the north west of the Corrib gas field, and include the West Dooish and Cashel prospects. The commercial viability of these Celtic Sea and North West coast prospects has yet to be established, however, and they have been omitted from the JCS forecast for the time being. This situation will continue to be kept under review in future JCS publications.

4.2.2 Gas Storage

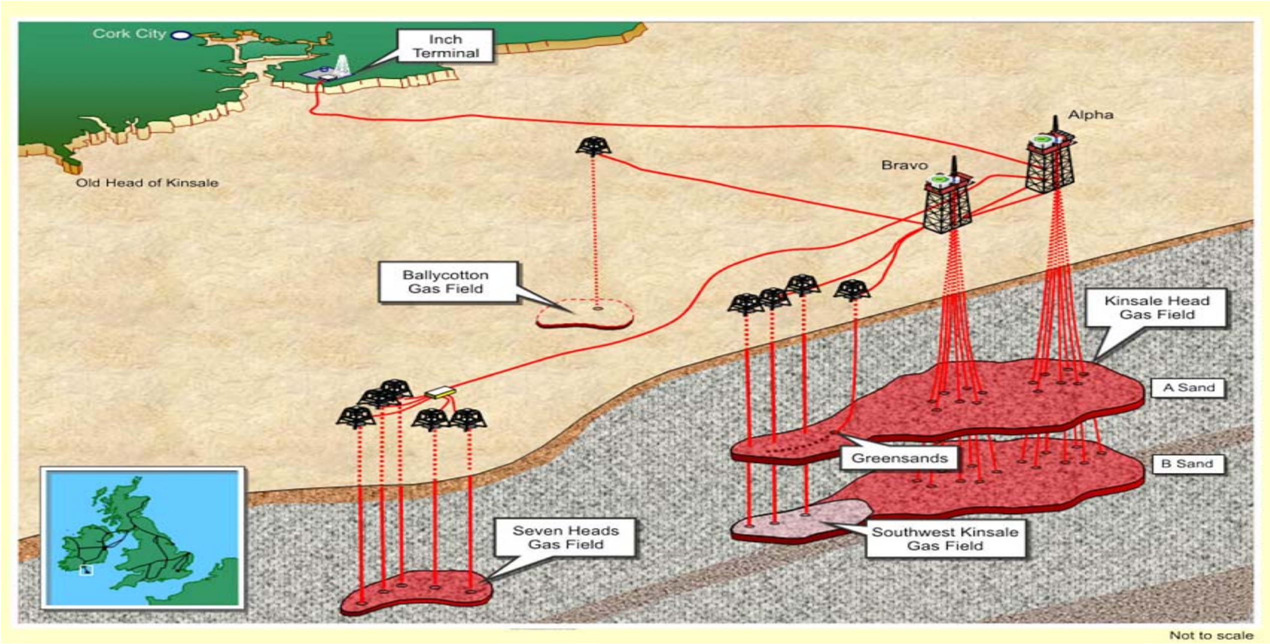
Kinsale Storage Facility

The Kinsale storage facility was developed by PSE Kinsale Energy Limited using the depleted Southwest Kinsale gas field. It currently has a working volume of c. 230 mscm (2,415.3 GWh) which is equivalent to about 4% of Ireland's annual consumption of gas. It has a maximum withdrawal rate of 2.6 mscm/d (27.3 GWh/d) and a maximum injection rate of 1.7 mscm/d (17.85 GWh/d). It mainly operates as a seasonal storage facility, but can also accommodate within-day gas withdrawals and injections.

The Kinsale storage and production facilities were sold by Marathon Oil Ireland Limited to Petronas in 2009 and Marathon was re-named as PSE Kinsale Energy Limited. PSE Kinsale Energy Limited is currently determining the commercial feasibility of increasing storage capacity in the Celtic Sea, with a possible start date of Q4 2014. PSE Kinsale Energy have indicated during the consultation process that they may develop the Ballycotton field as a storage facility resulting in a total working volume of c.930 mscm (9,791.7 GWh) with the ability to withdraw up to 11.5 mscm/d (120.8 GWh/d). PSE Kinsale Energy Limited has also noted that the economic viability of the existing storage facility is linked to that of its gas production operations.

The company has informed the CER that, as gas production is gradually declining, the existing storage operations will not be economic on a standalone basis unless the proposed storage expansion proceeds. Should the extension to the storage facility not take place, it is likely that the existing storage operations would cease 2 to 3 years prior to the termination of gas production.

The Kinsale scenario assumes the increased storage facility from October 2014, with the existing facility assumed to be in place for all years in the other two supply scenarios, Larne and Shannon LNG. The issue of potential reduction in flows from the existing storage facility was not presented during the consultation stage of the preparation of the JCS 2010 and therefore is not included as part of the network modelling process. This will be addressed in next year's JCS. The supply scenarios used in the 2010 JCS are detailed in Section 4.3.



Source: PSE Kinsale Energy Limited

Larne Salt-cavity Storage

Two project developers are also looking at the technical and commercial viability of introducing salt-cavity storage in the Larne area of NI. Islandmagee Storage Limited plan to develop a salt-cavity storage facility underneath Larne Lough, while the North East Storage project is seeking to develop an onshore salt-cavity storage facility near Larne. Both projects are still in the preliminary stages of development.

Islandmagee Storage Limited is a joint venture between Infrastrata plc and Mutual Energy Limited. Islandmagee Storage Ltd plan gas operations to commence in 2015 (see also Section 2.6.1).

The North East Storage project, which is a consortium consisting of BGE and Storengy (a GdFSuez company), involves the development of a salt cavern underground gas storage facility to the southwest of Larne. Initial supplies from the facility are estimated as becoming available in Q4 2014. An indicative figure of 300 mscm is being used for working gas capacity for this facility with projected maximum withdrawal rate of 15mscm/d and a maximum injection rate of 7mscm/d.

For the purposes of the 2010 JCS, a “generic” salt-cavity in the Larne area has been modelled based on a 500 mscm (5,523.6 GWh) working volume, a maximum withdrawal rate of 22.0 mscm/d (243.0 GWh/d) and a maximum injection rate of 12.0 mscm/d (132.6 GWh/d). It should be noted that data submitted by Islandmagee has been utilised form modelling purposes merely as it is the larger of the two storage projects at Larne and therefore constitutes the greater stress on the transmission systems in Ireland and Northern Ireland.

Gas injections into the salt-cavity facility are assumed to commence during the summer of 2014/15, and commercial withdrawals are assumed to commence during winter 2015/16. The salt-cavities are assumed to be developed on a phased-basis, with the maximum withdrawal rate taken as increasing from 6.0 mscm/d (66.2 GWh/d) in 2015/16 to 22.0 mscm/d (243.0 GWh/d) by 2017/18.

4.2.3 Liquefied Natural Gas (LNG)

Shannon LNG has received planning permission for both their proposed LNG re-gasification facility on the Shannon Estuary (near Ballylongford in Co. Kerry) and the associated transmission gas pipeline that will deliver gas into the transmission system in Ireland. The CER approved a consent to construct a pipeline from the proposed terminal to the BGÉ network in December 2009. Shannon LNG was granted the relevant foreshore permits in April of this year and a decision of the European Commission on their request for an exemption from regulated Third Party Access is expected in August 2010.

Shannon LNG has indicated that the proposed LNG terminal will be developed on a phased basis. Commercial operations of the initial phase are assumed to commence in 2015/16, with an initial maximum send-out during the ramp-up period of 11.3 mscm/d (127.0 GWh/d) (based on the profile provided by Shannon LNG).

The Shannon LNG terminal has been designed to facilitate expansion at a later date, through the installation of additional re-gasification facilities and the possible addition of LNG storage tanks. The maximum send out for subsequent phases are noted as 17.0 mscm/d (189.9 GWh/d) and 28.3 mscm/d (314.7 GWh/d) respectively.

As Phase I is the only relevant phase for the period under review in this JCS, no analysis has been undertaken for Phase II and III of the proposed facility.

4.2.4 Interconnector Imports

Declining Kinsale production and rising gas demand led to the construction of the first Irish subsea interconnector (IC1) between Ireland and Scotland in 1993, which connected into the GB National Transmission System (NTS) at the Moffat Entry Point. A second subsea interconnector (IC2) was completed in 2002 to meet the projected increase in demand, and is also used to supply gas to the IOM.

The IC1 system in Scotland was also used to supply gas to NI. The SNIP subsea interconnector was completed in 1996 and connected into the IC1 system at Twynholm in Scotland. The SNIP currently supplies all of NI demand and is also used to supply gas to the town of Stranraer in Scotland which has relatively small demand.

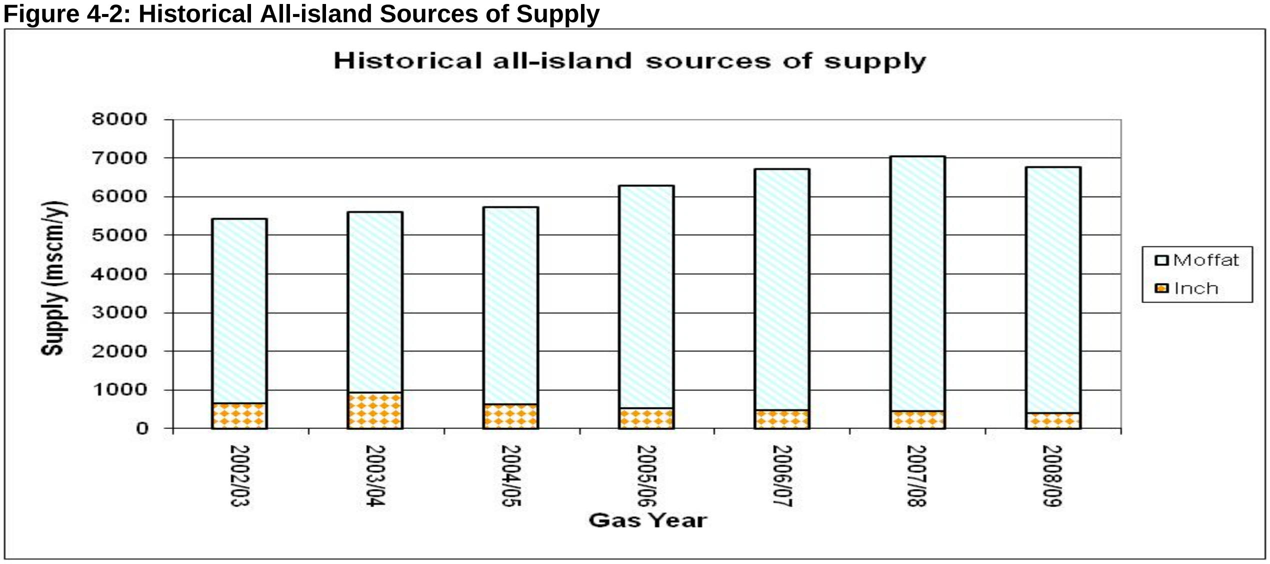
The first GB gas imports through the IC system in 1995 (IC1) were quite small, however they increased rapidly over time and accounted for c. 94.3% of total Irish annual demand in 2008/09 (IC1 & IC2). The historical breakdown of indigenous production and GB gas imports is given in Table 4.1 (for both Ireland and Northern Ireland).

Table 4-1: Breakdown of the historical indigenous production and GB imports[1]

	Unit	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
ENERGY								
Inch	GWh/y	6,637	9,705	6,397	5,451	4,976	4,772	4,259
Moffat[3]	GWh/y	53,221	51,982	56,890	64,023	69,236	72,645	70,446
Total supply	GWh/y	59,858	61,687	63,287	69,474	74,212	77,417	74,705
VOLUME[2]								
Inch	mscm/y	637	932	614	523	478	455	404
Moffat	mscm/y	4,790	4,678	5,120	5,762	6,231	6,589	6,365
Total I/C	mscm/y	4,234	4,391	4,122	4,448	4,858	7,044	6,769

[1]Includes Irish, NI and IOM gas demand plus any Inch Exit to refill Kinsale Storage
[2]Volumes are derived from energy values by assuming a GCV of 40 MJ/m^3 & 37.5 MJ/m^3 for 2002/03 to 2006/07, 39.7 MJ/m^3 & 37.8 MJ/m^3 for 2007/08, 39.8 MJ/m^3 & 37.9 MJ/m^3 for 2008/09, for Moffat and Inch respectively
[3]There is a minor revision to Moffat data (<0.3%) for 2007/08 compared to previous JCS

Figure 4-2: Historical All-island Sources of Supply



4.3 Supply Scenarios

At the current time there is uncertainty regarding the potential timing of the commencement dates of the projects noted above. A scenario approach was used to manage the uncertainty associated with these projects. The following supply scenarios were developed and agreed upon by the Regulatory Authorities:

- The **Larne Supply** scenario: Assumes Corrib gas from October 2012, Kinsale production (based on PSE Kinsale Energy Profile) and existing storage for all years, Larne Storage from October 2015 and GB imports via the ICs meeting any supply shortfall;

  This scenario also contains a sensitivity to assess the impact of a one year delay to Corrib.
- The **Shannon Supply** scenario: Assumes Corrib gas from October 2012, Kinsale production and existing storage for all years, Shannon LNG (Phase I) from October 2015, a NI salt-cavity storage facility from October 2015 and GB imports via the ICs meeting any supply shortfall;
- The **Kinsale Supply** scenario: Assumes Corrib gas from October 2012, expanded Kinsale storage from 2014/15, Shannon LNG from October 2015, a NI salt-cavity storage facility from October 2015 and GB imports via the ICs meeting any supply shortfall.

Supply Source	1. Larne Supply Scenario	2. Shannon Supply Scenario	3. Extended Kinsale Supply Scenario
Kinsale	Existing facility will continue to be available for all years.	Existing facility will continue to be available for all years.	Existing facility will continue to be available until October 2014 and extended storage facility is taken as coming online this year.
Corrib	October, 2012[24]	October, 2012	October, 2012
Larne Storage	October, 2015	October, 2015	October, 2015
Shannon LNG	Unavailable	October, 2015	October, 2015

Detailed forecasts of indigenous production and gas imports (including both IC system and LNG imports) are given in Appendix 1. In some of the above scenarios the aggregated supply capacity is greater than the forecast demand. The order of despatch for the various sources of supply varies for each of the supply scenarios. The following supply despatch orders were agreed upon by the Regulatory Authorities:

Table 4-2: Summary of Supply Source Merit Order for each Scenario

Despatch Order	Larne Supply Scenario	Shannon LNG Supply Scenario	Extended Kinsale Supply Scenario
1	Corrib Production	Corrib Production	Corrib Production
2	Kinsale Production	Kinsale Production	Kinsale Production
3	Kinsale Storage	Kinsale Storage	Extended Kinsale Storage
4	Larne Storage	Shannon LNG	Larne Storage
5	Moffat (GB Imports)	Larne	Shannon LNG
6		Moffat (GB Imports)	Moffat (GB Imports)

[24] A sensitivity of a 1 year delay to supplies from Corrib has also been included as part of the modelling for this scenario.

It should again be emphasised that the above has been assumed solely for demand/supply modelling and network analysis purposes. The actual order in which supplies will be despatched will be determined by shipper nominations and the commercial arrangements between shippers and producers/suppliers at the various Entry Points.

5 Network analysis

5.1 Transmission network capacity modelling

The purpose of the hydraulic network modelling is to test the adequacy of the existing all-island transmission network for a forecast demand under a number of supply scenarios, establishing where pressures are outside acceptable operational boundaries or where there is insufficient capacity to transport the necessary gas. This chapter summarises the results of the network analysis carried out for this JCS.

In order to assess the system on days of different demand pattern three demand type days were analysed for each supply scenario over a 10 year period from 2009/10 – 2018/19 inclusive:

- Severe 1-in-50 winter peak
- Average year winter peak
- Average year summer minimum

These demand type days, which are generated from the gas demand forecast, have been chosen as they represent the best case scenario regarding maximum possible withdrawal rates on peak days and maximum possible injection rates on summer minimum days.

Modelling was carried out using "PipelineStudio®" simulation software which was configured to analyse the transient 24 hour demand cycle over a minimum period of three days to obtain consistent steady results (see Appendix 2 for more details of the network analysis modelling)

The ability of the all-island transmission system to accommodate the forecast demand requirements of gas was validated against the following criteria:

- Maintaining the specified minimum and maximum operating pressures at key points on the transmission systems, including:
    - Minimum of 55 barg at the Dublin City gates;
    - Minimum of 45 Barg at Ballyveelish (for Waterford area)
    - Minimum of 25 Barg at Ballineen (West Cork);
    - Minimum of 30 Barg at Coolkeeragh (Derry ~Londonderry);
    - Minimum of 35 Barg on the South North Pipeline (SNP);
    - Minimum of 56 Barg at the inlet to Twynholm; *and*
    - Not to exceed the Maximum Operating Pressure (MOP) of the onshore transmission systems, currently 70 Barg in Ireland and 75 Barg in NI;
- Ensuring gas velocities do not exceed their design range of 10 – 12 m/s; *and*
- Operating the compressor stations within their performance envelopes.

5.2 System configuration

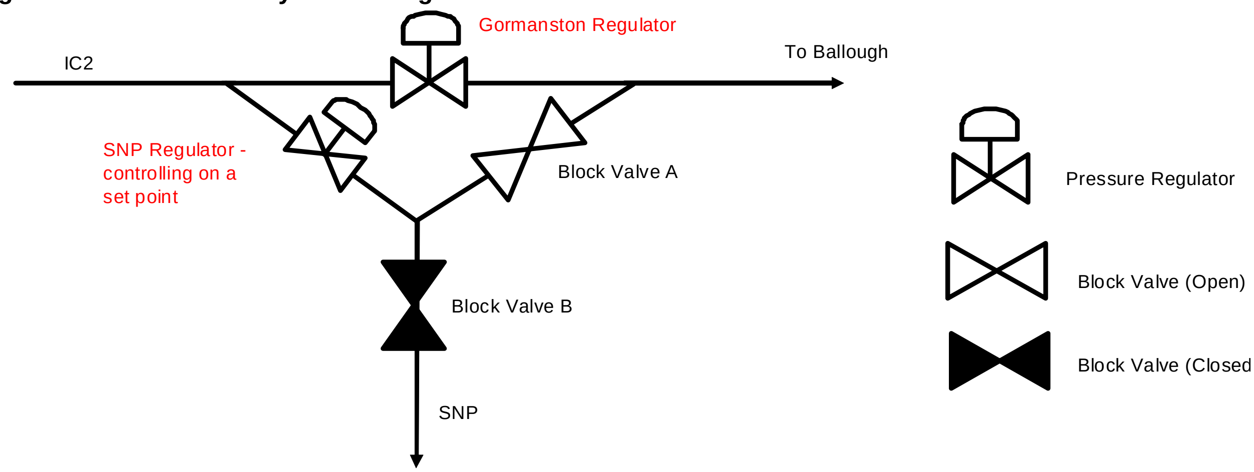
The Irish and Northern Ireland gas transmission networks are physically separated at Gormanston under the current configuration of the two systems. For the relevant years under review it is assumed the necessary operational and commercial requirements are in place as part of the Common Arrangements for Gas (CAG) project, to facilitate the export of surplus gas from NI (Larne storage gas) into Ireland, and export surplus gas from Ireland into NI, when required.

