Joint Capacity Statement 2009

Commission for Energy Regulation
An Coimisiún um Rialáil Fuinnimh

Utility Regulator
ELECTRICITY GAS WATER

Contents

Foreword

The Joint Capacity Statement 2009 (JCS) presents a summary of the analysis and review of the impact of forecast gas supply and demand on the transmission systems for both Ireland and Northern Ireland over the next eight years. The analysis presented in the JCS has been prepared by the Transmission System Operators (TSOs) in each jurisdiction.[1]

This first annual JCS has been 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 Commission') is required to publish such analysis, including a seven 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 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 Commission and the Utility Regulator jointly published a Memorandum of Understanding (MoU) on the development of the CAG project.[2] In establishing the CAG, the Commission 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 process, both authorities noted their commitment to a single approach to security of supply on the island which involves the production of a Joint Capacity Statement.

The 2009 JCS is the first to have been produced on an all-island basis and is a key aspect of the CAG's joint System Planning and Development workstream. In previous years, an annual Pressure Report prepared by the Utility Regulator, and an annual Gas Capacity Statement (GCS), prepared by the Commission, presented separate gas supply and demand in the transmission systems for Northern Ireland and Ireland respectively. The analyses required separate modelling of gas flows in each jurisdiction based on various scenarios. The 2009 JCS departs from this approach by basing the analysis on the aggregate demand of both Ireland and Northern Ireland and the available supplies required to meet this demand. This is the fundamental difference from the modelling previously carried out by the Regulatory Authorities to produce separate statements.

The 2009 JCS includes updated analysis and modelling of the impact of forecast gas supply and demand on the island's transmission systems for the period 2008/09 to 2015/16. The study provides the best estimate of the adequacy of the transmission system on the island to meet demand growth in the two jurisdictions. The analysis takes into account the potential introduction of new gas supplies in the system, namely the delivery of Corrib gas, Shannon Liquefied Natural Gas (LNG), and gas storage in salt layers at Larne, and includes the possibility of substantially reduced production levels from Inch over the coming years. In light of those developments, a central case, as well as high and low scenarios, have been prepared in order to examine the capacity of the transmission system on the island to function safely under various conditions.

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[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 and Bord Gáis Éireann (UK) Limited working with Bord Gáis Networks.

[2] The MoU is available on both the websites of the Commission and the Utility Regulator.

Demand forecasts present in the 2009 JCS are lower than that produced in 2008, primarily reflecting the economic downturn, and lower forecasts of economic growth, together with improved energy efficiency.

Note: Since the central case assumptions used in this JCS were initially agreed, the forecast gas demand in Ireland and Northern Ireland has reduced even further, particularly in relation to the power generation sector. However, it is not possible to provide specific revised assumptions on earlier planned new generating stations which may now not go ahead in the timeframe covered by the JCS. Rather than revisit the scenario modelling exercise already carried out, the Regulatory Authorities have decided to retain these earlier scenarios and add a certain "health warning" or cautionary note to the effect that these capacity requirement scenarios may reflect a more optimistic representation of growth than would now be assumed, given the continued recession during 2009. It is important to bear in mind, however, that if this were to turn out to be the case it would not affect the basic conclusions of the underlying analysis as set out in Section 6 of the JCS

The report shows that the high pressure transmission system has sufficient capacity for supplies to meet the reasonable medium-term demand growth of the central case. There is no significant requirement to reinforce the transmission system in either jurisdiction at the present time. However, mitigation measures may be necessary in later years in order to cope with potential increased west to east flows, as well as north to south flows.

While the likely timing of the developments noted above has become somewhat more certain than last year, there remains a risk of further delays, which could create capacity constraints in onshore Scotland. The Regulatory Authorities are of the view that if such issues arise they should, where appropriate, be best addressed through performance improvement of operating equipment and commercial incentives to reduce peak-day demand, rather than high cost capital investment.

The Regulatory Authorities would like to thank all those who contributed to the development of this Joint Capacity Statement, especially Bord Gáis Networks, Belfast Gas Transmission Limited, Premier Transmission Limited 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 and informative.

1 Introduction

1.1 Background

The Commission 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 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.

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

1.2 Differences from Previous Reporting

The issues dealt with in the JCS do not differ greatly from those covered in the separate studies carried out by the Utility Regulator and the Commission. The principal divergence from previous national reporting is that all flows are considered from the Moffat entry point to an integrated all-island system. Gas flows are not examined on a separate basis via the two subsea interconnectors (IC1 and IC2) to Ireland and via the Scotland to Northern Ireland pipeline (SNIP) to Northern Ireland.

In the 2008 GCS, it was noted that operating a single network in an efficient manner may be complicated by contractual limits on the Scottish onshore capacity of the SNIP and regulatory issues in relation to the South-North Pipeline (SNP).[3] An integral feature of this year's JCS under the CAG is the treatment of the transmission system in Ireland and Northern Ireland on an all-island basis. In this light, the analysis takes into account the possibility for increased flows through the SNIP, exceeding the current 8.08 million standard cubic meters per day (mscm/d) limit.

While last year's Pressure Report set out a 'middle-only' scenario, the JCS includes scenarios based on both a central case and 'high-low' approach. This report, in contrast with last year's Gas Capacity Statement, has also taken into consideration the impact of storage at Larne on an all-island system, including the potential for reverse flows through the SNIP and through IC1 and 2 in later years. This year's modelling also took into account the potential for adjusting flows through the SNP in order to improve the ability of the system to move gas from the Larne storage facility to the south, to allow NI shippers access to the IC inventory product and to facilitate any summer operational benefits that arise from the CAG project.

[3] See Appendix C of the Gas Capacity Statement 2008.

1.3 General approach

The Joint Capacity Statement 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 2008/9 to 2015/16. 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.

1.3.1 Overview of Supply Demand and Analysis

For this year's Statement, the Regulatory Authorities and TSOs jointly developed future demand and supply forecasts based on a number of key assumptions and inputs.

For the demand forecasts 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[4].
- sources for fuel and commodity prices as required inputs for a merit order electricity model run by Bord Gáis Éireann (BGÉ). Prevailing spot and forward prices for the UK National Balancing Point (NBP) have been used.[5]
- the gas-fired power stations assumed to be connected to the network in Ireland in each year as provided by EirGrid.
- Irish electricity demands in light of Low Demand EirGrid modelling.
- forecasts for new housing constructions supplied by Bord Gáis Networks (BGN), which are used to forecast residential demand for gas.
- assessments of the likely impact on residential gas consumption of measures to improve energy efficiency.

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 circulated by the Regulatory Authorities seeking information related to current and projected levels of supply and demand;
- general economic and industry forecasts. In particular, the Statement used information provided from the ESRI about macro-economic factors and changes in the housing market; and
- from BGN, the number of new load connection enquiries and the current year's operating experience.
- Meetings held with industry stakeholders by BGN on behalf of the TSOs 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

[4] Quarterly Economic Commentary, Winter 2008, ESRI, Dec 2008.
[5] It should be noted that there is a relatively high degree of volatility of some of these prices, which creates some additional uncertainty, but which can broadly be taken into account by the range of scenarios being adopted.

In the preparation of this Joint Capacity Statement, the Regulatory Authorities received information on the projected commencement dates of certain proposed developments. Gas from the Corrib field was taken as being available from April 2010 and the proposed LNG importation facility at Shannon from 2013/14. Supplies from Inch were considered as remaining available until 2012/13 and gas from the salt cavity storage at Larne was taken as coming online in 2014/15. The proposed timings of these projects have been used to develop the various supply and demand scenarios. The analysis has also taken into account the construction of new gas-fired Combined Cycle Gas Turbine (CCGT) stations at Aghada, Whitegate and Kilroot.

Information related to measured daily pressures and profile of consumption have been used to form the first base-year network model, which was subsequently run for the seven years of the Statement, thus making eight years of analysis for the supply/demand scenario. The individual market sectors are combined to form annual demand projections, while corresponding peak-day demands are calculated for 1-in-50 winter peak-day conditions. Analysis of minimum summer day supply scenarios was also carried out.

Gas supply information obtained from questionnaire responses is primarily used to balance supply and demand on the basis of:

- indigenous gas production and indigenous stored gas being made available first; and
- imported supplies then being used to meet the projected balance of demand level.

The supply forecasts derived from the questionnaire, in addition to those set out in Gaslink's Transmission Development Statement, have been utilised.[6]

Any variation in the timing of new indigenous gas sources or in the rates of demand growth will generate different capacity requirements on the network. The approach taken to address the uncertainties in the planning process was to:

- develop a central scenario for demand based on information gathered as described above and
- agree upon a number of additional supply scenarios, conducting a full network analysis to test the adequacy of the system over the relevant time horizons;

1.3.2 Supply Scenarios

To assess the adequacy of the transmission network on the island, a central case demand forecast was developed and analysed under a number of potential supply scenarios for an eight-year period. Five main supply scenarios are set out in the JCS:

- A **Central Case ('Inch Extended')** which assumes that Corrib gas will be available from April 2010 and that the Kinsale production and storage facilities continue in operation beyond October 2013. Additional sources of supply are not included.

[6] "Transmission Development Statement, For Period 2008/09 to 2014/15", Gaslink, Dec 2008.

- A **Low Supply scenario** which assumes a year delay to Corrib gas to April 2011. Kinsale gas production and storage activities are taken to have ceased by October 2013 and no further sources of supply are provided for.

- A **High Supply scenario** which assumes the introduction of gas from Corrib Shannon LNG and a NI salt-cavity storage facility over the next five years. Kinsale gas production and storage are not included post October 2013.

- Two sensitivities, **'No Shannon LNG' and 'No Larne',** are included as part of the High Supply Scenario

These scenarios simulate the 24-hour demand cycle over a minimum period of 3 days. The scenarios are based upon potential increases/decreases in future gas supply depending on the development of Shannon LNG and the Larne storage facility, as well as the introduction of supplies from the Corrib Gas Field and continued production and storage at Inch.

This scenario analysis is to examine whether the system is adequate to cope with a reasonable expectation of demand over the next eight years. The assumptions related to demand growth are present in Section Three of this Statement and specific results of the analysis are described in detail in Section Five.

The input assumptions for the central case scenario were developed by a working group, which included the Commission, the Utility Regulator, Gaslink, Premier Transmission Limited (PTL) and BGN. The detailed demand modelling was then carried out by BGN using the agreed input assumptions. In addition to the above modelling work and information provided by shippers, there was also extensive consultations with other relevant stakeholders, including the Economic Social Research Institute (ESRI), EirGrid, power station developers, offshore gas producers, gas storage developers and Liquefied Natural Gas (LNG) developers.

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.

1.3.3 Modelling

The detailed modelling of the transmission system using specialist network analysis software has been undertaken by the TSOs with additional oversight by the Regulatory Authorities. Peak-day modelling has focused on the central case scenario, as well as the high and low supply scenarios, in particular in relation to insufficient capacity and the potential for pressure to be raised outside of acceptable parameters. The Regulatory Authorities have jointly reviewed the demand forecasting model. In particular, the merit order model for electricity generation has been examined and the Regulatory Authorities are satisfied that the model specifies the proper inputs and assumptions in order to generate the appropriate gas demand forecasts. The Regulatory Authorities have also considered whether their assumptions regarding gas generator demands are consistent with the discussions with stakeholders in the electricity sector. Having examined the modelling output of the various scenarios, discussions were held between the Regulatory Authorities and the TSOs in order to assess the 'pinch points' and potential mitigation measures.

1.4 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 the central planning case projections for gas demand by market sector.

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

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

Section 6 discusses the conclusions and recommendations arising from the analysis in previous sections.

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

Appendix 2 explains the model testing that has been undertaken.

Appendix 3 provides the network schematics in relation to each of the supply scenarios.

Appendix 4 is a glossary of the terms used in the Statement

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 circa 12,300km of pipelines. The integrated supply network is sub-divided into 2,298km 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 BGÉ onshore high pressure transmission network consists of approximately 2,019km of pipe.

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

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-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 the 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 (previously by 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.