The current configuration (CAG closed) at Gormanston is shown in Figure 5-1:

- One of the Block Valves (BV A or BV B) at Gormanston is closed, depending on operational requirements ;
- The flow of gas from IC2 into the Irish and NI transmission systems is controlled through separate regulators (i.e. the Gormanston and S/N regulators), with their own individual settings.

The combined effect of this configuration is that the two systems are physically separated for operational purposes, and have separate pressure control regimes. Under the existing CAG Closed arrangement gas would only flow from IC2 into the SNP in the event of an emergency or if there was insufficient capacity available on the SNIP to meet NI demands.

Figure 5-1: CAG Closed system configuration at Gormanston

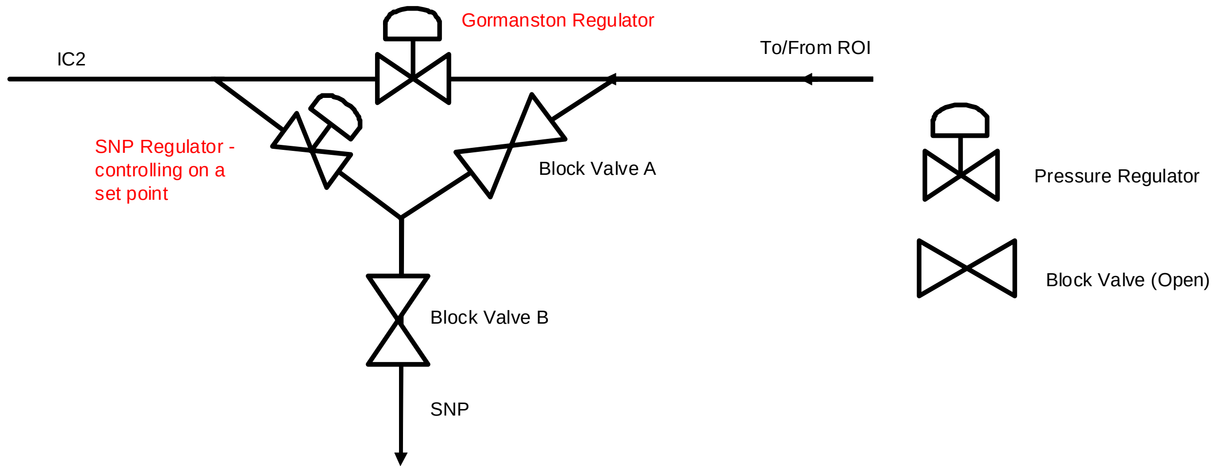


Network modelling assumes that under a future CAG operational environment, this ‘CAG closed’ arrangement would change to a ‘CAG open’ configuration, where given certain supply and demand scenarios there may be scope to minimise operating costs by operating as a single all-island system.

The corresponding ‘CAG open’ configuration for Gormanston is shown in Figure 5-2:

- Both BV A and BV B at Gormanston are open; *and*
- The SNP would be set to zero-flow control; *and*
- The combined effect of this configuration is that the two systems are effectively joined at Gormanston and have a common pressure regime.

Figure 5-2: CAG Open system configuration at Gormanston



In the CAG Open system configuration there is no flow-control mechanism available to control the flow of gas into and out of NI. The gas will simply flow through the open BV depending on the relative system pressures on the Irish and NI transmission systems. Additional measures may be required for safety reasons, to ensure that the pressure does not exceed the Irish MOP of 70 Barg.

It is assumed for modelling purposes in the 2010 JCS that under the CAG arrangement, the option would be available to operate the network under either a CAG Closed or a CAG Open configuration where either configuration would minimise operating costs. This assumption will continue to be reviewed in the preparation of future Statements.

5.3 Entry Point Assumptions

The main Entry Point assumptions in terms of gas pressures, Gross Calorific Value (GCV) and flow profiles are summarised in Table 5-1 , which shows both the contractual minimum pressure and the pressure assumed for network analysis.

Table 5-1: Summary of Main Entry Point Assumptions

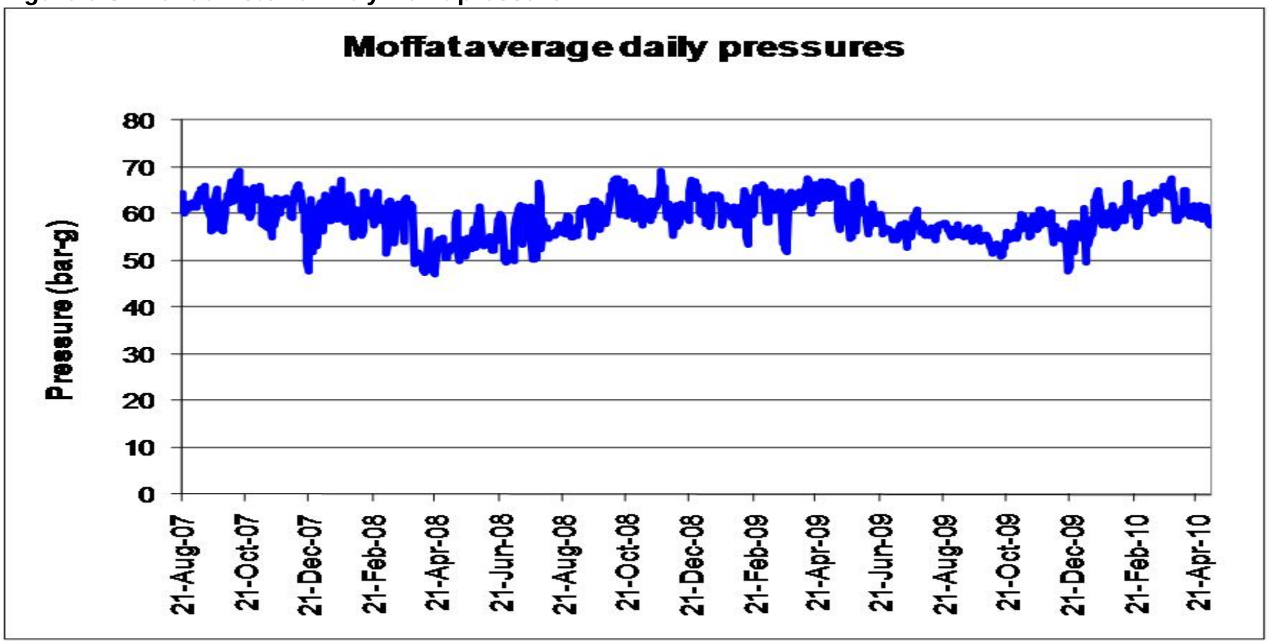
	Unit	Moffat	Inch	Corrib	Shannon	Larne
PRESSURE						
Contractual	Barg	42.5	30.0	Up to 85	N/A	N/A
Assumed	Barg	47.0/55.0	30.0/70.0[1]	Up to 85	Up to MOP[2]	Up to MOP[2]
OTHER						
GCV	MJ/m^3	39.77	37.80	37.64	40.46	39.77
Flow profile[3]		Flat	Flat	Flat	Flat	Flat
Max Supply[4]	Mscm/d	32.0	3.4/11.5[1]	10.0	11.3	22.0

[1]For the Extended Kinsale Supply scenario where Inch Storage is developed, 70Barg is assumed available at the Inch Entry point with max supply capacity of 11.5 mscm/d
[2]MOP=Maximum Operating Pressure (MOP) of the Pipeline
[3]Flat flow profile assumes that the hourly delivery of the Entry Point = 1/24th of the daily delivery
[4]The maximum capacity for each supply source over the forecast period. Max supplies may not coincide.

Under the Pressure Maintenance Agreement (PMA), National Grid are required to provide a minimum pressure of 42.5 Barg at Moffat. However, they have also advised Gaslink a higher Anticipated Normal Operating Pressure (ANOP) pressure of 47 Barg (i.e. the expected pressure under normal circumstances).

Given that actual historic daily average pressures at Moffat have ranged from 47.1 Barg to 69.3 Barg since 2007/08, averaging at 59.2 Barg (see Figure 5-3); a 1-in-50 peak day source pressure of 47.0 Barg and an average year source pressure of 55.0 Barg at Moffat have been assumed for modelling purposes. It is worth noting that there can be a large daily variation in gas inlet pressure from Moffat. This can have implications on the results of the network analysis, particularly in regard to accommodating reverse flow through the SNIP.

Figure 5-3: Moffat historic Entry Point pressure



Currently, under the Inch Connected Systems Agreement (CSA) PSE Kinsale Energy is required to provide a minimum pressure of 30 Barg at Inch. For the purpose of analysing the Extended Kinsale supply scenario it has been assumed that the MOP of the Inch to Midleton pipeline can be raised to 70 Barg and Kinsale will be able to deliver up to this pressure when increased levels of storage are available.

Contractually, the Corrib Operator will be required to provide up to 85 Barg at Bellanaboy. Modelling assumes that Corrib gas can enter the Ringmain at Craughwell at a pressure no greater than 70 Barg, consistent with the current ring main MOP.

No contractual arrangements have been finalised with Shannon LNG, but it is assumed that they will be able to deliver up to the MOP of the ring-main.

SNIP currently has an MOP of 75 Barg, but it is assumed SNIP MOP could be upgraded to 85 Barg coincident with the availability of Larne Storage. While no contractual arrangements being in place with either of the proposed Larne gas storage projects, it is assumed that they will be able to deliver gas at 85 Barg.

The daily flows through each Entry Point are assumed to follow a flat flow profile, with the diurnal swing in the demand profile being absorbed by the line-pack of the island's onshore transmission systems and the subsea Interconnector (IC) system and the SNIP.

5.4 Twynholm & Scotland Northern Ireland Pipeline

NI currently has a contractual entitlement to 8.1 mscm/d (89.3 GWh/d) (rising to 8.64 mscm/day from 2015) at Twynholm. Network models restrict flows through Twynholm in accordance with these entitlements. Network modelling assumes Twynholm operates under flow control and, therefore, the gas entering SNIP would follow a flat flow profile. SNIP is taken to have a design of pressure of 75 barg, but assumed SNIP MOP could be upgraded to 85 Barg coincident with the availability of Larne storage.

A number of sensitivity runs were carried out in order to establish whether the network can accommodate the larger withdrawal and injection rates proposed at Larne in the latter years under review. For these model runs network analysis assumes Twynholm AGI is upgraded to provide the capability to operate in reverse mode and any capacity restrictions at the AGI would be removed.

5.5 Onshore Scotland Compressor Station Capacities

The physical capability of the Moffat Entry Point is essentially determined by the physical capacity of Beattock Compressor Station. The 2009 JCS identified a potential scenario where towards 2015/16 the projected flows from Moffat and the IC system would marginally exceed the assumed maximum capacity of the Beattock and Brighouse Bay compressor stations in Scotland.[25] It was noted that performance testing was required in order to confirm Beattock's capability to flow in excess of 31mscmd to Brighouse Bay. BGN has recently completed a study to analyse the performance of these compressor stations and the results are discussed in the following two sections

The capacity of a compressor station is defined as a function of the gas inlet conditions and the ability of the compressor component parts to meet specific output conditions. The parameters of this function include:

- Required outlet pressure (whilst remaining within the maximum and minimum compression ratio)
- Required outlet temperature
- Available inlet pressure
- Available inlet temperature
- Molecular weight/density
- Power available within compressor units
- Configuration of compressor units (in series or in parallel mode)

Duty parameters for the compressor unit are set by these station inlet and outlet boundary conditions. Station outlet conditions are within station control and are determined by downstream pipeline pressure and temperature limits.

For all years under review the forecast supply requirement from Moffat under the varying supply scenarios is within the theoretical maximum capacity of Beattock Compressor Station as assessed. See details below.

5.5.1 Performance review of Beattock compressor station

The main driver of the Beattock station capacity is the available pressure from the National Grid NTS system at Moffat. The theoretical maximum capacity of the existing Beattock compressor station has been assessed at 353 GWh/d (32.0mscm/d), based on the following assumptions:

---

[25] This is the 'Low Supply' scenario which involved a one year delay to the Corrib project until, and no additional sources of supply coming on stream within the forecast period and no gas from Inch after 2013/14,

- An inlet pressure of 47 Barg at the compressor station, based on the National Grid ANOP of 47.0 barg for the Moffat Entry point;

- A discharge pressure of 85 Barg to ensure that the contractual minimum pressure of 56 Barg is maintained at Twynholm;

- A gas inlet temperature of 15 °C, and a gas molecular weight of 18.3; *and*

- Three compressor units operating in "series-mode" configuration, with the fourth unit operating in stand-by mode.

The performance testing study indicated that it should be possible to flow 353 GWh/d (32.0mscm/d) without major modifications to the existing station, under the above assumptions. There are a number of caveats in relation to this theoretical study:

- The above capacity is significantly higher than the original design capacity of the station, namely 287 GWh/d (26.0mscm/d), and a more detailed analysis of the subsystems would be required to verify that they were capable of meeting these flows (i.e. station pipe-work, meters, filters and after-coolers etc); *and*

- Minor modifications would be required to the station pipe-work to mitigate the flow-related vibrations that arise at these higher flow-rates (above the original design-flow).

The capacity of the station is sensitive to the assumed station inlet pressure. If the minimum contractual pressure under the PMA of 42.5 Barg is assumed, then the theoretical maximum capacity of the station in series mode reduces to 302 GWh/d (27.4mscm/d). The capacity is also sensitive to the gas temperature assumptions.

5.5.2 Performance review of Brighouse Bay compressor station

The main driver of the Brighouse Bay capacity is the available pressure at the station inlet. If it is assumed that Beattock is flowing 32 mscm/d and discharging at 85 Barg then the available pressure at the Brighouse Bay inlet will be 60 Barg or higher.

The maximum theoretical capacity of Brighouse Bay has been assessed at 298 GWh/d (27mscm/d) based on a station inlet pressure of 60Barg and a discharge pressure of 120Barg (to give a compression ratio of 2.0). Note this is the maximum stand alone capacity based on these pressure assumptions and does not take into consideration supply to Northern Ireland. Assuming the capacity of Beattock is 32mscm/d, and allowing the contractual 8.08mscm/d for Northern Ireland at Twynholm, leaves c. 23.9mscm/d of capacity available at Brighouse Bay Compressor Station.

5.6 Summary of Overall Modelling Results

The results of the JCS 2010 modelling indicate that the existing transmission infrastructure has sufficient capacity to transport the necessary gas to meet the current forecast demand over the next ten year period modelled without the need for reinforcement. This conclusion is subject to a number of restrictions depending on the balance between the various new supply sources. Should these restrictions not be considered as acceptable then further investment in the system would be needed. Under certain supply scenarios the transmission network cannot simultaneously accommodate the proposed maximum flows from all the assumed supply sources for a number of reasons:

- Combined maximum levels of supply exceed the forecast all island demand. See Figure 5-4. It should be noted that supplies from Moffat are assumed to be dispatched last (following the available indigenous production) for the modelling of the supply scenarios noted below. Transporting large volumes of supply from the West and South Coast (Inch) to meet the majority of demand on the east coast (Dublin), results in a significant pressure drop across the transmission system in Ireland. System pressures in the western and southern parts of the transmission system must not exceed the MOP of 70 Barg, whilst maintaining the minimum pressure requirement of 55 Barg at Dublin City Gate stations.

  - From 2014/15 with the presence of Corrib and the increased level of supply available from Inch, due to the developed Ballycotton storage. There are physical limits to the combined levels of gas that can be delivered to the east coast.

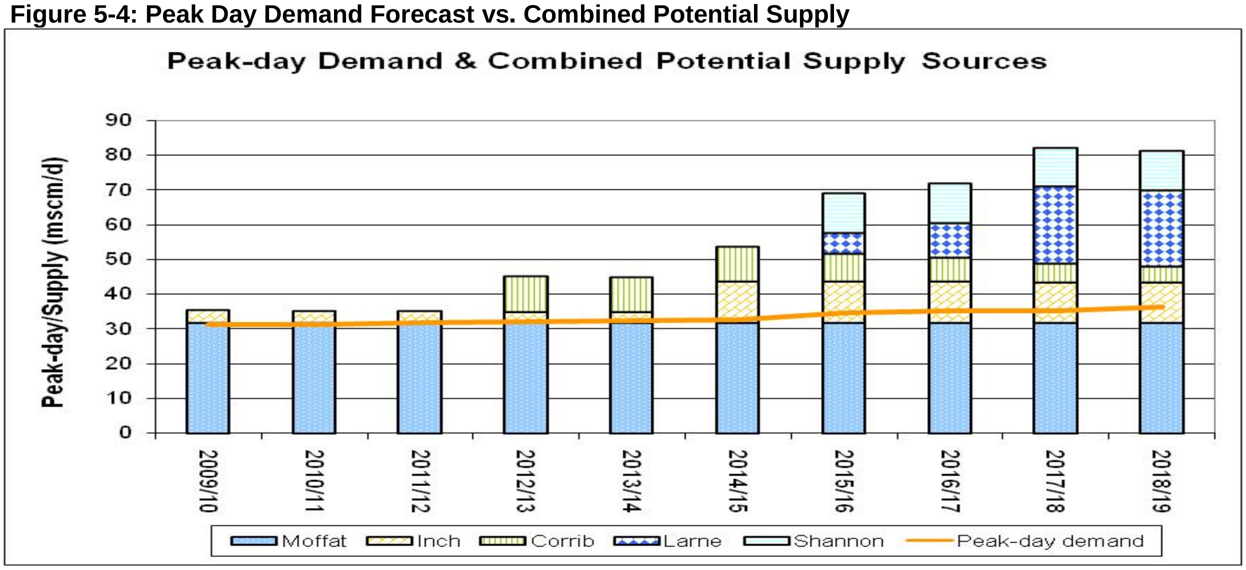
  - From 2015/16 with the availability of Corrib, Kinsale and Shannon LNG, the existing transmission infrastructure cannot accommodate the proposed combined levels of supply from all three sources without reinforcement.

- There may be limitations to the levels of gas that can be injected into Inch, under the Extended Kinsale supply scenario depending on supply sources available. The presence of Shannon LNG allows for higher prevailing pressures in the southern part of the ring main aiding injection into Inch.