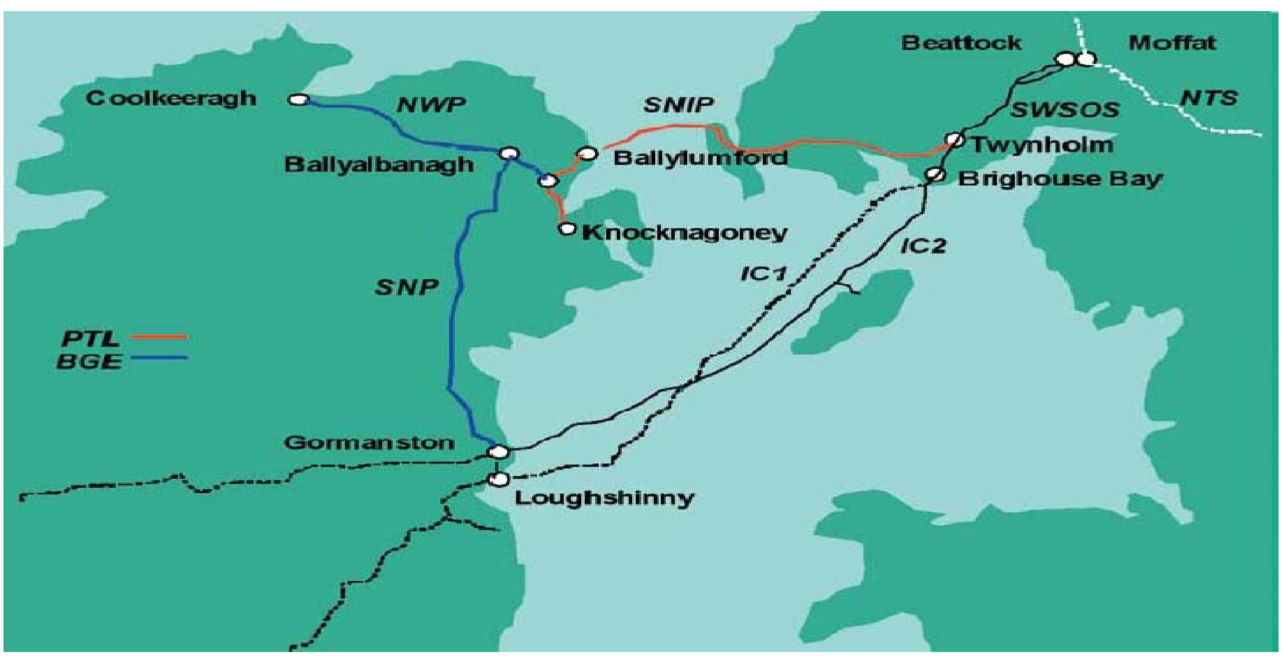
Part of the Mayo to Galway pipeline will link the Corrib gas field to the Irish market. The 149 km of 650mm diameter pipeline from Mayo to Galway will connect an onshore terminal in Bellanaboy Co. Mayo, into the Pipeline to the West at Craughwell in Co. Galway. The Mayo-Galway pipeline is fully operational and the remainder of the pipeline is to be commissioned in stages before the arrival of Corrib gas so that the Mayo towns can be supplied with gas.

The onshore Irish system is connected to the Northern Ireland transmission system through the 'South-North' pipeline. The South-North Pipeline (SNP) runs between the IC2 land-fall at Gormanston, Co. Meath to the North West pipeline at Ballyalbanagh in Co. Antrim. There is the potential for supplying customers in Ireland along the SNP but currently there are no connections to the section of the pipeline in Ireland.

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 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. As well as Coolkeeragh, several distribution networks are being developed in towns adjacent to the pipeline by firmus Energy.

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 154.5 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) 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. Bord Gáis Networks carries out the day-today 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 Joint Capacity Statement and covers the period 2008/09 to 2014/15.[7]

Northern Ireland has three transmission system operators (TSO), 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

One of the main prospective developments that will have a significant impact on the system is the proposed Liquefied Natural Gas (LNG) import terminal on the Shannon Estuary. The view of the developer is that this terminal will be in operation by 2013/14. This timing is incorporated into our central scenario. The proposed terminal would be connected to the existing transmission system by *circa* 26km of pipeline. The construction of the terminal has received planning permission (subject to certain conditions), and applications for the necessary consents for the pipeline to the transmission system have been submitted and are currently under consideration. The Department of Enterprise Trade and Investment are also working on a study to consider possible extension to the NI gas transmission network. This provides the possibility that there may be future pipeline projects in this jurisdiction.

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[7] "Transmission Development Statement, For Period 2008/09 to 2014/15", Gaslink, Dec 2008.

When gas begins to flow through the Bellanaboy entry point from the Corrib field and the Shannon LNG project becomes operational, the direction of flows on the Irish transmission network could potentially change significantly. Currently gas flows primarily from the East Coast 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, but increasingly also to new towns along the Pipeline to the West. If gas from Corrib and Shannon LNG displaces gas coming through the interconnectors, increasingly gas will flow from the West of Ireland to centres of demand in the East and the South. The central supply and demand cases, and the scenarios, should help to test the implications of these potential major changes in the operation of the network and will 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 Corrib field and the Shannon LNG project would physically flow to NI.

The other prospective development is the construction of salt cavity storage at Larne. Islandmagee Storage Limited (recently changed from Portland Gas NI Ltd) propose to develop a 500 mscm salt cavity storage facility under Larne Lough. Islandmagee Storage Limited has completed seismic testing and plans to submit a planning application by Q4 2009, with first gas operations expected to begin in 2014. The gas storage facility will be located adjacent to the SNIP and no extensive pipeline development will be required to facilitate connection. It is expected that the storage facility will be made available to at least the NI and Irish markets. Again, the supply and demand cases, and the scenarios, should help to test the implications of the storage facility on the operation of the network.

In addition, Bord Gáis Strategic Investments (BGSI) and Storengy (a GdFSuez company) are actively progressing a study with the view to developing a salt cavern underground gas storage facility to the southwest of Larne. A seismic survey will be carried out in 2009 which will indicate the actual potential working gas capacity that could be developed. This will be followed by a test drill in 2010. In the interim, an indicative figure of 300 mscm is being used for working gas capacity for this facility. The North West Pipeline passes through the licensed area covered by the feasibility study.

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

Gas is delivered by the high pressure transmission network to above ground installations (AGI) designed to reduce the pressure to a suitable level for delivery to the BGÉ distribution system. The majority of the 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 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 network in the Greater Belfast area which has 125,000 customers and the firmus network in the ten towns along the SNP and NWP which have about 5,000 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 DSOs with development and capacity obligations set out in the 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 a consortium led by Shell and Statoil in the Atlantic Ocean. The nature of drilling of this type is that the prospects for finding commercially viable reserves of gas are necessarily very uncertain. The Regulatory Authorities are also mindful that the recent purchase of Marathon's upstream interests from the Kinsale/Ballycotton fields by PSE Kinsale Energy Ltd may also see further developments at the Inch entry point.

3 Gas Demand

3.1 Introduction

A single “Central Case” gas demand forecast was developed for the JCS, which included a combined forecast for both Ireland and Northern Ireland The methodologies used to develop the relevant components of the demand forecast were very similar to those used in the previous GCS and Pressure Report, and may be briefly summarised as follows:

- The gas demand of the different sectors of the Irish economy was modelled separately using a combination of historic gas demand, information provided by shippers and other stakeholders and future expectations of economic growth, new housing construction, electricity demand and fuel-prices; *and*
- The future gas demand for NI was derived from information primarily provided by shippers as part of the postalised tariff arrangements and potential end users, which was collated and consolidated by PTL and the Utility Regulator.

The outlook for future gas demand is more uncertain compared to previous years, due to the deepening economic recession. Although slowing economic growth was factored into the forecast, the severity of the slowdown was not fully appreciated when it was being finalised at the end of 2008.

In the short-term gas demand is expected to contract in certain sectors due to the economic recession, particularly in the I/C sector. This will be partially offset by the planned construction of new gas-fired power stations. The overall impact is that the forecast growth in gas demand over the next few years will be lower than previously indicated.