- Network configuration and prevailing pressure in onshore Scotland may limit the levels of gas that can be injected and withdrawn to and from Larne storage.

Depending on the timing and levels of proposed new gas supplies and the demand profile assumed, the network can accommodate a number of combinations of supply. However, it cannot accommodate every eventuality due to certain physical constraints. The natures of these constraints on the existing gas transmission systems in Ireland and NI are described in more detail in the following sections for each supply scenario.

Figure 5-4: Peak Day Demand Forecast vs. Combined Potential Supply



5.7 Network analysis results for the Larne Supply Scenario

5.7.1 Severe winter, 1-in-50 peak day demand

The peak-day demand and supply balance for the Larne supply scenario are shown in Figure 5-5 and in Table 5-2.

Entry capacity assumptions are as follows:

- Existing Kinsale gas production and storage facilities continue in operation with declining production from the Kinsale and Seven Heads gas-fields and a maximum delivery of up to 27.3 GWh/d (2.6mscm/d) from Kinsale storage;

- Corrib production based on the latest production profile received assumes first commercial production from October 2012;

- Larne Storage based on the latest profile received from the Islandmagee storage project which assumes gas will be available for withdrawal from October 2015. It should again be noted that data submitted by Islandmagee has been utilised for modelling purposes as it is the larger of the two storage projects at Larne and therefore constitutes the greater stress on the transmission systems in Ireland and Northern Ireland. This is the case in relation to all of the supply scenarios[26]; *and*

- The capacity of the Moffat Entry Point is assumed to be approximately 353 GWh/d (32.0mscm/d), based on the results from the recent performance review of Beattock compressor station.

There is more than sufficient supply capacity available between Inch, Corrib, Larne and Moffat Entry Points to meet the forecast severe winter 1-in-50 peak-day demands of Ireland, NI and the IOM over the forecast period. Whilst shipper nominations will decide in practise the actual order of despatch, a merit order was agreed as follows, primarily to test the capability of the network to accommodate proposed flows from Larne storage:

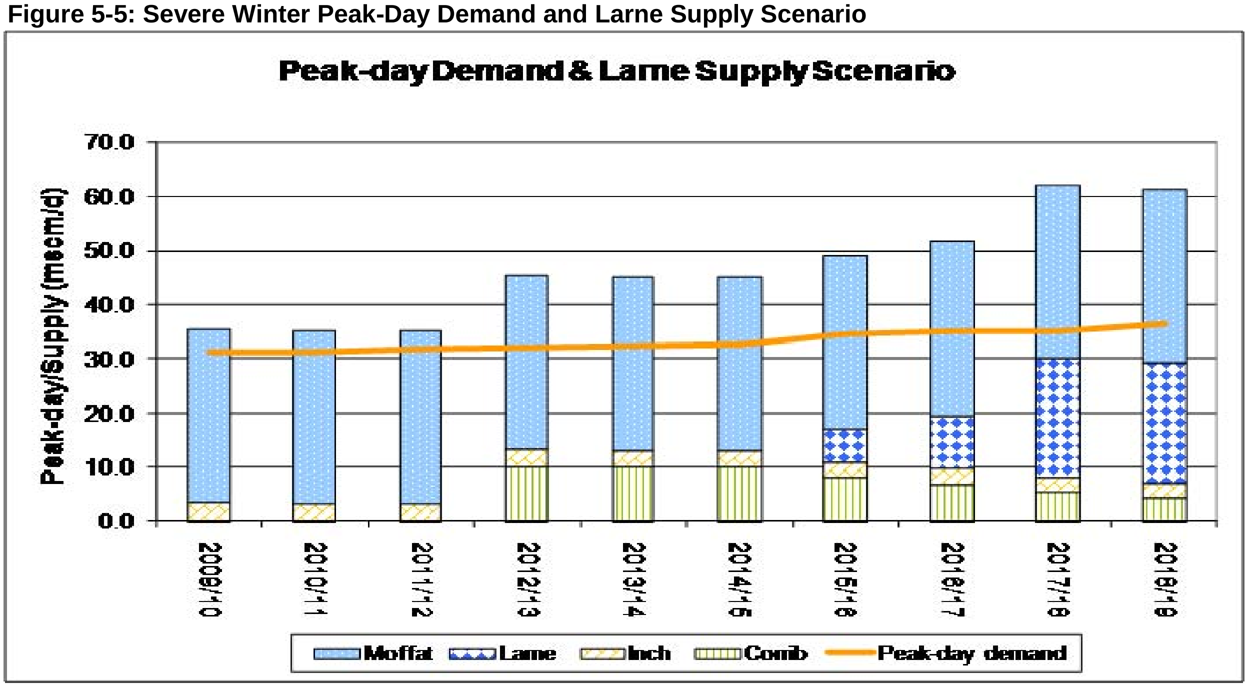
- Indigenous production - Kinsale and Corrib production gas;

- Storage gas – existing Kinsale;

- Storage gas – Larne;

- Supply balance required imported from Moffat.

Figure 5-5: Severe Winter Peak-Day Demand and Larne Supply Scenario



[26] It should be noted that in the event that both proposed storage projects at Larne were to proceed, significant investment would be required to facilitate such increased west-east and/or north-south flows. This scenario is outside of the scope of the JCS 2010.

Table 5-2: 1-in-50 Winter Peak-day Demand & Larne Combined Available Supply Sources

	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19
Mscm/d	**1-in-50 Winter Peak-day Demand**									
Power	11.8	11.9	12.1	12.0	11.9	12.0	12.1	12.7	12.8	13.9
I/C	4.6	4.6	4.7	5.0	5.2	5.4	5.4	5.4	5.5	5.5
RES	6.3	6.3	6.2	6.3	6.2	6.2	6.1	6.0	6.0	5.9
Own-use	0.4	0.4	0.4	0.3	0.3	0.3	0.4	0.4	0.3	0.4
Total Irish	23.1	23.2	23.4	23.6	23.5	23.9	24.0	24.6	24.6	25.6
IOM	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
NI	7.7	7.7	7.8	8.1	8.2	8.2	10.0	10.0	10.0	10.1
Total CAG	31.3	31.4	31.8	32.2	32.3	32.7	34.6	35.2	35.2	36.4
Mscm/d	**Potential Maximum Available Supply Sources**									
Moffat	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0
Inch + Moffat	35.5	35.3	35.2	35.1	35.0	34.9	34.8	34.8	34.7	34.7
Inch + Moffat + Corrib	35.5	35.3	35.2	45.1	45.0	44.9	42.9	41.6	40.0	39.1
Inch + Moffat + Corrib + Larne	35.5	35.3	35.2	45.1	45.0	44.9	48.9	51.6	62.0	61.1

See also Appendix 1: Peak-day demand forecasts

The modelling results indicate all demand flow requirements on both the Irish and the Northern Ireland transmission systems are achieved whilst maintaining the required pressure constraints, even if the start date for the first commercial production from the Corrib gas field is delayed by 1 year to October 2013. As is evident in the above table, current supplies from Moffat and Inch are forecast as being sufficient to meet the peak-day demand of the island's transmission systems until 2016/17.

However, it may not be possible to accommodate the maximum proposed Larne withdrawal rates of 22mscmd. Rates are limited by the NI demand, and the ability of the existing transmission systems to physically export gas to the Irish market. Route options for physical export from NI into Ireland include:

- Allowing the gas to enter into Ireland via the SNP under a CAG open configuration and/or,
- Reverse flow through SNIP to Twynholm and routed to Ireland via Brighouse Bay and the IC subsea system.

The requirement to maintain a minimum pressure of 55 barg at Dublin City Gates coupled with the demand profile in NI and on the SNP will determine the capacity available for gas to flow via the SNP into the Irish market.

Depending on the flow requirement, assumed available pressure from Moffat and the need to maintain a minimum pressure lift (16 Barg) across Beattock Compressor Station will determine the maximum reverse flow capability at Twynholm, whilst maintaining the minimum inlet pressure of 52 Barg at Brighouse Bay.

In this supply and demand scenario maintaining the above requirements limits the maximum Larne withdrawal rates to circa 20.8mscmd. Accommodating this rate of withdrawal was dependent upon the following:

- The level of demand in NI (including the proposed construction of a new CCGT at Kilroot);
- Routing 4.2mscm/d (incl. a CCGT on the SNP) down the SNP into Ireland, under a CAG open configuration;
- Routing 6.6mscm/d in reverse through SNIP via Twynholm and into Ireland via the IC system; and

- Beattock set to discharge at 63 Barg, based on achieving a minimum pressure lift of 16 barg on the assumed inlet pressure of 47 Barg available from Moffat.

- The requirement to maintain 55barg on the transmission system at Dublin

Maximising Larne withdrawal depends on (i) the level of NI demand, (ii) SNIP export capacity (with Twynholm operating in reverse mode) and (iii) SNP export capacity (CAG open configuration)

- SNIP import and export capacity is dependent upon prevailing pressure in onshore Scotland.

5.7.2 Average year, winter peak day demand

As with the severe winter 1-in-50 winter peak day analysis, all demand flow requirements on both the Irish and the Northern Ireland transmission systems are achieved whilst maintaining pressures within boundary conditions.

Modelling also indicated that it was theoretically possible to accommodate the maximum proposed Larne withdrawal rates of 22mscm/d in 2017/18 and 2018/19. Accommodating this rate of withdrawal was dependent upon the following:

- The level of demand in NI (including the proposed construction of a new CCGT at Kilroot)

- Routing 8.6mscm/d in reverse through SNIP via Twynholm and into Ireland via the IC system; and

- Assuming pressures of the order of 55 Barg are available from Moffat, thus sufficiently high enough to allow Beattock compressor station to be bypassed whilst maintaining a minimum inlet pressure of 52 Barg at Brighouse Bay compressor station.

- Routing 4.2mscm/d (incl. a CCGT on the SNP) down the SNP into Ireland, under a CAG open configuration;

5.7.3 Average year, summer minimum day demand

Maximum proposed injection rates to Larne storage of 12mscm/d in 2017/18 and 2018/19 have been received as a part of the consultation process in establishing the supply and demand scenarios for this year's JCS. Injection rates to Larne storage are maximised by routing the gas required via the SNIP and via Interconnector 2 (IC2) and up the SNP (CAG closed configuration with Block Valve A closed and Block Valve B open) in this supply scenario. Limiting the Twynholm capacity to 8.64mscm/d thereby limits the potential Larne injection rate.

Network analysis indicates that the maximum possible injection into Larne storage whilst limiting the Twynholm capacity to 8.64mscmd was 9.4mscmd in 2018/19. This is based upon:

- Routing 7mscmd up the SNP into NI from IC2, under a CAG closed configuration. It should be noted that this exceeds the original design capacity of the SNP pipeline. The result would be higher than anticipated pressure loss along the SNIP and SNP but no reinforcement would necessarily be required.

If restrictions on the capacity of Twynholm were removed, the proposed maximum potential injection rate of 12mscm/d into Larne storage may be accommodated in 2018/19, based upon balancing the flow into NI between SNP and SNIP as follows:

- Routing 7.1mscm/d up the SNP into NI from IC2, under a CAG closed configuration. It should be noted that this level of flow is above the original design capacity of the SNP and modifications may be required at the AGI connecting IC2 to SNP to facilitate such high flows.

- Routing 11.1mscm/d into SNIP via Twynholm.

It is important to note that given the summer minimum day represents the day of lowest forecast demand over the summer period; it is reflective of the best case scenario regarding maximising potential injection rates.

Operating the network in a CAG open configuration to allow surplus Irish supplies to be routed up the SNP, limits the level of injection to Larne storage.

- Allowing the Irish and NI systems to be operated separately under a CAG closed configuration ensures maximum levels of injection to Larne (higher pressures available at the southern end of SNP increase the SNP import capacity).

All other demand requirements were met whilst maintaining satisfactory network pressures.

5.8 Network analysis results for the Shannon LNG Supply Scenario

5.8.1 Severe winter, 1-in-50 peak day demand

The peak-day demand and supply balance for the Shannon LNG supply scenario is shown in Figure 5-6.

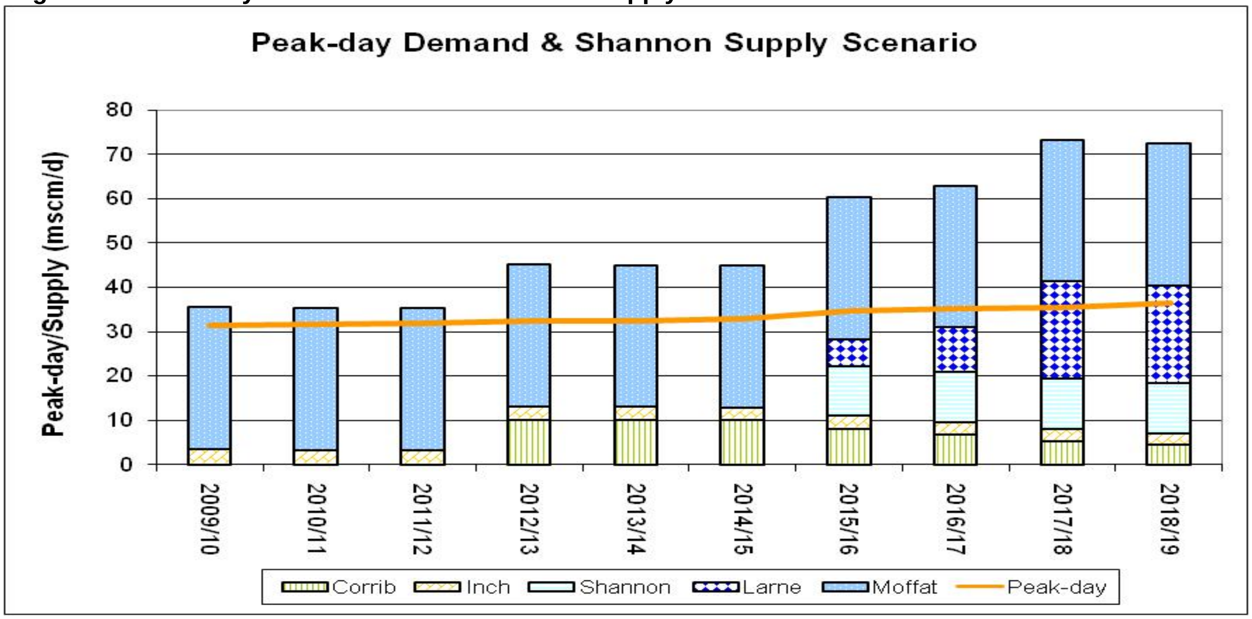
Entry capacity assumptions are as per the Larne supply scenario with the addition of Shannon LNG from October 2015/16 as per the latest Phase 1 profile received.

The following merit order was agreed as follows in order to test the capability of the network to accommodate the combined proposed flows from Corrib and Shannon LNG:

- Indigenous production - Kinsale and Corrib production gas;
- Storage gas – Kinsale existing;
- LNG – Shannon;
- Storage gas – Larne[27];
- Supply balance required imported from Moffat.

[27] See the Regulatory Authorities' note as regards the Larne Storage figures in Section 5.7.1.

Figure 5-6: Peak-day Demand and Shannon LNG Supply Scenario



Modelling indicated all demand flow requirements on both the Irish and the Northern Ireland transmission systems are achieved whilst maintaining the required pressure constraints. Given the demand profile and the ramping down of Corrib supply coincident with the supply of Shannon LNG, it was possible to accommodate the combined supply of west coast gas assumed to be available without reinforcement for all years with the exception of 2015/16. In this year, there was a requirement to constrain the total West Coast supply from the 211 GWh/d that was available to 192 GWh/d in order to remain within maximum and minimum operating pressure limits around the network.

In 2016/17 with a slight increase in Irish demand and the continued ramping down of Corrib production it was not necessary to constrict the West coast supply and the available c.198 GWh/d of supplies was absorbed by demand in Ireland without violating pressure constraints.

From 2017/18 onwards, Larne storage supplies exceed the NI demand and the excess is exported to the Irish market. The level of supply available from Larne is also such that no imports through Moffat are required on the peak day, i.e. indigenous supplies balance all-island peak-day demand. For these years the excess Larne supply can be routed into Ireland via the SNIP, Twynholm and the IC subsea system, with some export via the SNP, 'CAG open' configuration.

It should be noted that with the introduction of supplies from both Shannon and Larne (2015/16 onwards), flows through Moffat, Beattock and Brighouse Bay Compressor Stations are reduced or almost zero. Operation of the compressor stations and other equipment under these conditions will require investigation and validation.

5.8.2 Average year, winter peak day demand

As with the 1-in-50 winter peak day analysis, all demand flow requirements on both the Irish and the Northern Ireland transmission systems are achieved whilst maintaining pressures within boundary conditions. However, given the lower demand profile, the network was unable to accommodate the combined levels of gas available from Corrib and Shannon LNG in both 2015/16 and 2016/17 without breaching the required pressure boundary conditions. Restricting the combined available West Coast Gas from c.211 GWhr/d in 2015/16 and from 198 GWhr/d in 2016/17 to c. 181 GWhr/d and to 192 GWhr/d for the respective gas years with the balance supplied from Moffat ensures pressures constraints are maintained.

From 2017/18 onwards, as the rate of withdrawal from Larne storage ramps up, the level of supply available from Larne is also such that no imports through Moffat are required, i.e. indigenous supplies balance all-island demand.

For these years the excess Larne supply can be routed via SNIP, Twynholm and the IC subsea system, with some export via the SNP, 'CAG open' configuration.

5.8.3 Average year, summer minimum day demand

Combined levels of Irish supply sources are significantly higher than the forecast Irish demand from 2015/16 with Shannon LNG and Corrib online, resulting in a requirement to operate the network in a CAG open configuration and allow NI import the surplus gas up the SNP.

Given the assumption that Shannon LNG is lower down the merit order of supplies than Corrib gas in this scenario, it is necessary to limit the level of supply from Shannon to the balance of the residual Irish demand after Corrib supply and the level of gas that can be exported up the SNP.

Network modelling indicated it was possible to accommodate c. 7.7 mscm/d from the available 11.3 mscm/d at Shannon LNG in 2015/16 – routing c. 4.8 mscm/d up the SNP to supply SNP and NI demands. As Corrib production declines the level of available surplus supplies from Ireland to be exported to NI via the SNP decrease to 4.1 mscm/d in 2018/19.

Facilitating the export of surplus Irish supplies into NI via a CAG open network, limits the maximum possible injection rate into Larne storage, when compared to operating under a CAG closed configuration where higher pressures are available at the Southern end of the SNP, thus increasing the SNP import capacity.

From 2016/17, allowing the surplus gas from Irish supplies to be routed up the SNP it would not be possible to inject 12mscmd into Larne storage, without breaching minimum pressure constraints in NI.