3.2 The Irish gas demand forecast

3.2.1 Historic Irish annual gas demand

The historic Irish annual gas demand is summarised by sector in Table 3.1, for the period from 2002/03 to 2007/08. The Irish annual gas demand has grown by 4.2% p.a. over the period. Most of this growth has come from the power generation sector and to a lesser extent from the residential sector:

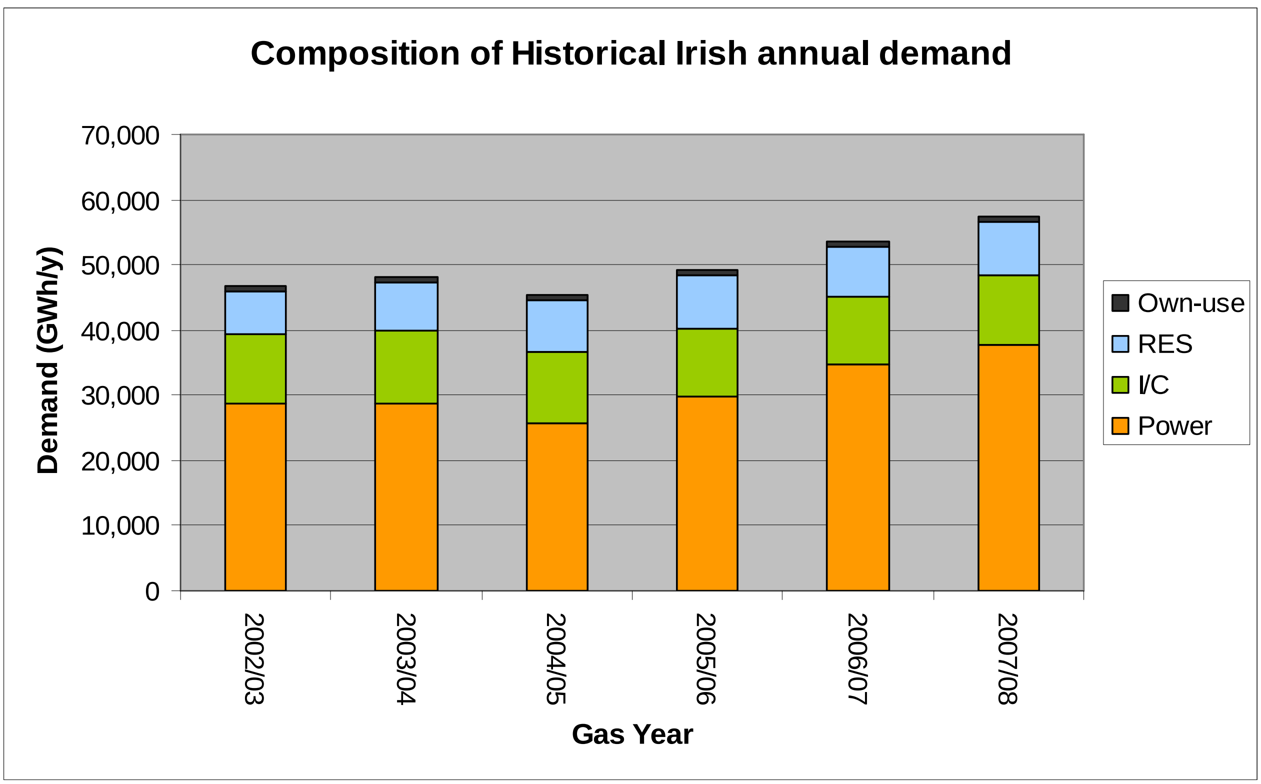
- Power sector gas demand grew by 5.6% p.a. due to the growth in electricity demand and the construction of new gas-fired stations, e.g. the Aughinish Combined Heat & Power (CHP) plus the Tynagh and Huntstown II Combined Cycle Gas Turbine (CCGT) stations;
- Residential gas demand grew by 4.2% p.a., however, 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 due to the previous economic expansion being offset by the closure of a number of large I/C sites, particularly during 2004/05 (e.g. ADM, Irish Sugar etc).

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
ENERGY							
Power[2]	GWh/y	28,775.1	28,845.2	25,630.4	29,774.9	34,687.9	37,758.5
I/C	GWh/y	10,537.6	11,153.8	11,127.0	10,352.5	10,485.5	10,507.4
RES	GWh/y	6,700.6	7,433.6	7,756.7	8,148.9	7,716.1	8,238.5
Own-use[3]	GWh/y	616.7	735.0	878.3	814.9	779.1	814.0
Total Irish	GWh/y	46,630.0	48,167.7	45,392.3	49,091.1	53,668.6	57,318.4
VOLUME							
Power	mscm/y[4]	2,612.8	2,629.3	2,327.3	2,698.1	3,140.0	3,417.9
I/C	mscm/y	956.8	1,016.7	1,010.3	938.1	949.2	951.1
RES	mscm/y	608.4	677.6	704.3	738.4	698.5	745.8
Own-use	mscm/y	56.0	67.0	79.8	73.8	70.5	73.7
Total Irish	mscm/y	4,234.0	4,390.6	4,121.7	4,448.4	4,858.2	5,188.5

[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
[4]Volumes have been derived from the energy values by assuming a Gross Calorific Value (GCV) of 40 MJ/m^3 for Moffat & 37.5 MJ/m^3 for Inch for 2002/03 to 2006/07, and 39.7 MJ/m^3 and 37.8 MJ/m^3 respectively for 2007/08

Fig. 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 continues to grow, increasing from 61.7% in 2002/03 to 65.9% in 2007/08 (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 18.3% in 2007/08 (see Figure 3.1). The residential sector share of total gas demand has remained relatively constant over the period at c. 14.4%.

3.2.2 Irish gas demand forecast methodology

Separate gas demand forecasts have been prepared for the residential, I/C and power generation 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 50% of the Gross Domestic Product (GDP), i.e. it is assumed to grow or contract in line with economic growth or recession; *and*
- The historic weather adjusted residential gas demand is assumed to grow in line with increasing customer numbers, after adjustment 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 working group. 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 is given in the following sections.

3.2.3 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 outlook for future electricity demand is uncertain given the ongoing economic recession, and the "Low Demand" forecast published in the latest EirGrid Generation Adequacy Statement (GAR) 2009 – 2015 was considered to be most appropriate for modelling purposes. The historic and forecast annual Total Electricity Requirement (TER) is shown in Fig. 3.2, together with the corresponding growth rates.