Network analysis indicates that the maximum possible injection into Larne storage whilst limiting the Twynholm capacity to 8.64 mscm/d was 6.5 mscm/d in 2018/19. This is based upon:

- Routing 4.1 mscm/d of surplus Irish supplies up the SNP into NI, under a CAG open configuration; and
- Routing 8.64 mscm/d into SNIP via Twynholm

If restrictions on the capacity of Twynholm were removed, pressures available in onshore Scotland in this supply and demand scenario suggest the maximum potential injection rate into Larne storage increases to 10.4 mscm/d in 2018/19, based upon the following:

- Routing 4.1 mscm/d of surplus Irish supplies up the SNP into NI, under a CAG open configuration; and
- Routing 12.6 mscm/d into SNIP via Twynholm.

If the supply sources were rebalanced such that Irish supplies were matched to Irish demands alone and the network operated under a CAG closed configuration, analysis indicated that it was possible to achieve 12mscm/d of injection to Larne in 2018/19. This was dependent upon:

- Routing 6.4 mscm/d of Moffat gas from IC2 up the SNP into NI, under a CAG closed configuration;
- Routing 11.9 mscm/d into SNIP via Twynholm; and
- Shannon LNG supply was limited to 7.3 mscm/d, based on 4.4 mscm/d available from Corrib.

It should be noted that flows exceeding 5 mscm/d are above the original design capacity of the SNP and modifications may be required at the AGI connecting IC2 to SNP to facilitate such high flows.

5.9 Network analysis results for the Extended Kinsale Supply Scenario

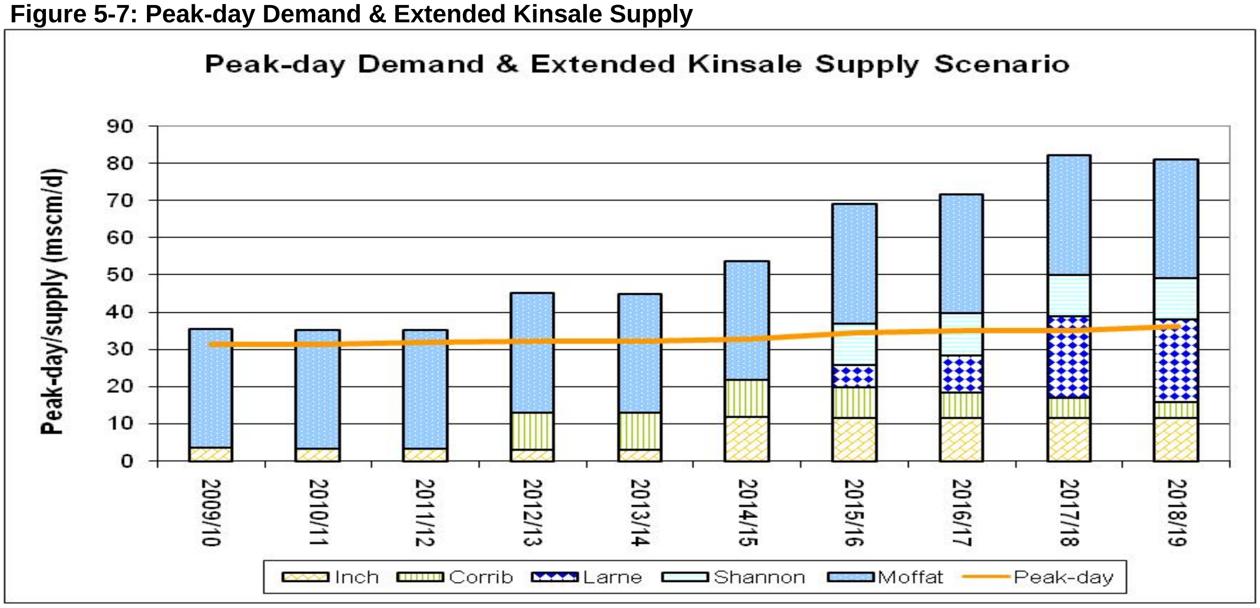
5.9.1 Severe winter, 1-in-50 peak day demand

The peak-day demand and supply balance for the Kinsale supply scenario is shown in Figure 5-7. Entry capacity assumptions are as per the Shannon LNG supply case with additional storage capacity available from October 2014/15 via Inch, when the Ballycotton facility is proposed to be developed. The potential combined level of supply from Irish sources is circa 30 mscm/d.

The following merit order was agreed as follows in order to test the capability of the network to accommodate the combined proposed flows from Corrib, Kinsale and Shannon LNG:

- Indigenous production - Inch and Corrib production gas;
- Storage gas – Inch – (Ballycotton developed);
- Storage gas – Larne[28];
- LNG – Shannon;
- Supply balance required imported from Moffat.

Figure 5-7: Peak-day Demand & Extended Kinsale Supply



Modelling indicated that all demand flow requirements on both the Irish and the Northern Ireland transmission systems are achieved whilst maintaining the required pressure constraints. However, deep network reinforcement would be required in order to accommodate the proposed combination of available Irish supply sources.

Both insufficient demand and transmission system constraints result in the inability to accommodate maximum flows from all supply sources in Ireland and Larne in this scenario. From 2015/16 the combined volume of maximum West Coast, Inch and Larne gas supplies cannot be accommodated; the existing transmission system could not physically accommodate maximum supply from all of these supply sources.

[28] See the Regulatory Authorities' note as regards the Larne Storage figures in Section 5.7.1.

The purpose of this scenario was to assess the feasibility of the existing network to accommodate the proposed maximum rates of withdrawal from the expanded Kinsale storage facility (c.11.5mscm/d). Due to the system limitation outlined above, for modelling purposes the merit order of supplies had to be rebalanced with Moffat supply running ahead of Shannon LNG in order to reduce the level of Irish supply sources and to focus on the effect of supplies from the Kinsale facility.

Even in 2014/15, with no Shannon LNG or Larne assumed, the transmission system cannot accommodate the combined maximum supplies of Inch and Corrib. Similar to the limitations on West Coast gas supply detailed in the Section 5.8, there are physical limitations on the volume of gas supply that can be transported from West Coast and Inch supply sources.

Network modelling indicated as flows from Inch increase, the system's capacity to transport gas from the west coast diminishes, and conversely, increased West Coast gas supplies result in the system's capacity to transport Inch gas diminishing. It should be noted, the change of rate in Inch supply does not equate to the rate of change in West Coast supply, i.e. the relationship is not 1 to 1.

Network analysis has determined that the maximum proposed withdrawal rate of gas from the Inch storage facility, 11.5mscmd, is feasible only in 2018/19, when supply from Corrib has tailed off to c. 4.4mscm/d. This indicates that depending on the level of Irish demand and the supply mix of Inch and West Coast gas, existing infrastructure is limited in the combinations of supply from these sources that can be accommodated. The Inch to Midleton pipeline is assumed to have been up-rated to 70 Barg for this analysis; further engineering analysis would be required to confirm the validity of this assumption.

From 2017/18 onwards, Larne storage supplies exceed the NI demand and the excess is exported to the Irish market, under a CAG open configuration. The level of supply available from Larne is also such that no imports through Moffat are required, i.e. indigenous supplies balance all-island demand.

For these years the balance of surplus Larne supply routed via SNP and SNIP is as follows:

- 2017/18 – 4.3 mscm/d exported into Ireland via SNP, and 6.2 mscm/d routed in reverse via SNIP;
- 2018/19 – 4.2 mscm/d exported into Ireland via SNP, and 6.5 mscm/d routed in reverse via SNIP.

5.9.2 Average year, winter peak day demand

As with the severe winter 1-in-50 winter peak day analysis, all demand flow requirements on both the Irish and the Northern Ireland transmission systems are achieved whilst maintaining pressures within boundary conditions. However, given the lower demand profile the network was also in this case unable to accommodate the combined levels of gas available from Corrib and Inch without breaching the required pressure boundary conditions. In the early years, the maximum Inch withdrawal rates that can be accommodated are approximately 9mscm/d, increasing to 11.4mscm/d in 2018/19. As Corrib production declines, the export capacity of Inch increases. It is important to note, however, that the rate of decline in Corrib production does not equate to the rate of increase of Inch withdrawals.

From 2017/18 onwards, Larne storage supplies exceed the NI demand and the excess is exported to the Irish market. The level of supply available from Larne is also such that no imports through Moffat are required, i.e. indigenous supplies balance all-island demand.

For these years the excess Larne supply can be routed via SNIP, Twynholm and the IC subsea system, with some export via the SNP.

5.9.3 Average year, summer minimum day demand

Though PSE Kinsale Energy has not provided specific injection rates for the proposed expansion of the Inch storage facility, they have indicated they may inject up to 9mscm/d in the summer of 2014. Network analysis indicates the maximum injection that is feasible with existing infrastructure on the 2013/14 Summer Minimum day is c. 7.0mscm/d. Post 2013/14 the injection requirement of circa 6.5mscm/d is feasible on the summer minimum demand day for each year analysed due to the high pressures present in the southern section of the Irish transmission system.

Given the higher injection rate to Inch storage, it was possible for the network to accommodate the combined available supply from Corrib & Shannon LNG without reinforcement for all years, by operating the network under a CAG open configuration and allowing the surplus supply to enter the SNP.

In 2018/19, given the ramping down in Corrib production, there is no surplus of gas supply to be routed to NI via the SNP and as such the network is configured as CAG closed. Network analysis indicates that the maximum possible injection into Larne storage whilst limiting the Twynholm capacity to 8.64mscm/d under this configuration was 9.4mscm/d in 2018/19.

This is dependent upon SNP importing 7mscm/d of gas via IC2. It should be noted that flows exceeding 5 mscm/d are above the original design capacity of the SNP and modifications may be required at the AGI connecting IC2 to SNP to facilitate such high flows.

If restrictions on the capacity of Twynholm were removed, pressures available in onshore Scotland in this supply and demand scenario suggest the maximum potential injection rate into Larne storage increases to c.12mscm/d in 2018/19. The balance of flows between SNIP and SNP is 12.2mscm/d and 6mscm/d respectively.

It is important to note that given that the summer minimum day represents the day of lowest forecast demand over the summer period, it is reflective of the best case scenario regarding maximising potential injection rates.

Network modelling also identified that maximising Inch injection rates depends on (i) prevailing pressure in the southern section of the transmission system in Ireland and (ii) Cork area demand. The prevailing pressure in the southern part of the Irish transmission system depends on the source of supply. The presence of Shannon LNG allows for maximum pressure in the southern part of the ring main.

All other demand requirements were met whilst maintaining satisfactory network pressures.

5.10 Peak-day and Local Reinforcement Requirements

The ability of the local area 40 and 19 barg networks in Dublin, Cork, Waterford, the North East and Limerick areas, to meet the forecast peak-day demands was analysed as part of the JCS process. This analysis showed that there was sufficient capacity to meet the current forecast peak-day demand over the period in all the local area networks.

Currently, there are a number of new connection queries in the Limerick area. It is worth noting, if these loads (which are above assumed normal growth levels) were to materialise, reinforcement of the local transmission system may be required. BGN are currently investigating the potential requirements in relation to these connection queries.

6 Summary & Conclusions

The analysis presented in the 2010 Joint Gas Capacity Statement does not differ markedly from that carried out last year. The 2010 JCS again examines the aggregate gas demand of Ireland and Northern Ireland, as well as the available supplies needed to meet that demand, over a 10 year period, whereas the previous statement covered 7 years. Extending the period examined aligns with European standards and is considered to be a more suitable timeframe,

The 2010 JCS provides the best estimate of the adequacy of the network to meet demand growth on the island and the Regulatory Authorities welcome the production of this second JCS as part of the development of a harmonised approach to security of supply on the island under the CAG project.

6.1 Gas Demand

The forecast gas demand of the island is lower than that published in the 2009 JCS mainly on account of the economic downturn but also because of the projected decrease in electricity demand and improved energy efficiency targets. Forecast Irish annual gas demand is lower than that presented in the 2009 JCS particularly towards the middle of the forecast period (being over 12% lower between 2011/12 and 2013/14) but is projected to increase significantly towards the end of the forecast period. NI annual gas demand is similarly lower than that presented last year but, unlike the Irish case, growth is projected throughout the forecast period, particularly from 2015/16 when the proposed Kilroot CCGT comes into operation. Peak day demand on the island is not expected to grow considerably in the medium term but is similarly projected to increase significantly from 2013/14. As per the 2009 JCS, the outlook for future gas demand is more uncertain compared to previous years, due to the economic recession.

As regards Irish annual gas demand in 2008/09, an overall decrease of -3.1% was experienced due to the deepening economic recession and reduced demand from the power generation sector. However, Irish peak day gas demand grew by 5.5% in 2008/09 due to colder weather and generally lower gas prices.

Northern Ireland annual gas demand in 2008/09 decreased by 7.9%, primarily as a result of economic conditions and a lower despatch order at the Ballylumford power station. Since power stations account for 76% of the gas volumes used in Northern Ireland any reduction in volumes shipped to power stations will have a significant impact to the overall figure. For example, even though the overall demand was lower, distribution companies experienced a growth in volumes of 8.7% over the same period.[29]

Natural gas continues to be a very important fuel for power generation, and remains the fuel of choice for new thermal power station projects. Over 2,500MW of new gas-fired CCGT and OCGT capacity is to be commissioned over the next ten years in order to meet growth in electricity demand and to replace older and less efficient generating stations (c.1,200MW). Power sector gas demand is forecast to contract between 2009/10 and 2013/14 due to decreased demand for electricity, the roll-out of renewable generation projects, further interconnection with GB and projected rises in gas prices. However, recovery is expected from 2014/15 on account of increasing electricity demand as industry emerges from the effects of the recession. The potential for increased use of gas fired generation due to increasing carbon prices is also expected to stimulate higher demand in the latter half of the forecast period.

Forecast I/C demand is lower in the early years than that presented in the 2009 JCS. I/C demand is expected to remain largely flat during this period. However, from 2012/13 results are more positive as an aggressive economic recovery has been assumed as part of this year's JCS.

The downturn has also affected projections for residential gas demand which is forecast to be c. 14.2% lower by 2015/16 than that published last year. This decrease is also the result of increased savings from energy efficiency measures as set out in the Irish Government's *National Energy Efficiency Action Plan 2009–20*. It should be noted that uncertainty exists in relation to the implementation of the energy efficiency initiatives for existing and new housing. However, it is considered that should the Irish government's energy efficiency programmes not come to pass or should the relevant targets not be met, it would not result in the need for additional network development.

[29] Data source: NI annual actual exit quantities 2008/09 and 2007/08

6.2 Sources of Gas

In the short term, the island's demand will continue to be met from GB imports via the Moffat Entry Point and from gas storage at Inch. However, security of gas supply on the island is likely to be enhanced by the development of further gas sources in the coming years.

In relation to the introduction of Corrib gas, the planning application for the infrastructure required to connect the final onshore section of the pipeline from its landfall at Glengad to the Bellanaboy terminal is currently before An Bord Pleanála. Flows from Corrib have been analysed in all of the previous Gas Capacity Statements (including last year's JCS with the Utility Regulator) and, as part of the modelling undertaken, the commencement date of the project has been pushed forward year on year with specific scenarios developed to address further delays. While there is no immediate risk posed by these delays (principally due to the significant reduction in gas demand on account of the economic recession), further delay to the Corrib project will impact on the security of gas supply in Ireland. Gas flows from Corrib will likely assist Ireland to meet forthcoming provisions of the EU Proposed Regulation on security of gas supply (see Section 6.5 below).

The Regulatory Authorities also note the likely increasing importance of gas storage as a supply source over the coming years. Analysis is ongoing in relation to the technical and commercial feasibility of salt-cavity gas storage in the Larne area as part of the project of Islandmagee Storage Ltd and the North East Storage project jointly led by BGE and Storengy. PSE Kinsale Ltd also plan to significantly enhance their gas storage capacity by developing the Ballycotton gas field off Inch. This development would ensure the long-term commercial viability of the Kinsale offshore gas storage facility and significantly contribute to security of gas supply on the island.

As regards the Shannon LNG project, the CER approved a consent to construct a pipeline from the proposed terminal to the BGÉ's network in December 2009 and a decision of the European Commission on their request for an exemption from regulated Third Party Access is expected in August of this year.

The proposed timings of these projects have been used to develop the three supply scenarios. The impact of these supply scenarios and of forecast demand on the transmission system over the next ten years was modelled by BGN using specialist network analysis software. The aim of the scenario analysis is to examine whether the system is adequate to cope with a reasonable expectation of demand. It should be noted that commercial incentives for further development of gas supplies in Ireland and associated infrastructure have not been taken into consideration in the 2010 JCS as per previous reports. Such considerations will be taken into account as part an examination of transmission charges under the CAG project. It should also be taken into account that, while this JCS has examined potential gas flows from various Entry Points, actual flows will be determined by shipper nominations.

6.3 Modelling Results

6.3.1 Demand Requirements

The outlook for security of gas supply on the island remains positive given the potential introduction of new supply sources in the coming years. The results of modelling in the JCS 2010 are also positive in that they indicate that the existing transmission infrastructure has sufficient capacity to transport the necessary gas to meet the current forecast demand scenario. The Regulatory Authorities therefore do not consider that reinforcement of the transmission system in Ireland and Northern Ireland is necessary at the current time in order to sustain adequate system pressures. This view is based on the following conclusions drawn from the modelling of the supply and demand scenarios:

- There is more than sufficient supply capacity available between Inch, Corrib, Larne and Moffat Entry Points to meet the forecast severe winter 1-in-50 peak-day demands of Ireland and Northern Ireland to 2018/19.
- The network modelling analysis indicates all demand flow requirements on both the Irish and the Northern Ireland transmission systems are achieved whilst maintaining the required pressure constraints, even in the event that the start date for the first commercial production from the Corrib gas field is delayed by 1 year to October 2013.
- The ability of the local area networks in Dublin, Cork, Waterford, the North East and Limerick areas to meet the forecast peak-day demands was examined. This analysis has shown that there is sufficient capacity to meet the current forecast peak-day demand over the period in all the local area networks.

6.3.2 Potential Need for Future Reinforcement

The transmission networks in Ireland and Northern Ireland can accommodate a number of combinations of supply, but this depends on the timing and levels of proposed new gas supplies, and the demand profile assumed. Though the network can maintain supplies at all levels of demand without reinforcement, this conclusion is subject to a number of restrictions relating to the balance between the various supplies.

Transporting large volumes of gas from the west (Corrib and Shannon LNG) and south (Kinsale) to meet the majority of Irish demand in the east results in a significant pressure drop across the Irish transmission system. This implies physical limits to the combined levels of gas that can be delivered to the east coast, requiring restrictions depending on the balance between supplies. Significant reinforcement would be required to remove these restrictions in order to accommodate these potential maximum levels of supplies from the south and west.