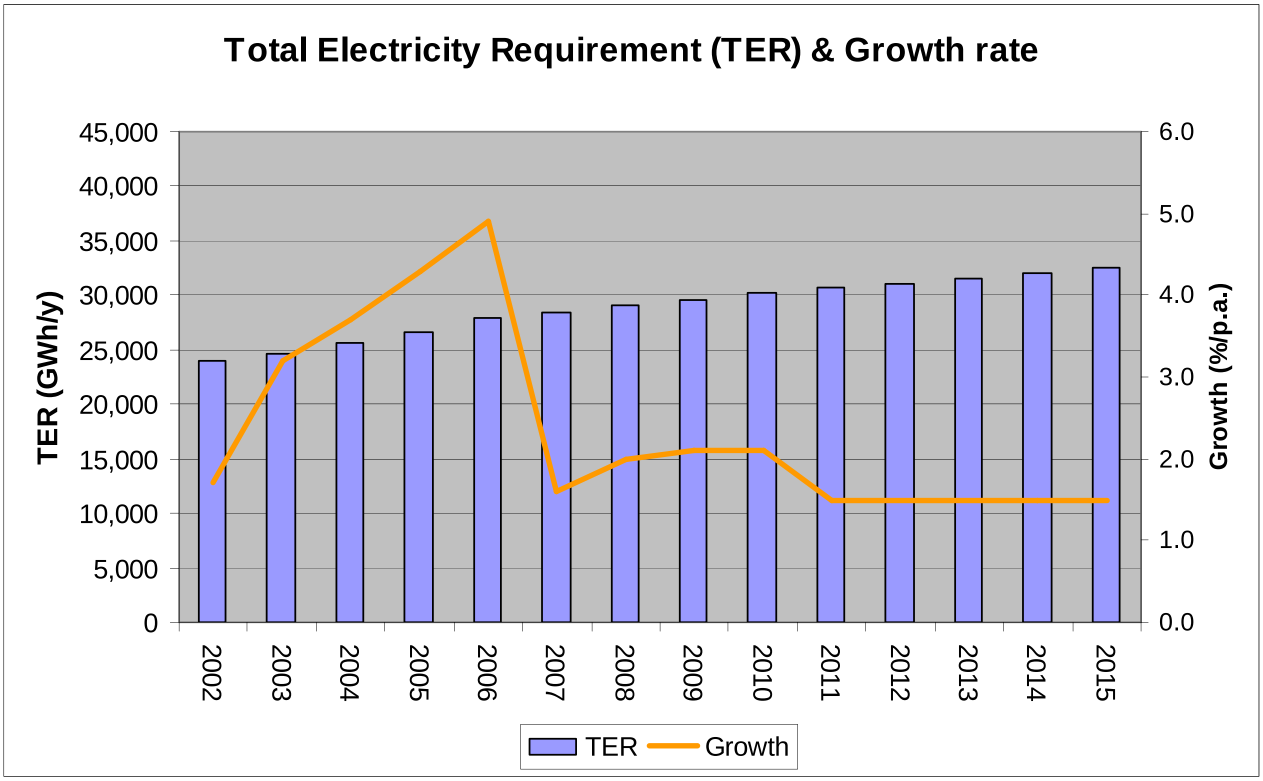
The GAR Low Case scenario assumes a lower growth rate in electricity demand, compared to that assumed in previous years. The annual Irish TER grew at an average rate of 3.0% p.a. between 2001 and 2008, but is only projected to grow at 1.6% p.a. between 2008 and 2015 in the latest GAR Low Case scenario.

The level of future renewable generation construction has also been taken from the latest GAR. This assumes that the installed wind-powered generation in Ireland will increase from 920 MW in 2008 to 2,900 MW by the end of 2016.

Wind is obviously an intermittent resource, and the average annual Load Factor (LF) of wind-powered generation is c. 31%. 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.

Fig 3.2: Historical and forecast Irish annual TER & Electricity Growth Rates



It is assumed that the 500 MW East/West (E/W) electricity interconnector with Great Britain (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 3.2, and may be briefly summarised as follows:

- The 430 MW Aghada CCGT and 445 MW Whitegate CCGT in the Cork Harbour area are already under construction and are expected to commence full commercial operation by October 2009 and May 2010 respectively;
- It is assumed that ENDESA will construct a 420 MW CCGT at Great Island and a 300 MW Open Cycle Gas Turbine (OCGT) at Tarbert by 2011/12, and also retire the existing on-site oil-fired stations once the new gas-fired stations are fully commissioned;
- It is assumed that construction will shortly start on the 445 MW Quinn CCGT in Co. Louth and the 430 MW Kilroot CCGT in NI, and that both will commence commercial operation by 2012/13; *and*
- The forecast also includes provision for two 100 MW OCGTs to provide the necessary flexibility to back-up all of the additional renewable generation that is forecast to come on stream.

In aggregate the JCS forecast assumes that 2,670 MW of new gas-fired CCGT and OCGT capacity will be commissioned 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). It should again be noted that such forecasts may be impacted given the continued economic recession during 2009.

Table 3.2: 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	Oct-09
Whitegate	CCGT	Cork	445	May-10
Quinn	CCGT	Louth	445	Oct-12
Kilroot	CCGT	Belfast area	430	Oct-12
Great Island	CCGT	Wexford	420	Oct-11
Tarbert	OCGT	Kerry	300	Oct-11
Other OCGT	OCGT	Various	2 x 100	Oct-12+
RETIREMENTS				
Poolbeg	Dual-fuel	Dublin	461	Oct-09
Great Island	Oil	Wexford	216	Oct-12
Tarbert	Oil	Kerry	589	Oct-12

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. 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 Fig. 3.3, 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;
- Followed by gas-fired OCGTs; *and*
- Followed by gas-oil OCGT.

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 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. 3.4 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. 3.4, 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).

Fig. 3.3: Generation price duration curve

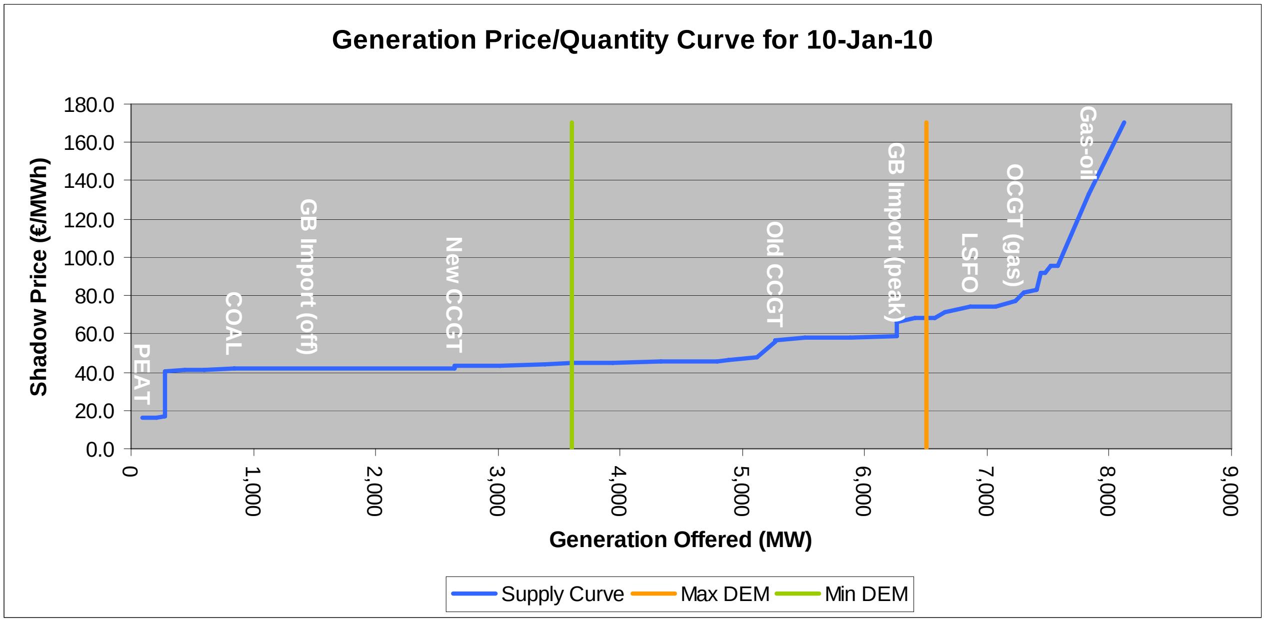
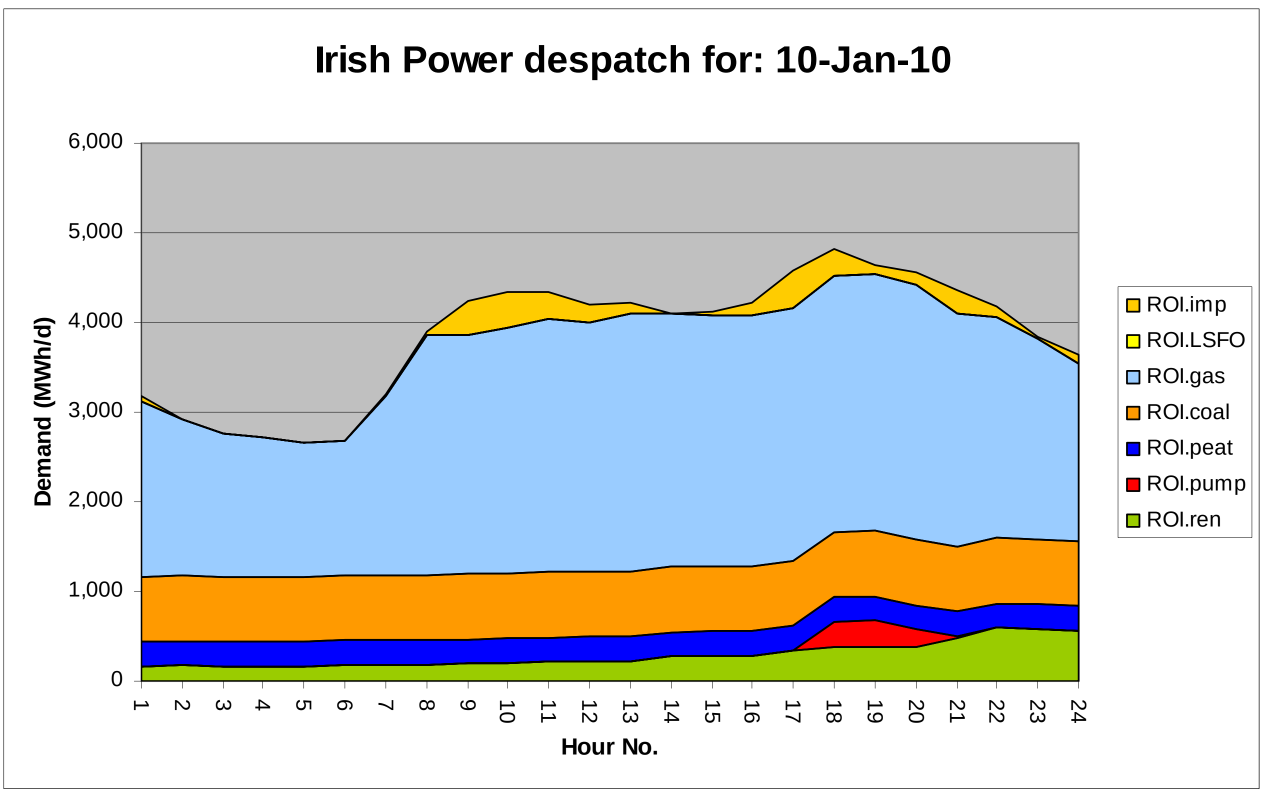


Fig. 3.4: Generator despatch on peak-day by fuel-type



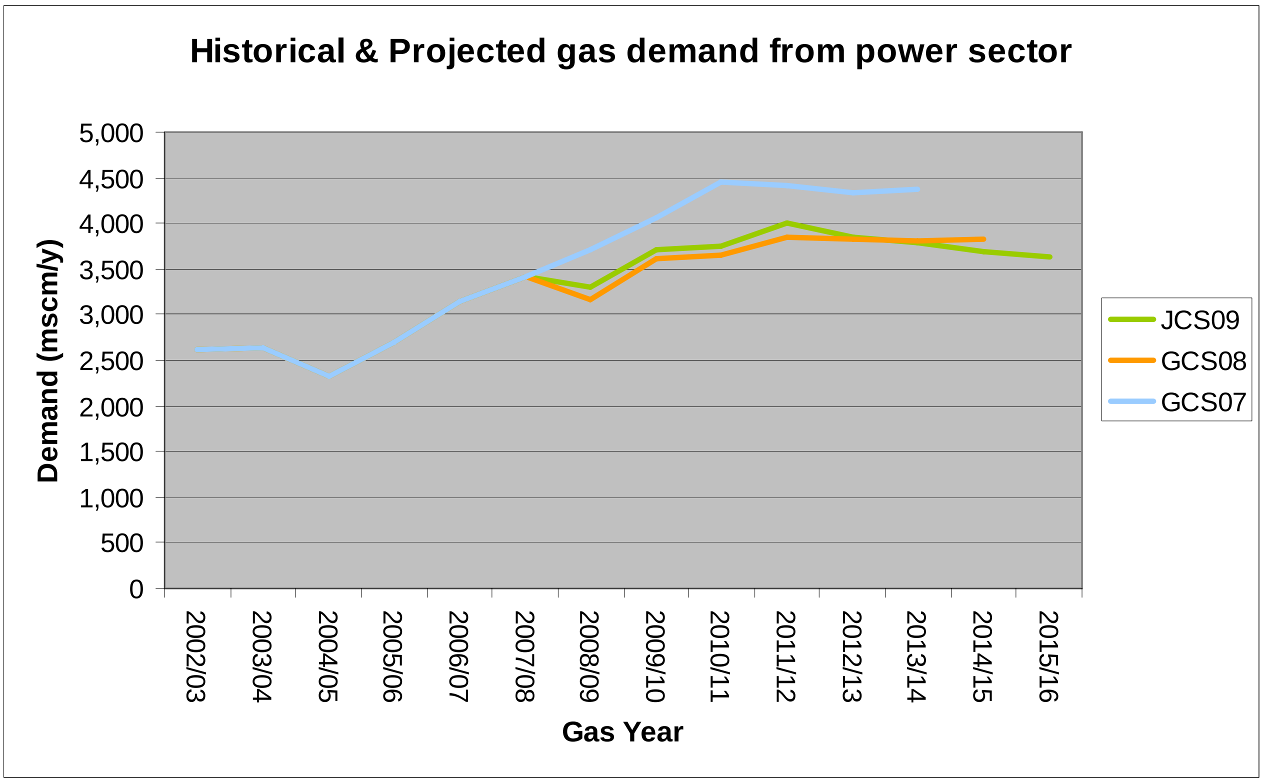
The 2009 JCS forecast annual gas demand of the power sector is presented in Table 3.3 in both energy and volume terms, together with the corresponding forecast from 2008 and 2007 GCS. The historical and forecast annual gas demand of the sector is shown in Fig. 3.5.