In addition, depending on the introduction and timing of new gas infrastructure, the potential flows between Ireland and Northern Ireland may vary significantly. Such changes in gas flows correspondingly impact upon the requirement for reinforcement of the onshore and offshore systems over the coming years. The Regulatory Authorities therefore wish to emphasise the importance of timely information in relation to the commissioning of future gas projects.

In certain supply scenarios, the combined maximum supply from the island's supply sources will exceed the forecast peak-day demand of Ireland and Northern Ireland. One solution would be to physically export gas to GB. However, the issues associated with such a scenario are outside the scope of this year's JCS.

The current network configuration and prevailing pressure in onshore Scotland may limit the levels of gas that can be injected and withdrawn to and from Larne storage. In all scenarios, the maximum available gas from Larne exceeds the gas demand in NI. The SNP currently has insufficient capacity to export all of this surplus gas to Ireland. A number of potential solutions are possible depending on the other additional supplies that are available:

- Allowing an amount of the surplus gas to enter into Ireland via the SNP under a CAG open configuration; and/or
- Reverse flow through SNIP to Twynholm and routed to Ireland via Brighouse Bay and the IC subsea system using existing infrastructure. The maximum reverse flow capability through SNIP is, however, dependent upon prevailing pressure in onshore Scotland which is dictated by the supply scenario.

Facilitating the export of surplus supply from Ireland to Northern Ireland by operating in a CAG open configuration may restrict the maximum levels of gas which may be injected into Larne on a summer minimum day (when compared with a CAG closed network configuration).

The modelling results also indicate that the introduction of supplies from both Shannon and Larne (from 2015/16 onwards) may cause flows through Moffat, Beattock and Brighouse Bay compressor stations to be significantly reduced. The operation of the compressor stations under such conditions would require investigation and validation. The 2009 JCS identified a potential scenario where towards 2015/16 the projected flows from Moffat and the IC system would marginally exceed the assumed maximum capacity of the two compressor stations in Scotland.[30] BGN has carried out performance testing on its two compressor stations at Beattock and Brighouse Bay during 2009, to determine the maximum theoretical capacity of each station. The Moffat supply forecasts in the 2010 JCS are within these determined capacities of the Beattock and Brighouse Bay compressor stations, for all years in all scenarios of the JCS.

In summary, the requirement for future investment remains highly dependent upon the timing and combination of new supply sources. The Regulatory Authorities will closely examine this issue as part of the preparation of future Joint Gas Capacity Statements and welcome continuing updates from all developers as to the progress of proposed gas supply projects.

---

[30] This is the 'Low Supply' scenario which involved a one year delay to the Corrib project until, and no additional sources of supply coming on stream within the forecast period and no gas from Inch after 2013/14,

6.3.3 Effect of January 2010 Record Peak Demand

The winter of 2009/10 was exceptional in terms of the demands that were placed on the gas systems in Ireland and Northern Ireland. Despite this record demand, the SNIP and IC system delivered sufficient supplies at all times and no curtailment of supplies was necessary. In particular, IC2 ensured that the Irish transmission system could meet peak-day gas demand during this period of severe weather. Without IC2 it may have been necessary to curtail gas supplies to the power sector in Ireland on 7th January during record electricity peak demand. No major incidents were encountered on the transmission and distribution systems to meet this peak-day demand.

The low levels of wind-powered electricity generation experienced during this period highlights the importance of gas-fired generation in meeting required electricity demand during cold weather periods and, as has been noted in previous reports, there will continue to be a substantial requirement for conventional thermal generation to back-up wind generation, especially on calm days.

6.4 Longer Term Issues

It is considered that the future operation of the transmission system as part of the CAG project, as well as the potential development of new sources of supply, will serve to enhance the capability of the network to meet demand growth on the island. While the timings of these projects are not certain, it should be noted that the Regulatory Authorities are mindful of the importance of these developments to the security of gas supply.

As has been noted above, the integration of the two systems under CAG, the possibility of increased flows from Kinsale storage and the proposed introduction of gas storage at Larne, as well as greater flows from the West from Corrib and the Shannon LNG project will have a significant impact on the movement of gas on the island and on the Scottish onshore system. In later years there is the potential for reverse flows through the SNP, SNIP and IC1 and 2 in order to improve the ability of the system to move gas from the Larne storage facility to the south. In January of this year Gaslink submitted a Code Modification (A043) which proposes to change the Code of Operations in Ireland in order to facilitate virtual reverse flow at Moffat. This Code Modification proposal affects a number of areas including the Moffat Agency Arrangements, the development of corresponding virtual reverse flow facility upstream of Moffat, Regulatory Arrangements, Transporter Arrangements and Shipper Arrangements. Gaslink have been engaging with the Regulatory Authorities and Mutual Energy Limited, as well as with National Grid and the Moffat Agent, to develop high level principles for a reverse flow product at Moffat. This work will continue to be progressed in 2010 and 2011 by Gaslink, Mutual Energy Limited and the Regulatory Authorities on the proposed virtual reverse flow arrangements.

6.5 Interaction with GB

GB imports through Moffat will remain an integral aspect of the island's transmission systems. The reliance on such imports will continue until supplies from the proposed projects are brought on stream. While the scenarios examined involve a reduced dependence on gas through Moffat due to the commencement of the majority of the developments previously noted, it remains likely that a proportion of gas would be sourced from Moffat, in particular when supplies from the Corrib gas field decline from their initial peak. The introduction of salt cavity storage at Larne will likely require further interaction with GB in respect of storage export and commercial reverse flow through Moffat. Overall, the commercial and operational arrangements of the all-island gas market will continue to be heavily influenced by developments in GB.

Over the past year, the Regulatory Authorities have also provided input to the relevant government departments on the production of an EU Regulation concerning measures to improve security of gas supplies which will build upon Directive 2004/67/EC.[31] The Regulation is likely to introduce new requirements concerning the development of preventative and emergency action plans, as well as new infrastructure and supply standards. Regional cooperation both between Member States and between relevant natural gas undertakings is at the heart of this proposed Regulation and is present in all of the above obligations. The Regulatory Authorities regard this regional dimension as positive, in particular regarding measures to prevent and respond to emergencies, and look forward

---

[31] COM(2009) 363/4, *Proposal for a Regulation of the European Parliament and the Council concerning measures to safeguard security of gas supply and repealing Directive 2004/67/EC*.

to further engaging with relevant parties in GB to develop these arrangements. The Regulation is expected to be finalised in Q3 of 2010 and the Regulatory Authorities will continue to monitor its development.

6.6 Conclusion of the Regulatory Authorities

Overall, the outlook for the island's security of gas supply remains relatively positive due to the various gas infrastructure projects which may provide significant supplies into Ireland and Northern Ireland in later years. The recently announced gas storage expansion at the PSE Kinsale Energy facility is a welcome development in this regard. The Regulatory Authorities therefore do not consider that it is necessary to undertake any immediate actions to address potential concerns about security of gas supply.

The new sources of supply described in the JCS may significantly change the direction and nature of flows on the island's transmission network. As is noted above, scenario analysis shows that reinforcement is not currently required to maintain safe system pressures, given the current forecast demand. However, it is evident that, should a number of these projects come into operation at the same time, without investment allowable minimum operating pressures might not be obtainable. In addition to monitoring developments, the Regulatory Authorities would therefore like the Transmission System Operators in both jurisdictions to continue to investigate the most cost effective options for network reinforcement to deal with longer term pressure maintenance issues in the event of increasing flows from both the West and South in Ireland in light of flows from Corrib, Shannon and Inch, and also from the potential storage gas facilities at Larne. The Regulatory Authorities will keep this issue under review for future Statements.

The Regulatory Authorities welcome the continued co-operation within the framework of the CAG project and would like to thank all parties involved in the preparation of the JCS 2010.

Appendix 1: Peak-day demand forecasts

Irish Peak-day demand forecast

The Irish peak-day demands are summarised in Tables A1-1 to A1-3. These represent the forecast peak-day demand under severe 1 in 50 weather conditions, i.e. weather conditions so severe that statistically they are only likely to occur once every fifty years.

Only the distribution peak-day demand is weather corrected to 1 in 50 weather conditions. The power stations and transmission connected I/C sites are not weather corrected, as their daily demand tends to be driven by relative fuel-prices and economic growth etc (and in aggregate are not weather sensitive). The process for deriving the peak-day demands may be summarised as follows:

- The daily demand from each power station is generated directly from a merit-order stack model of the electricity market;
- The daily demand of the transmission connected Daily Metered (DM) I/C sites is derived from their forecast annual demand, using the historical daily profile for the sector;
- The daily demand of the distribution connected DM I/C sites is derived from their forecast annual demand (weather corrected), using a profile derived from a regression model (which is used to derive the relationship between the daily demand of the sector and the weather, and takes account of 1 in 50 weather conditions); *and*
- The daily demand of the Non-Daily Metered (NDM) sector is similarly derived from their forecast annual demand (weather corrected), using a profile derived from a regression model (which takes account of 1 in 50 weather conditions).

The daily gas demand from each of the above sectors is then combined into its power, I/C and residential components. This involves splitting the NDM peak-day demand into its residential and I/C components. The Irish peak-day demand is assumed to be equal to the aggregate peak-day demand of the power, I/C residential sectors.

The daily demand for the Irish power sector is based on the likely usage of Irish power stations taking into account forward fuel prices, etc. Assumptions include the peak day availability of non gas fired stations. The peak day power sector forecast demand is less than the sum of the maximum potential demand (as it is considered unlikely that all gas fired stations would operate at maximum potential load on a peak day).

NI Peak-day demand

The NI peak-day demand was derived from information provided by PTL and Utility Regulator. In addition, provision was also made for a future 430 MW CCGT at Kilroot. The peak-day forecast is summarised by sector in Table A1-4.

IOM Peak-day forecast

The peak-day demand forecast for the IOM was based on information provided by the Manx Electricity Authority (MEA), who also operate the natural gas system on the IOM.

In the tables that follow, volume conversion calculations have been carried out using a weighted average of forecast peak day supplies for the particular supply scenario and take into account the relevant calorific value of the gas delivered at each Entry Point.

Table A1-1: 1-in-50 Winter Peak-day Demand & LARNE Supply Scenario

	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19
ENERGY	GWh/d									
Power	129.2	130.5	132.5	130.2	128.2	130.2	131.2	138.6	139.8	151.8
I/C	50.4	50.2	51.8	53.6	55.9	58.3	58.9	59.2	59.5	59.9
RES	69.6	69.1	68.4	67.8	67.1	66.5	66.0	65.5	65.0	64.5
Own-use	4.8	4.8	4.9	3.4	3.4	3.5	4.5	4.1	3.8	4.1
Total Irish	254.0	254.5	257.6	254.9	254.6	258.5	260.5	267.4	268.1	280.3
IOM	5.7	5.8	6.2	6.3	6.4	6.5	6.6	6.6	6.7	6.8
NI	84.2	85.1	86.2	87.3	88.4	89.1	108.3	109.0	109.6	110.3
Total CAG	343.9	345.4	350.0	348.4	349.4	354.0	375.3	383.0	384.5	397.5
Inch	36.2	34.3	33.2	32.1	31.0	30.2	29.4	29.0	28.7	28.4
Corrib	0.0	0.0	0.0	104.5	104.5	104.5	84.6	70.8	55.4	45.9
Larne	0.0	0.0	0.0	0.0	0.0	0.0	66.2	110.5	230.0	230.5
Shannon	N/A									
Moffat	307.6	311.0	316.8	211.8	213.9	219.2	195.2	172.8	70.5	92.7
Total	343.9	345.4	350.0	348.4	349.4	354.0	375.3	383.0	384.5	397.5
VOLUME	Mscm/d									
Power	11.8	11.9	12.1	12.0	11.9	12.0	12.1	12.7	12.8	13.9
I/C	4.6	4.6	4.7	5.0	5.2	5.4	5.4	5.4	5.5	5.5
RES	6.3	6.3	6.2	6.3	6.2	6.2	6.1	6.0	6.0	5.9
Own-use	0.4	0.4	0.4	0.3	0.3	0.3	0.4	0.4	0.3	0.4
Total Irish	23.1	23.2	23.4	23.6	23.5	23.9	24.0	24.6	24.6	25.6
IOM	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
NI	7.7	7.7	7.8	8.1	8.2	8.2	10.0	10.0	10.0	10.1
Total CAG	31.3	31.4	31.8	32.2	32.3	32.7	34.6	35.2	35.2	36.4
Inch	3.5	3.3	3.2	3.1	3.0	2.9	2.8	2.8	2.7	2.7
Corrib	0.0	0.0	0.0	10.0	10.0	10.0	8.1	6.8	5.3	4.4
Larne	0.0	0.0	0.0	0.0	0.0	0.0	6.0	10.0	20.8	20.9
Shannon	N/A									
Moffat	27.9	28.2	28.7	19.2	19.4	19.8	17.7	15.6	6.4	8.4
Total	31.3	31.4	31.8	32.2	32.3	32.7	34.6	35.2	35.2	36.4

Table A1-2: Peak-day Demand & SHANNON LNG Supply Scenario

	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19
ENERGY	GWh/d									
Power	129.2	130.5	132.5	130.2	128.2	130.2	131.2	138.6	139.8	151.8
I/C	50.4	50.2	51.8	53.6	55.9	58.3	58.9	59.2	59.5	59.9
RES	69.6	69.1	68.4	67.8	67.1	66.5	66.0	65.5	65.0	64.5
Own-use	4.8	4.8	4.9	3.4	3.4	3.5	2.9	2.4	1.9	2.2
Total Irish	254.0	254.5	257.6	254.9	254.6	258.5	258.9	265.6	266.3	278.5
IOM	5.7	5.8	6.2	6.3	6.4	6.5	6.6	6.6	6.7	6.8
NI	84.2	85.1	86.2	87.3	88.4	89.1	108.3	109.0	109.6	110.3
Total CAG	343.9	345.4	350.0	348.4	349.4	354.0	373.8	381.3	382.7	395.6
Inch	36.2	34.3	33.2	32.1	31.0	30.2	29.4	29.0	28.7	28.4
Corrib	0.0	0.0	0.0	104.5	104.5	104.5	84.6	70.8	55.4	45.9
Larne	0.0	0.0	0.0	0.0	0.0	0.0	66.2	110.5	171.3	193.8
Shannon	0.0	0.0	0.0	0.0	0.0	0.0	107.4	127.0	127.0	127.0
Moffat	307.6	311.0	316.8	211.8	213.9	219.2	86.2	44.1	0.3	0.6
Total	343.9	345.4	350.0	348.4	349.4	354.0	373.8	381.3	382.7	395.6
VOLUME	Mscm/d									
Power	11.8	11.9	12.1	12.0	11.9	12.0	12.0	12.7	12.7	13.8
I/C	4.6	4.6	4.7	5.0	5.2	5.4	5.4	5.4	5.4	5.4
RES	6.3	6.3	6.2	6.3	6.2	6.2	6.0	6.0	5.9	5.9
Own-use	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2
Total Irish	23.1	23.2	23.4	23.6	23.5	23.9	23.7	24.3	24.3	25.3
IOM	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
NI	7.7	7.7	7.8	8.1	8.2	8.2	9.9	10.0	10.0	10.0
Total CAG	31.3	31.4	31.8	32.2	32.3	32.7	34.2	34.8	34.9	36.0
Inch	3.5	3.3	3.2	3.1	3.0	2.9	2.8	2.8	2.7	2.7
Corrib	0.0	0.0	0.0	10.0	10.0	10.0	8.1	6.8	5.3	4.4
Larne	0.0	0.0	0.0	0.0	0.0	0.0	6.0	10.0	15.5	17.6
Shannon	0.0	0.0	0.0	0.0	0.0	0.0	9.6	11.3	11.3	11.3
Moffat	27.9	28.2	28.7	19.2	19.4	19.8	7.8	4.0	0.0	0.1
Total	31.3	31.4	31.8	32.2	32.3	32.7	34.2	34.8	34.9	36.0

Table A1-3: Peak-day Demand & KINSALE Supply Scenario

	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19
ENERGY	GWh/d									
Power	129.2	130.5	132.5	130.2	128.2	130.2	131.2	138.6	139.8	151.8
I/C	50.4	50.2	51.8	53.6	55.9	58.3	58.9	59.2	59.5	59.9
RES	69.6	69.1	68.4	67.8	67.1	66.5	66.0	65.5	65.0	64.5
Own-use	4.8	4.8	4.9	3.4	3.4	2.1	1.7	1.7	2.4	2.7
Total Irish	254.0	254.5	257.6	254.9	254.6	257.1	257.7	265.0	266.8	279.0
IOM	5.7	5.8	6.2	6.3	6.4	6.5	6.6	6.6	6.7	6.8
NI	84.2	85.1	86.2	87.3	88.4	89.1	108.3	109.0	109.6	110.3
Total CAG	343.9	345.4	350.0	348.4	349.4	352.6	372.6	380.6	383.1	396.1
Inch	36.2	34.3	33.2	32.1	31.0	95.7	102.9	103.4	105.1	120.8
Corrib	0.0	0.0	0.0	104.5	104.5	104.5	84.6	70.8	55.4	45.9
Larne	0.0	0.0	0.0	0.0	0.0	0.0	66.2	110.5	222.6	229.4
Shannon*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moffat	307.6	311.0	316.8	211.8	213.9	152.4	119.0	95.9	0.0	0.0
Total	343.9	345.4	350.0	348.4	349.4	352.6	372.6	380.6	383.1	396.1
VOLUME	Mscm/d									
Power	11.8	11.9	12.1	12.0	11.9	12.2	12.2	12.8	13.0	14.1
I/C	4.6	4.6	4.7	5.0	5.2	5.5	5.5	5.5	5.5	5.5
RES	6.3	6.3	6.2	6.3	6.2	6.2	6.1	6.1	6.0	6.0
Own-use	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.3
Total Irish	23.1	23.2	23.4	23.6	23.5	24.1	23.9	24.6	24.7	25.8
IOM	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
NI	7.7	7.7	7.8	8.1	8.2	8.3	10.1	10.1	10.2	10.2
Total CAG	31.3	31.4	31.8	32.2	32.3	33.0	34.6	35.3	35.5	36.7
Inch	3.5	3.3	3.2	3.1	3.0	9.1	9.8	9.9	10.0	11.5
Corrib	0.0	0.0	0.0	10.0	10.0	10.0	8.1	6.8	5.3	4.4
Larne	0.0	0.0	0.0	0.0	0.0	0.0	6.0	10.0	20.2	20.8
Shannon*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moffat	27.9	28.2	28.7	19.2	19.4	13.8	10.8	8.7	0.0	0.0
Total	31.3	31.4	31.8	32.2	32.3	33.0	34.6	35.3	35.5	36.7

** See Section 5.9.1*

Table A1-4: 1-in-50 Severe Winter Peak-day demand for NI

	09/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19
ENERGY	GWh/d									
Total DX	27.4	28.2	29.4	30.4	31.6	32.2	32.8	33.5	34.2	34.8
Total Power	56.9	56.9	56.9	56.9	56.9	56.9	56.9	75.5	75.5	75.5
Total NI	84.2	85.1	86.2	87.3	88.4	89.1	89.7	109.0	109.6	110.3
VOLUME	Mscm/d									
Total DX	2.5	2.6	2.7	2.8	2.9	2.9	3.0	3.0	3.1	3.2
Total Power	5.1	5.1	5.1	5.1	5.1	5.1	5.1	6.8	6.8	6.8
Total NI	7.6	7.7	7.8	7.9	8.0	8.1	8.1	9.9	9.9	10.0

Appendix 2: System Modelling Approach

A hydraulic model of the combined Irish and NI transmissions is constructed using Pipeline Studio® software. Pipeline Studio® pipeline simulator allows the user to configure and analyse scenarios using transient modelling.