Table 3.3: Forecast annual gas demand of power sector

	Unit	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
ENERGY									
JCS09	GWh/y	36,374	40,720	40,592	43,478	41,813	41,607	40,694	40,215
VOLUME									
JCS09	mscm/y[1]	3,309	3,750	3,784	4,037	3,861	3,803	3,691	3,624
GCS08	mscm/y	3,170	3,615	3,654	3,845	3,826	3,808	3,830	
GCS07	mscm/y	3,712	4,064	4,454	4,413	4,337	4,379		

[1]Volumes have been derived from the energy values by assuming a weighted GCV based on the annual No Larne supply scenario.

Fig. 3.5: Annual historical and forecast gas demand for the power sector



The overall outlook for the power sector gas demand is very similar to that presented in the previous 2008 GCS (but see "Note" on this in the Foreword). The power sector gas demand was already forecast to fall during 2008/09 in the 2008 GCS due to slowing economic growth, and this is still the case in the 2009 JCS.

The power sector gas demand is forecast to recover between 2009/10 and 2011/12 due to the commissioning of the Aghada and Whitegate CCGTs in the Cork harbour area. It is forecast to potentially decline from 2012/13 onwards due to a combination of factors:

- The increasing volume of renewable electricity production will reduce the electricity output of all thermal power station, including gas-fired stations;
- The commissioning of the Kilroot CCGT in NI is expected to displace the electricity output of the older gas-fired stations in Ireland;

- The commissioning of the E/W electricity interconnector by 2012/13 is expected to lead to greater levels of electricity imports, which again will inevitably displace the electricity output of all thermal-fired generation (including the gas-fired power station).

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

There were approximately 21,506 I/C customers connected to the Irish gas transmission and distribution systems at the end of the 2007/08 gas year. A breakdown of the total annual I/C gas demand by category is given in Table 3.4, in both energy and volume terms:

- TX DM I/C: The larger transmission connected Daily Metered (DM) I/C sites, which accounted for 36.1% of total I/C demand in 2007/08, and includes the larger factories and co-ops etc;
- DX DM I/C: The larger distribution connected DM I/C sites, which accounted for 26.9% of total I/C demand in 2007/08, 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 37.0% of total I/C demand in 2007/08, and includes shops, offices, schools and restaurants etc.

Table 3.4: Breakdown of the historical Irish annual I/C gas demand[1]

	Unit	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
ENERGY							
TX DM I/C	GWh/y	4,460.7	4,853.8	4,953.4	4,004.1	4,029.4	3,791.6
DX DM I/C[2]	GWh/y	106.6	1,682.1	2,467.6	2,596.8	2,826.9	2,829.5
DX NDM I/C	GWh/y	5,970.2	4,618.0	3,706.0	3,751.6	3,629.2	3,886.3
Total I/C	GWh/y	10,537.6	11,153.8	11,127.0	10,352.5	10,485.5	10,507.4
VOLUME							
TX DM I/C	mscm/y[3]	405.0	442.4	449.8	362.8	364.7	343.2
DX DM I/C	mscm/y	9.7	153.3	224.1	235.3	255.9	256.1
DX NDM I/C	mscm/y	542.1	420.9	336.5	340.0	328.5	351.8
Total I/C	mscm/y	956.8	1,016.6	1,010.4	938.1	949.1	951.1

[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 GCV of 40 MJ/m^3 for Moffat & 37.5 MJ/m^3 for Inch for 2002/03 to 2006/07, and 39.7 MJ/m^3 and 37.8 MJ/m^3 respectively for 2007/08*