All scenarios simulate the 24 hour demand cycle of the all-island transmission system over a three day period to obtain steady consistent results.

The "all-island" hydraulic model includes all the major components of the Irish and NI transmission systems, including the Irish 70 barg system, the Dublin City 40 barg systems, the SNP, North/West and SNIP Pipelines. The Irish 19 barg transmission systems are modelled separately.

The transmission network model includes:

- All of the relevant physical characteristics of the transmission pipelines, including pipeline lengths, wall-thickness and internal diameter;
- All of the major flow-regulating stations, i.e. Twynholm, Carrickfergus, Gormanston (IC2 landfall), Loughshinny (IC1 landfall), Craughwell, and the Dublin City Gates – i.e. Abbotstown, Brownsbarn and Diswellstown:
    - Twynholm is modelled as a flow-control regulating station, with a minimum pressure drop across the regulators of 2.5 barg;
    - Carrickfergus is modelled with a differential-pressure control of 0.5 barg across the regulators;
    - Gormanston discharge from IC2 is be pressure-controlled (with 75% of the IC system flow assumed to come through IC2);
    - The Loughshinny discharge from IC1 is flow-controlled (with 25% of the IC system flow assumed to come through IC1); *and*
    - The discharge from the Dublin City Gates into their respective 40 barg systems is set to be pressure controlled.
- A generic-compressor model for each of three compressor stations at Beattock, Brighouse Bay and Midleton:
    - Beattock compressor station is assumed to be pressure controlled, to give a flat-discharge pressure of 85 barg in all scenarios;
    - The Brighouse Bay compressor station is modelled to achieve a flat flow profile; *and*
    - The Midleton compressor station is modelled to achieve a flat flow at the Inch Entry Point.

The hourly peak-day and minimum-day demands for each AGI off-take are entered into the hydraulic model on an energy basis. These are derived from the national peak-day and minimum-day forecasts using the following process:

- The hourly gas demand of the Irish power stations is generated directly by the merit-order stack model;
- The hourly gas demand of the NI power stations was provided by PTL and the Utility Regulator using information received from the shippers to the power stations; *and*
- The hourly demand for all other AGI off-takes was derived from their historic contribution (and pattern) to peak-day and minimum-day demand.

The conditions for the Entry Points are also entered into the hydraulic model, i.e. the supply pressure, the maximum daily flow, the hourly profile and molar composition of the gas. The hydraulic model then solves for the resultant system pressures and flows (taking into account the calorific value of the gas delivered to each Entry Point).

The resultant system pressure, flows and gas velocities are then checked to ensure that they comply with the criteria specified in Section 5. A failure to comply with the specified criteria indicates the need for future reinforcement.

Calibration of the hydraulic model

Given the record peak demand for the all-island's transmission system occurred on the 7th of January 2010, an opportunity to calibrate the hydraulic models for 1-in-50 demand flows against recorded pressures presented itself.

Hydraulic models were configured to represent demands over 7th – 9th January 2010, and analysis indicated resultant modelled minimum pressures vs. actual recorded minimum pressures to be accurate to within 1.5 barg when comparisons were made at numerous locations around the network. See Table A2-1 below. This calibration exercise validated the current methodology adopted for hydraulic network modelling.

Table A2-1 - Actual vs. modelled minimum pressures at various locations on network

	Twynholm	Coolkeeragh	Abbottstown Inlet Pressure	Brownsbarn	Rosanna Lower AGI (Wicklow) Inlet Pressure	Balineen	
Actual Minimum Pressure (Bar-g)	62.4	36.1	59.0	59.2	28.0	27.5	
Modelled	62.8	37.7	58.3	59.5	28.9	27.4	

Appendix 3: Network Schematics

Base Supply Scenario

1-in-50 Winter Peak Day

Year 2018/19

NI + SNP demands = 11.27mscmd

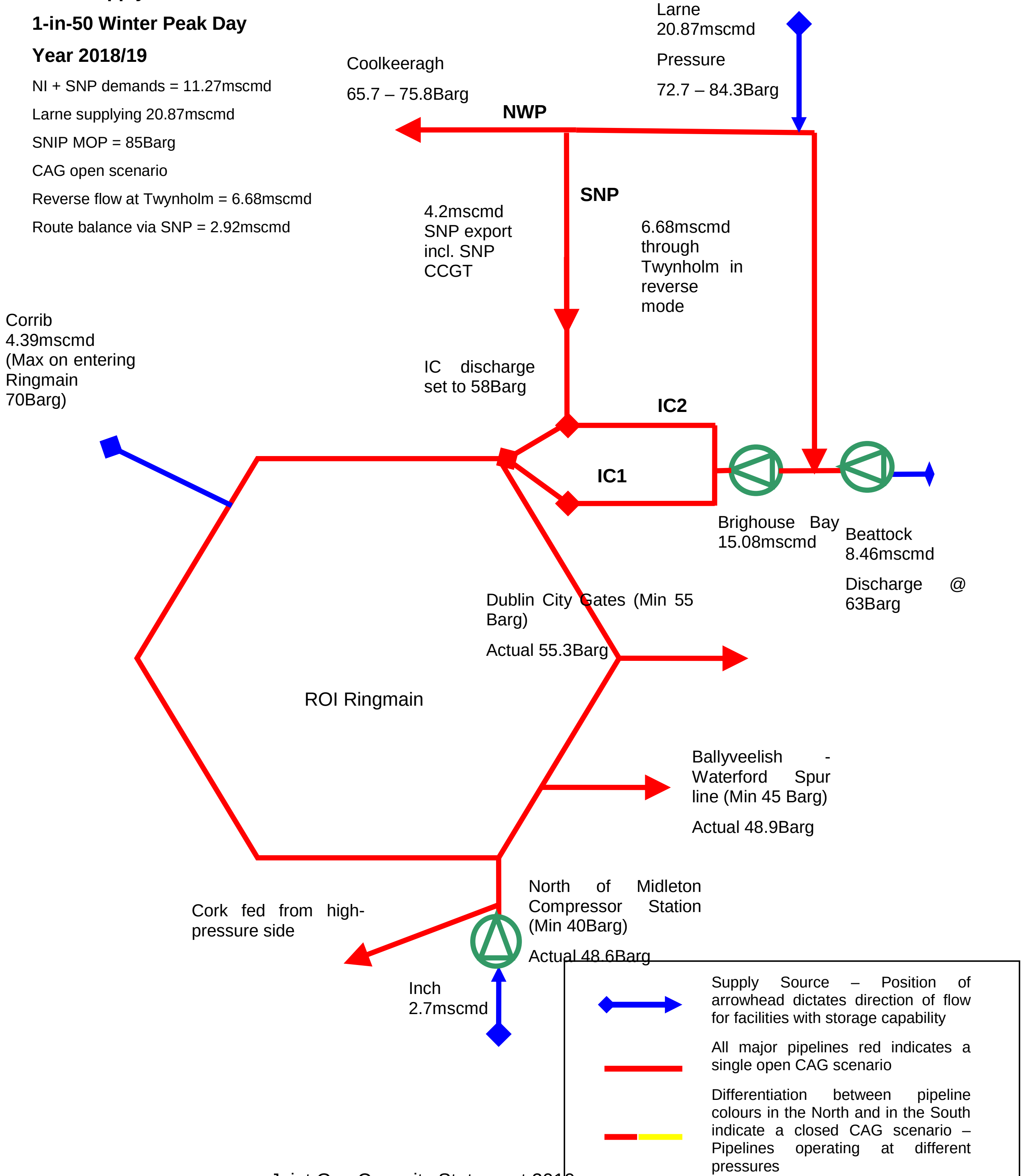
Larne supplying 20.87mscmd

SNIP MOP = 85Barg

CAG open scenario

Reverse flow at Twynholm = 6.68mscmd

Route balance via SNP = 2.92mscmd



Base Supply Scenario

Ave Year, Winter Peak Day

Year 2018/19

NI + SNP demands = 10.74mscmd

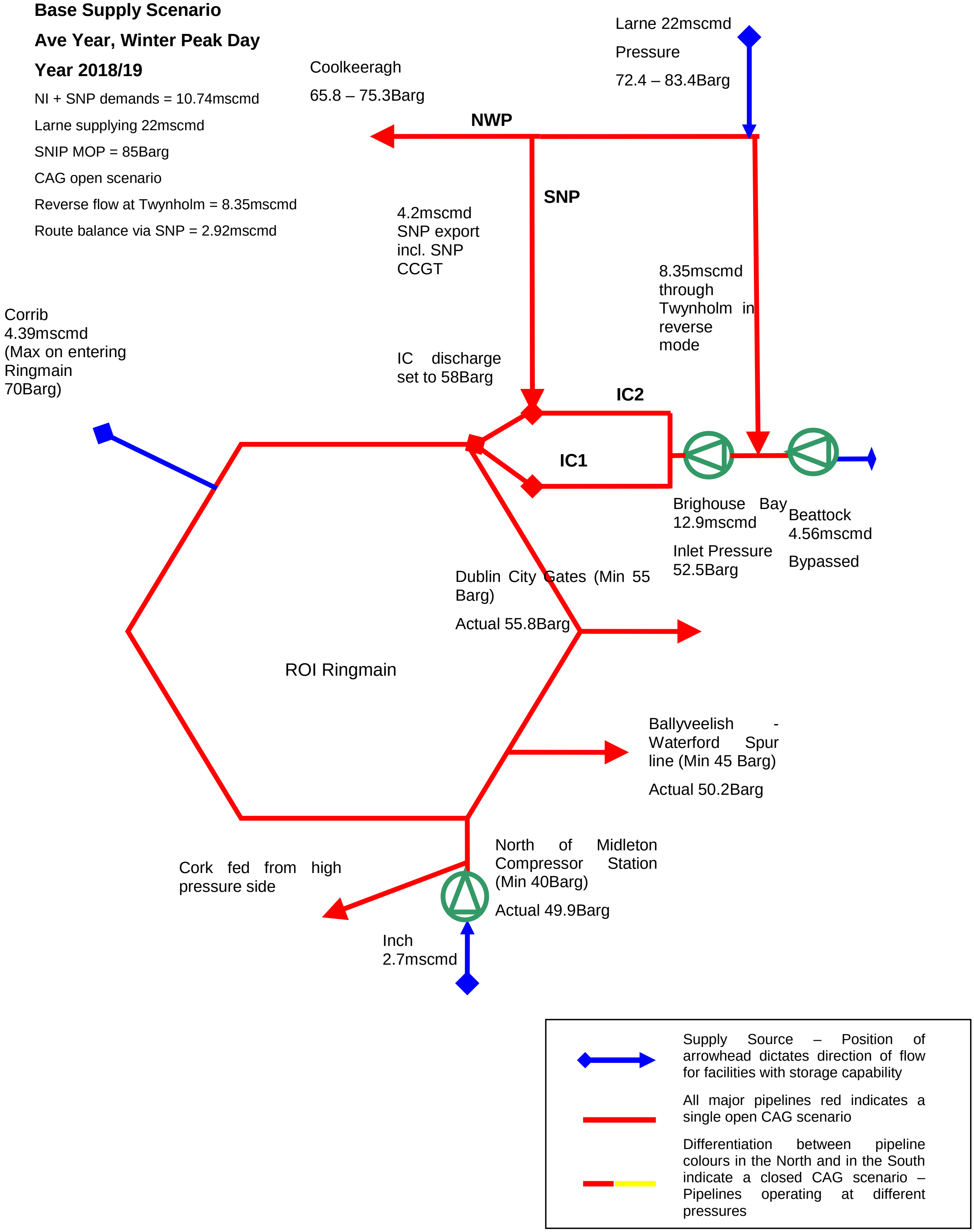
Larne supplying 22mscmd

SNIP MOP = 85Barg

CAG open scenario

Reverse flow at Twynholm = 8.35mscmd

Route balance via SNP = 2.92mscmd



Base Supply Scenario

Summer Minimum Day

Year 2018/19

NI + SNP demands = 6.24mscmd

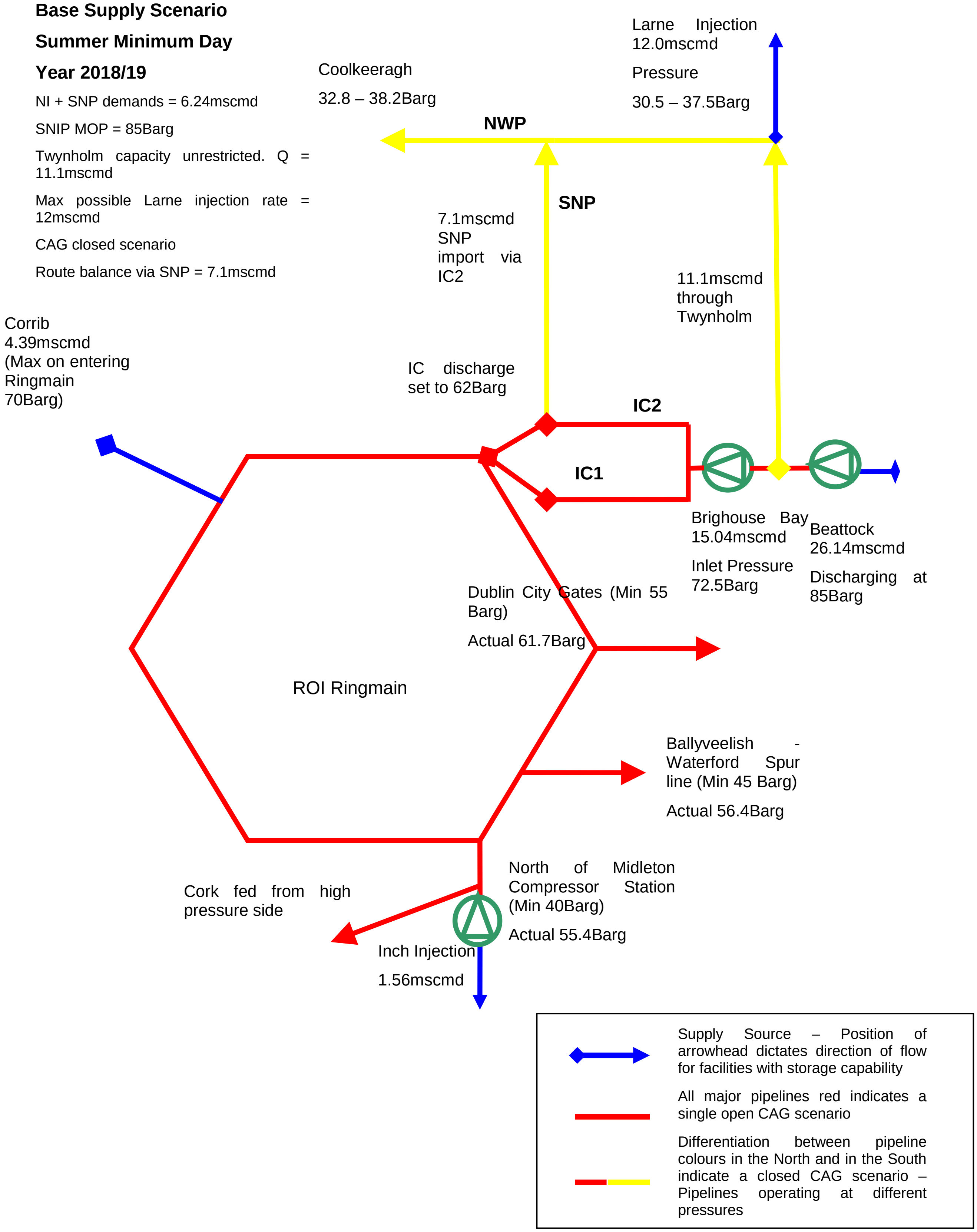
SNIP MOP = 85Barg

Twynholm capacity unrestricted. Q = 11.1mscmd

Max possible Larne injection rate = 12mscmd

CAG closed scenario

Route balance via SNP = 7.1mscmd



Extended Kinsale Supply Scenario

1-in-50 Winter Peak Day

Year 2018/19

NI + SNP demands = 11.27mscmd

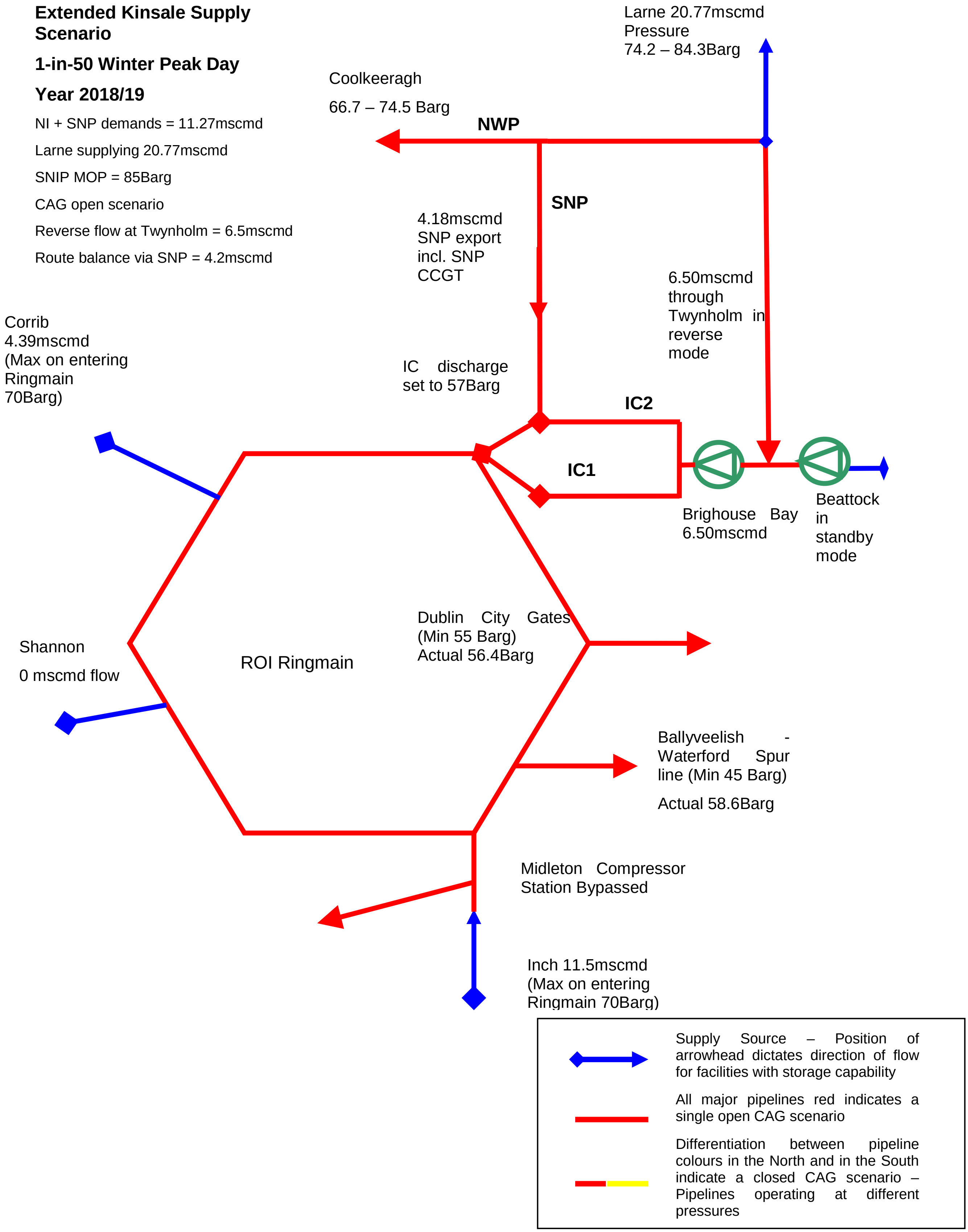
Larne supplying 20.77mscmd

SNIP MOP = 85Barg

CAG open scenario

Reverse flow at Twynholm = 6.5mscmd

Route balance via SNP = 4.2mscmd



Extended Kinsale Supply Scenario

Ave Year, Winter Peak Day

Year 2018/19

NI + SNP demands = 10.74mscmd

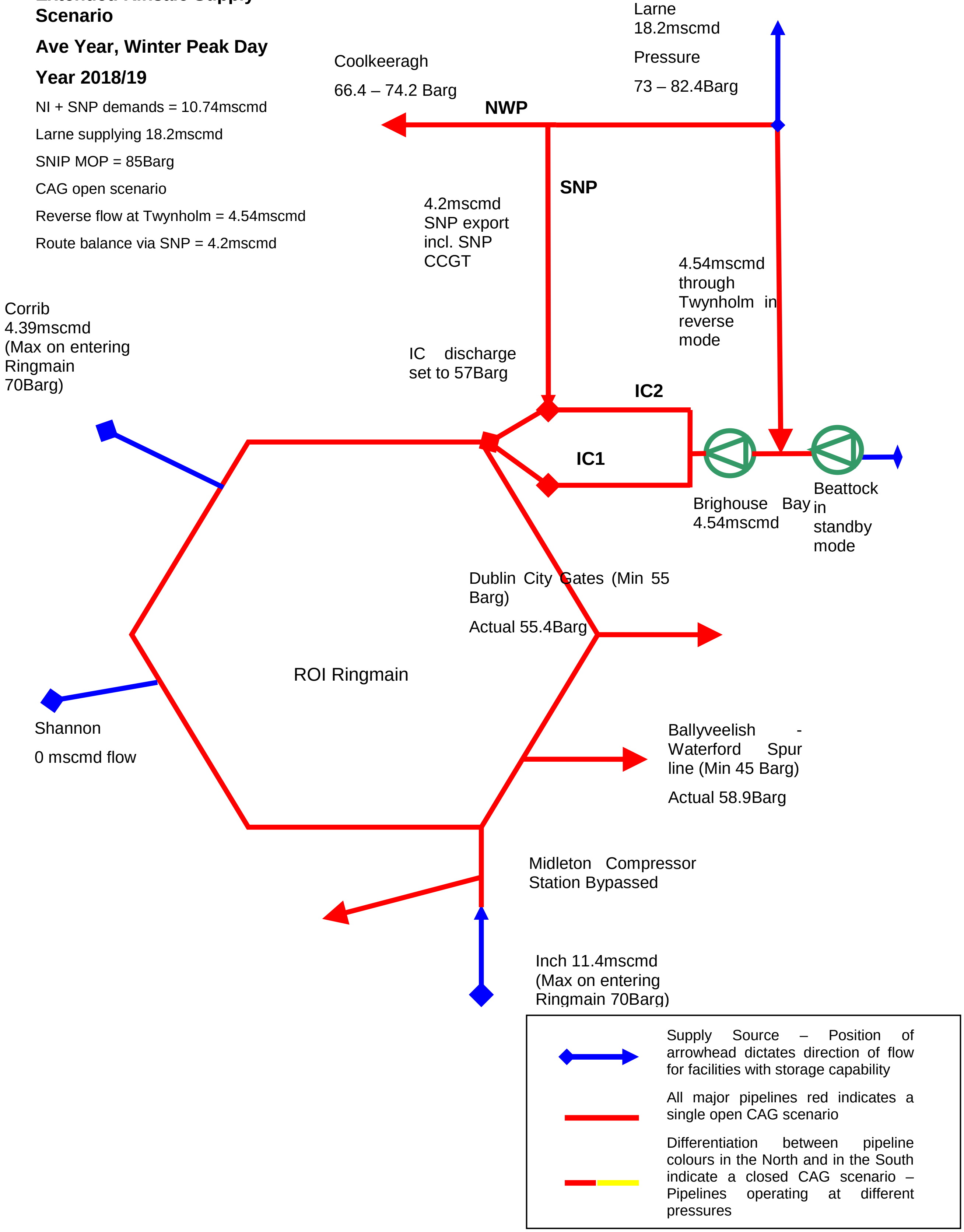
Larne supplying 18.2mscmd

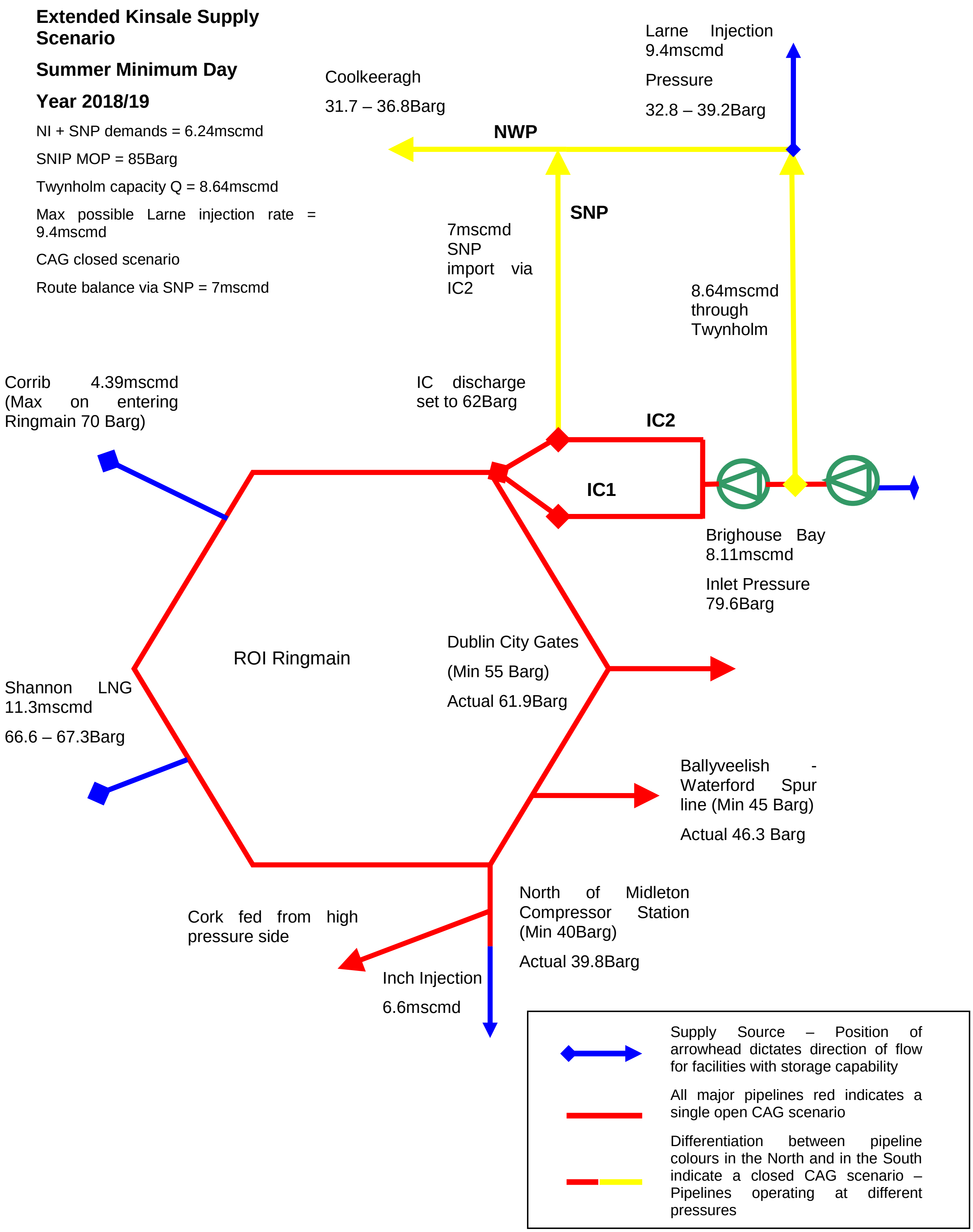
SNIP MOP = 85Barg

CAG open scenario

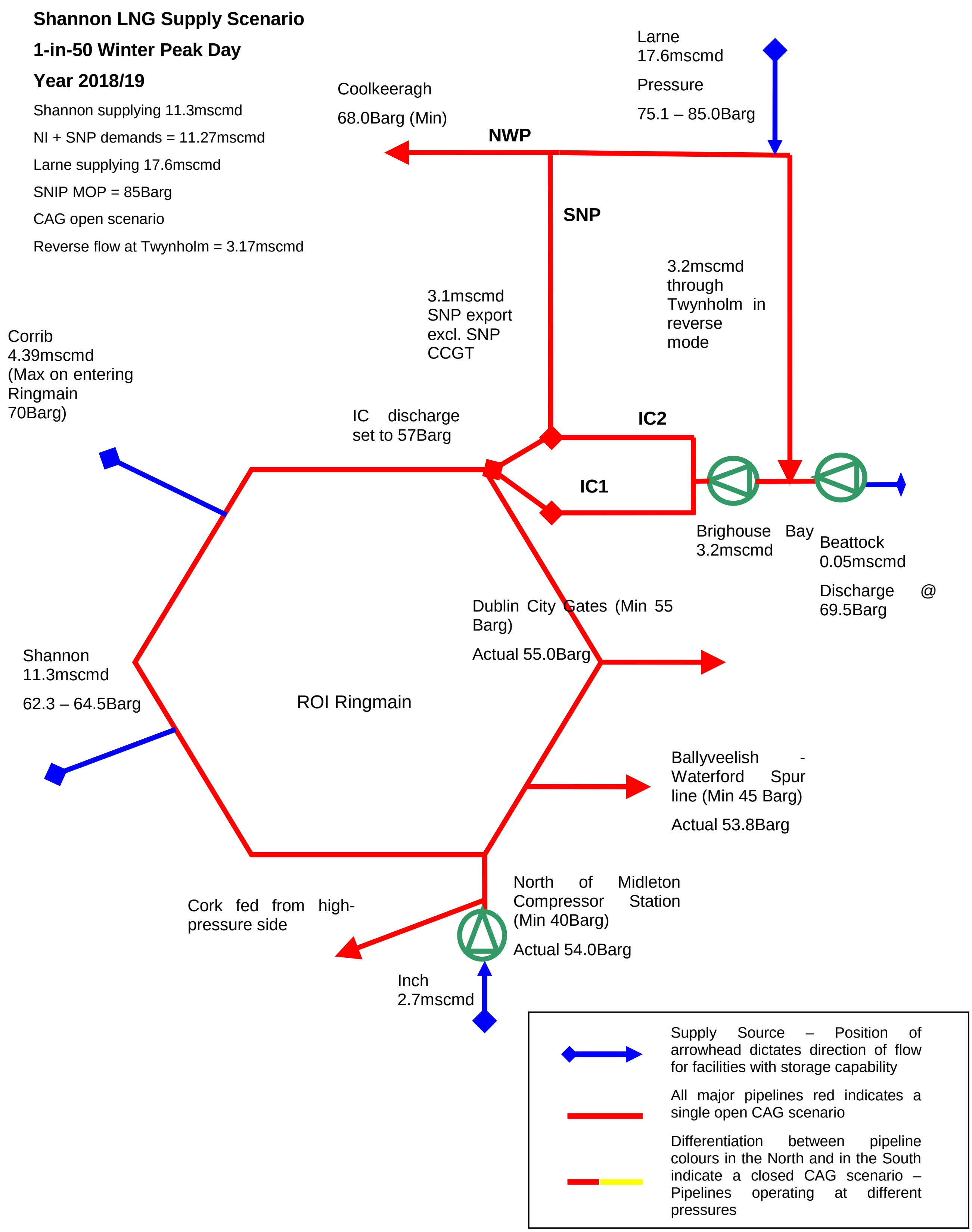
Reverse flow at Twynholm = 4.54mscmd

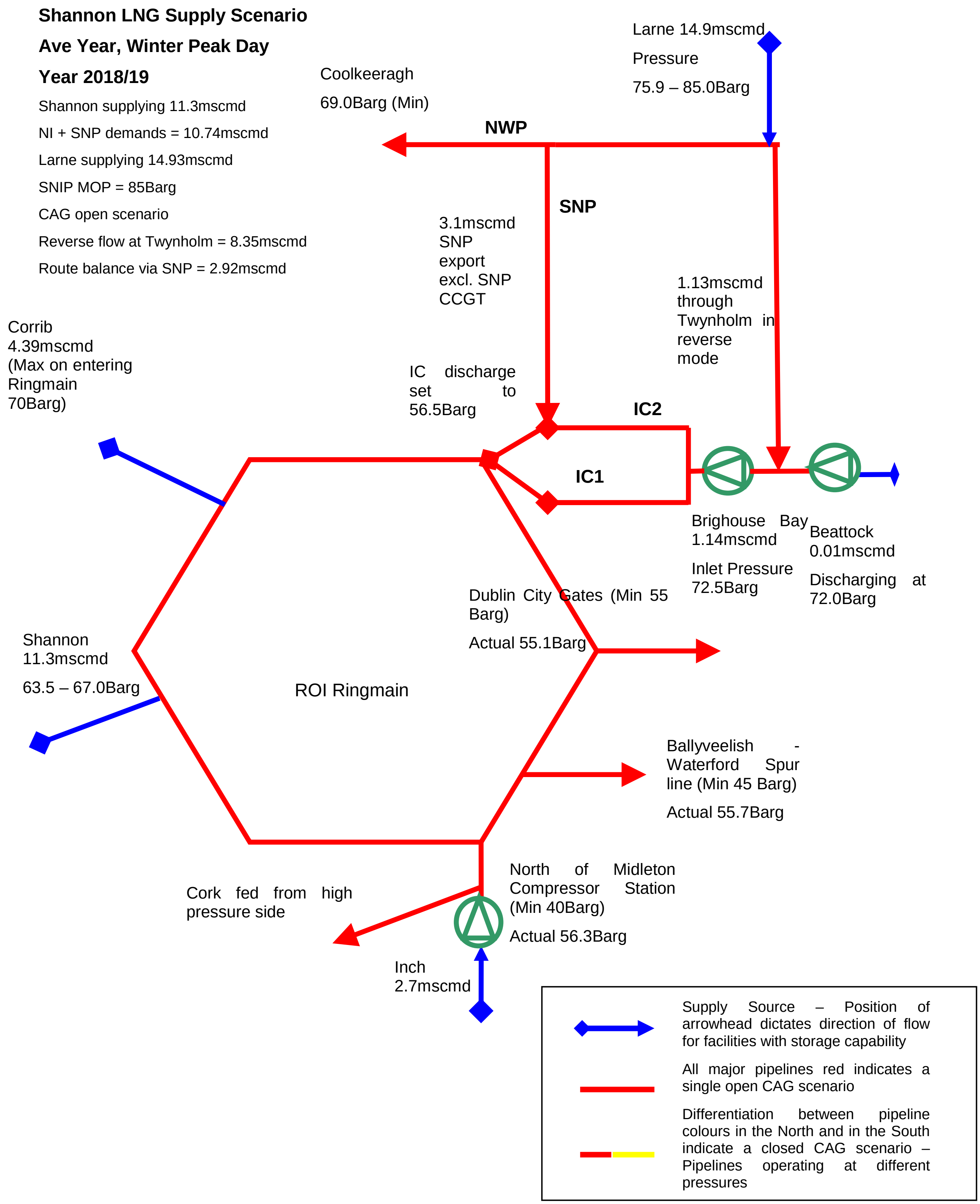
Route balance via SNP = 4.2mscmd





Extended Kinsale Supply Scenario
Summer Minimum Day
Year 2018/19
NI + SNP demands = 6.24mscmd
SNIP MOP = 85Barg
Twynholm capacity Q = 8.64mscmd
Max possible Larne injection rate = 9.4mscmd
CAG closed scenario
Route balance via SNP = 7mscmd
Coolkeeragh
31.7 – 36.8Barg
Larne Injection 9.4mscmd
Pressure
32.8 – 39.2Barg
NWP
SNP
7mscmd SNP import via IC2
8.64mscmd through Twynholm
Corrib 4.39mscmd (Max on entering Ringmain 70 Barg)
IC discharge set to 62Barg
IC2
IC1
Brighouse Bay 8.11mscmd
Inlet Pressure 79.6Barg
ROI Ringmain
Dublin City Gates
(Min 55 Barg)
Actual 61.9Barg
Shannon LNG 11.3mscmd
66.6 – 67.3Barg
Ballyveelish - Waterford Spur line (Min 45 Barg)
Actual 46.3 Barg
North of Midleton Compressor Station (Min 40Barg)
Actual 39.8Barg
Cork fed from high pressure side
Inch Injection
6.6mscmd
Supply Source – Position of arrowhead dictates direction of flow for facilities with storage capability
All major pipelines red indicates a single open CAG scenario
Differentiation between pipeline colours in the North and in the South indicate a closed CAG scenario – Pipelines operating at different pressures


Shannon LNG Supply Scenario
1-in-50 Winter Peak Day
Year 2018/19
Shannon supplying 11.3mscmd
NI + SNP demands = 11.27mscmd
Larne supplying 17.6mscmd
SNIP MOP = 85Barg
CAG open scenario
Reverse flow at Twynholm = 3.17mscmd
Larne 17.6mscmd
Pressure
75.1 – 85.0Barg
Coolkeeragh
68.0Barg (Min)
NWP
SNP
3.2mscmd through Twynholm in reverse mode
3.1mscmd SNP export excl. SNP CCGT
Corrib 4.39mscmd (Max on entering Ringmain 70Barg)
IC discharge set to 57Barg
IC2
IC1
Brighouse Bay 3.2mscmd
Beattock 0.05mscmd
Discharge @ 69.5Barg
Dublin City Gates (Min 55 Barg)
Actual 55.0Barg
Shannon 11.3mscmd
62.3 – 64.5Barg
ROI Ringmain
Ballyveelish - Waterford Spur line (Min 45 Barg)
Actual 53.8Barg
North of Midleton Compressor Station (Min 40Barg)
Actual 54.0Barg
Cork fed from high-pressure side
Inch 2.7mscmd
Supply Source – Position of arrowhead dictates direction of flow for facilities with storage capability
All major pipelines red indicates a single open CAG scenario
Differentiation between pipeline colours in the North and in the South indicate a closed CAG scenario – Pipelines operating at different pressures



Shannon LNG Supply Scenario
Ave Year, Winter Peak Day
Year 2018/19
Shannon supplying 11.3mscmd
NI + SNP demands = 10.74mscmd
Larne supplying 14.93mscmd
SNIP MOP = 85Barg
CAG open scenario
Reverse flow at Twynholm = 8.35mscmd
Route balance via SNP = 2.92mscmd
Coolkeeragh
69.0Barg (Min)
Larne 14.9mscmd
Pressure
75.9 – 85.0Barg
NWP
SNP
3.1mscmd SNP export excl. SNP CCGT
1.13mscmd through Twynholm in reverse mode
Corrib 4.39mscmd (Max on entering Ringmain 70Barg)
IC discharge set to 56.5Barg
IC2
IC1
Brighouse Bay 1.14mscmd
Inlet Pressure 72.5Barg
Beattock 0.01mscmd
Discharging at 72.0Barg
Dublin City Gates (Min 55 Barg)
Actual 55.1Barg
Shannon 11.3mscmd
63.5 – 67.0Barg
ROI Ringmain
Ballyveelish - Waterford Spur line (Min 45 Barg)
Actual 55.7Barg
North of Midleton Compressor Station (Min 40Barg)
Actual 56.3Barg
Cork fed from high pressure side
Inch 2.7mscmd
Supply Source – Position of arrowhead dictates direction of flow for facilities with storage capability
All major pipelines red indicates a single open CAG scenario
Differentiation between pipeline colours in the North and in the South indicate a closed CAG scenario – Pipelines operating at different pressures

Shannon LNG Supply Scenario

Summer Minimum Day

Year 2018/19

NI + SNP demands = 6.24mscmd

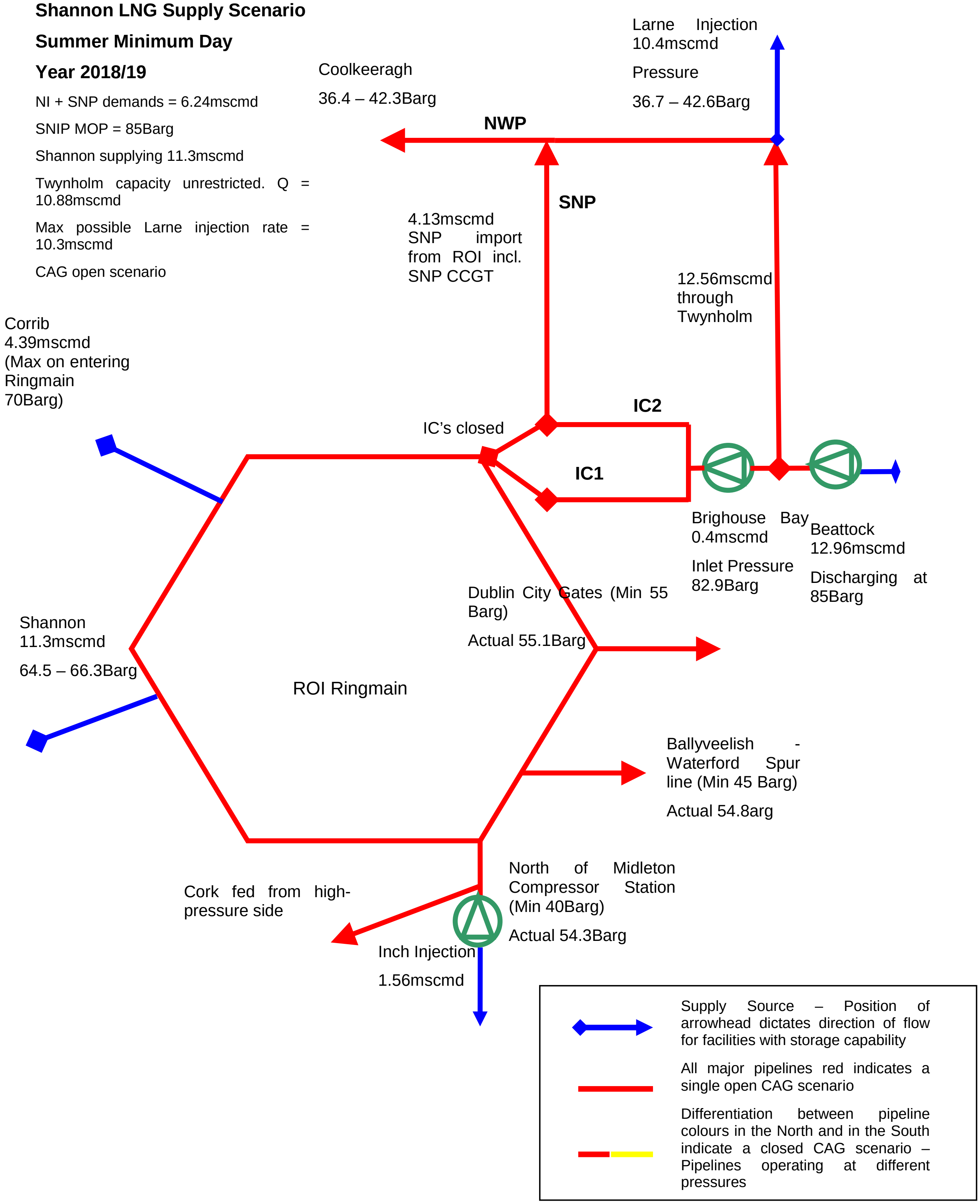
SNIP MOP = 85Barg

Shannon supplying 11.3mscmd

Twynholm capacity unrestricted. Q = 10.88mscmd

Max possible Larne injection rate = 10.3mscmd

CAG open scenario



Appendix 4: Energy Efficiency Assumptions[32]

National Energy Efficiency Action Plan 2009–20 (NEEAP)

The NEEAP sets out the Irish Government's strategy for meeting the energy efficiency savings targets identified in the White Paper, *Delivering a Sustainable Energy Future for Ireland - the Energy Policy Framework for 2007-2020* (2007) and the EU Energy Services Directive (ESD). These targets include:

- The White Paper target of a 20% reduction in Irish energy demand across the whole economy by 2020, with a higher 33% target for the Public Sector; *and*
- The ESD target of a 9% reduction in energy demand by 2016;

Table A4-1: NEEAP Energy efficiency savings targets

	2010 PEE[33] target (GWh)	*2016 PEE target (GWh)*	*2020 PEE target (GWh)*
Residential Sector			
Building Regulations 2002	1,015	1,015	1,015
Building Regulations 2008	130	1,425	2,490
Building Regulations 2010	0	570	1,100
Low carbon homes	0	130	395
SEI house of tomorrow	30	30	30
Warmer homes scheme	115	155	170
Home Energy Savings programme	450	600	600
Smart metering	0	650	690
Greener Homes scheme	265	265	265
Eco-design for energy appliances (lighting)	200	1,200	1,200
More efficient Boiler Standard	400	1,600	2,400
Total residential savings	2,605	7,640	10,355
Business & Commercial sectors			
SEI public sector retrofit programme	140	140	140.0
Building Regulations 2005	185	370	560.0
Building Regulations 2010	0	630	1,360.0
SEI energy agreements (IS 393)	465	685	4,070.0
SEI small business supports	160	330	565.0
Existing ESB DSM programmes	380	410	435.0
Renewable Heat Deployment programme	360	410	410.0
ACA for energy efficient equipment	100	400	800.0
Total business and commercial savings	1,790.0	3,375.0	8,340.0
Other sectors			
Transport	775	3,105	4,670
Energy Supply sector	275	300	365
Total measures identified above	5,445	14,420	23,730
White Paper target (20% reduction by 2020)			31,925
Additional measures yet to be identified			8,195

[32] These energy efficiency assumptions have also been utilised in Gaslink's *Transmission Development Statement 2009/10 – 2018/19*.
[33] Primary Energy Equivalent

Impact on residential gas demand

The proposed energy efficiency measures for the residential sector will have a material impact upon gas demand in the residential sector. The forecast for the residential sector in the JCS 2010 includes the following assumptions:

- Incremental gas demand from new residential connections will continue to reduce due to tighter building regulations. From the 2008 Building Regulations, a 40% improvement on energy performance of residential buildings relative to 2002 Building Regulations has been applied (see S.I. No. 854 of 2007). This has been taken as rising to 60% of 2005/06 levels from 2012/13 in light of planned 2010 building regulations as noted in the NEAAP; *and*
- Existing residential gas demand will also reduce due to the introduction of more efficient boiler standards (e.g. condensing boilers) and the combined impact of the Low Carbon Homes, Warmer Homes & Home Energy Saving schemes.

The NEEAP assumes a total reduction of 4,255 GWh in residential energy demand, due to the introduction more efficient boiler standards, and the combined impact of the Low Carbon Homes, Warmer Homes and Home Energy Saving schemes.

The average annual gas consumption of all new residential customers connected during the 2005/06 gas year was approximately 12.3 MWh/y. The forecast in the JCS 2010 assumes the average gas consumption of each new customer connected by 2012/13 will reduce by 60% of 2005/06 levels to 4.9 MWh/y by 2012/13.[34]

In addition, it also identifies the potential for a further energy efficiency reductions of 1,920 GWh from the retrofitting attic, cavity-wall and wall-lining insulation to existing houses (after adjusting for the impact of the Warmer Homes and Home Energy Savings schemes).The forecast for the JCS 2010 assumes that:

- Total energy efficiency savings of 6,173 GWh in residential heat demand between 2009/10 and 2019/20 from the above measures (annual reduction of 561 GWh/y);
- Approximately 27% of this target reduction will be achieved in gas-fired residential homes, based on the gas share of residential heat in 2008, i.e. the gas share of total residential TFC after excluding the electricity and renewable components; *and*
- This would lead to a reduction of 152 GWh/y in residential annual gas demand, which is equivalent to 1.8% of the residential gas demand in 2008/09.

If all of the above energy efficiency measures are implemented as planned and achieve the assumed energy savings, then it is estimated that annual residential gas demand will reduce by approximately -7.9% over the period.

However, the Regulatory Authorities again wish to emphasise that there is still considerable uncertainty regarding the implementation of the energy efficiency initiatives for existing housing.

Impact on I/C gas demand

The NEEAP assumes a total reduction of 3,375 GWh in I/C gas demand by 2016, and a total reduction of 8,340 GWh by 2020. Some of this reduction may have already occurred since the 2002-2005 baseline period. The forecast for the JCS 2010 assumes:

- That the total I/C energy demand will reduce by 3,375 GWh by 2016 and a further 4,965 GWh by 2020 (per the NEEAP), an annual reduction of 338 GWh/y up to 2016 and 1,174 GWh/y up to 2020;
- The gas share of these reductions is assumed to be 19.3% up to 2016 and 21.4% up to 2020, based on gas share of total I/C TFC in 2008 (of 23.0%) and adjustments to exclude initiatives which are specific to electricity (e.g. ESB demand reduction programmes); *and*
- This would lead to an annual reduction of 65.1 GWh/y in I/C annual gas demand up to 2014/15, and 266 GWh/y from 2015/16 onwards (which is equivalent to 0.6% and 2.6% of the 2008/09 I/C annual demand respectively).

[34] See also Section 3.5.5.

Appendix 5: Glossary

AGI: Above Ground Installation.

Barg: The unit of pressure that is approximately equal to atmospheric pressure (0.987 standard atmospheres). One millibar equals 0.001 bar.

BGÉ: Bord Gáis Éireann

BGN: Bord Gáis Networks

BGTL: Belfast Gas Transmission Limited

c.: Circa

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

CER: Commission for Energy Regulation

Combined Cycle Gas Turbine (CCGT): A unit whereby electricity is generated by a gas powered turbine and also a second steam-powered turbine. The hot exhaust gases expelled from the first turbine are fed into the heat exchanger to generate steam which powers the second turbine.

Combined Heat and Power (CHP): The simultaneous generation of electricity and heat for use within buildings or processes, by recovery of the heat produced in the power generation process. As such, CHP represents the highest efficiency means of generating electricity.

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

Cubic Metre (m^3): The unit of volume; approximately equal to 35.34 cubic feet. One million standard cubic metres is referred to as mscm.

Cushion Gas: The gas remaining in the storage reservoir after all of the stored gas has been withdrawn.

Customer: Customer in relation to natural gas means a final consumer of natural gas.

Daily Metered (DM) Customer: A customer that has a meter that is read daily by remote means.

Degree Day: A measure of the variation of one day's temperature against a standard reference temperature of 15.5°C.

Distribution: Distribution in relation to natural gas means the transport of natural gas through local or regional pipelines at pressures below 16barg with a view to its delivery to customers.

DX: Distribution Connected

Entry Point: A point at which natural gas is transferred from a connected system to the onshore transportation system.

ESRI: The Economic and Social Research Institute.

Flow Rate: The instantaneous rate of flow of natural gas normally expressed in GWh/d or mscm/d.

GAR: Generation Adequacy Report published annually by the Electricity Transmission System Operator, EirGrid.

Gas Year: The Gas Year is the year between 1st October and 30th September of the following year.

Interconnector: A transmission line which crosses or spans a border between Member States for the sole purpose of connecting the national transmission systems of these Member States.

IPP: Independent Power Producer.

JCS: Joint Gas Capacity Statement.

Kilowatt hour (kWh): The unit of energy used by the gas industry. Approximately equal to 0.0341therms. One Megawatt hour (MWh) equals 1,000kWh, one Giga watt hour (GWh) equals 1,000,000kWh, and one Terawatt hour (TWh) equals 10^{12}Wh.

Linepack: The storage of gas by compression in gas transmission and distribution pipelines.

LNG: Liquefied Natural Gas.

Load Factor: The ratio of the average daily demand to the peak-day demand. The load factor is used to estimate the peak-day demand from the forecast annual demand.

Load Duration Curve: A representation of an annual demand profile re-ordered from maximum to minimum day loads.

Mutual Energy Limited: The ultimate holding company of the NI licensed TSOs, Premier Transmission Limited (PTL) and Belfast Gas Transmission Limited (BGTL).

Natural Gas System: The system of pipelines and liquefied natural gas and storage facilities, excluding upstream pipelines, used for the transmission, distribution, storage and supply of natural gas to, from or within the state.

Non-Daily Metered (NDM): A meter that is read monthly or at longer intervals.

NEEAP: Irish Government's *National Energy Efficiency Action Plan 2009–20* (May 2009)

NWP: North West Pipeline in the Northern Irish Onshore system.

Open Cycle Gas Turbine (OCGT): A unit whereby electricity is generated by a gas powered turbine and no use is made of the hot exhaust gases.

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

Peak-day Demand (1-in-50 Peak Demand): The Irish transmission system is designed to meet a 1-in-50 year requirement. Such a year's weather pattern has an extremely low probability of occurring and, as such, would be expected to be exceeded only once in 50 years.

PTL: Premier Transmission Limited

PNG: Phoenix Natural Gas Limited

Shipper: Any person holding a shipping licence and having an entitlement by way of contract with the Transporter through a Standard Transportation Agreement (STA) to transport natural gas through the Transportation System or any part thereof or off-take at an exit point, whether for its own use or for use by a third party as an end user.

Shipping: The introduction into, the conveyance by means of, or take off from the natural gas system of natural gas by persons other than the operator of the relevant pipeline or facility.

Shrinkage: Gas that is input to the system but is not delivered to consumers or injected into storage. It is either gas for own use or unaccounted for.

SNP: South-North Pipeline

SNIP: The Scotland to Northern Ireland Pipeline.

Storage: The stocking of natural gas by a natural gas undertaking in a facility specifically designed for this purpose.

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

Supply: The delivery or sale of natural gas, including liquefied natural gas, to customers, and includes Shipping.

TER: Total Electricity Requirement - EirGrid's GAR converts total electricity sales at the customer level for a 52-week year to TER by bringing the figure to export level (applying loss factor of 8.3%) and adding an estimate of self-consumption.

TX: Transmission Connected

Disclaimer:

The purpose of the Joint Gas Capacity Statement 2010 (JCS) is to provide information on current and forecast gas supply and demand and its impact on the island's transmission systems. Whilst every effort is made to provide information that is useful, and care is taken in the preparation of the information, the Regulatory Authorities (the Commission for Energy Regulation in Ireland and the Northern Ireland Authority for Utility Regulation) give no warranties or representations, express or implied, of any kind with respect of this document, including, without limitation, its quality, accuracy and completeness.

To the fullest extent permitted by law the Regulatory Authorities shall not in any event be liable for any loss or damage or expense incurred or suffered arising out of or in connection with the use of the JCS or any reliance on the information contained or implied therein. Use of or reliance on the JCS and the information it contains is at the user's sole risk.

Prior to determining legal rights or taking business decisions, interested parties are advised to seek separate and independent advice and opinion in relation to the matters covered by the JCS and should not rely solely upon data and information contained therein. Information in this document does not purport to contain any or all the information which a prospective investor or participant in the gas markets of Ireland or Northern Ireland may need.