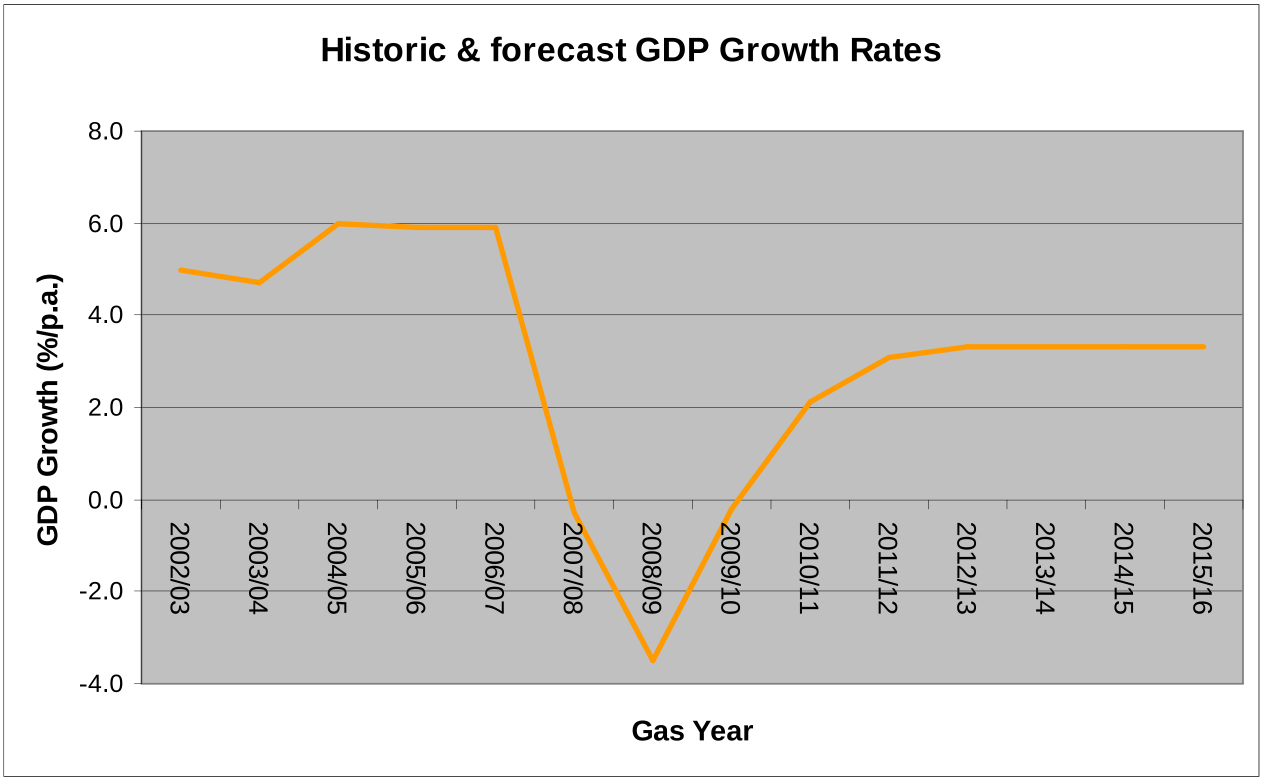
It can be seen that the overall I/C demand remained relatively flat over the period, with a 15.0% reduction in the transmission connected I/C demand being largely offset by a 10.5% increase in the distribution connected I/C demand.

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 towards a more modern service and knowledge based economy. Many of the commodity manufacturing based industries ceased during this period, e.g. IFI, Irish Steel, Irish Sugar and ADM.

The underlying drivers of I/C gas demand are complex and varied, and undoubtedly 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 50% of the overall economic growth rate, as measured using GDP. The underlying GDP projections are shown in Fig. 3.6.

Fig. 3.6: Historic and forecast Irish GDP growth rates



The starting point for the GDP forecast was the ESRI Quarterly Economic Commentary (QEC) for Winter 2008, which assumed that the Irish GDP would shrink by -2.4% in 2008 and -3.9% in 2009. The ESRI QEC didn't give any guidance beyond 2009, and earlier longer-term forecasts such as the Medium Term Review (MTR) had clearly been overtaken by the deepening economic recession.

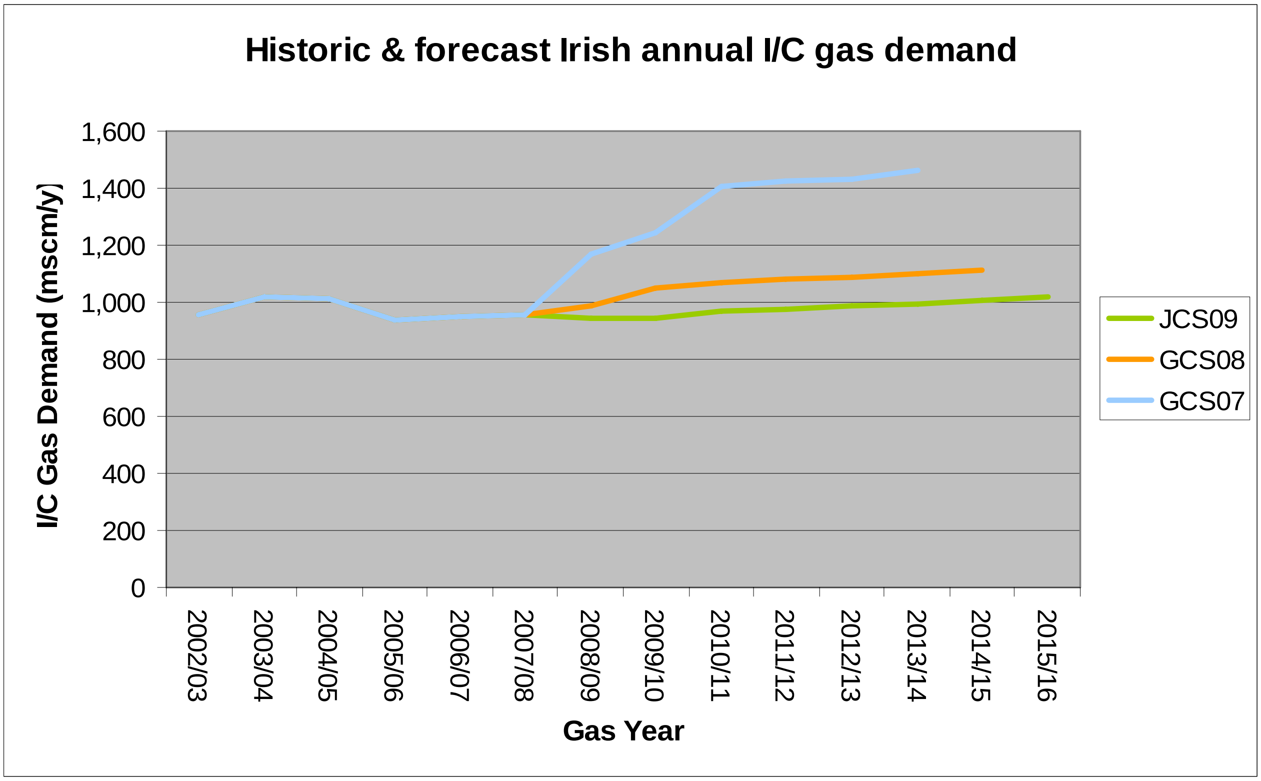
A pragmatic approach was adopted to counter the absence of any updated GDP forecast beyond 2010, which assumed that economic growth would begin to recover in 2010 and revert to its long-term growth potential of c. 3.0% p.a. by 2012. The resultant I/C demand forecasts are summarised in Table 3.6, together with the corresponding forecasts published in previous GSC (see also Fig. 3.7).

Table 3.5: Forecast annual gas demand of the Irish I/C sector

	Unit	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
ENERGY									
JCS09	GWh/y	10,364	10,326	10,428	10,579	10,743	10,910	11,079	11,252
VOLUME									
JCS09	mscm/y[1]	943	951	972	982	992	997	1,005	1,014
GCS08	mscm/y	989	1,049	1,066	1,080	1,090	1,099	1,113	
GCS07	mscm/y	1,169	1,245	1,407	1,424	1,434	1,464		

[1]*Volumes have been derived from the energy values by assuming a weighted GCV based on the peak day No Larne supply scenario.*

Fig. 3.7: Historical and forecast Irish annual I/C gas demand



The annual I/C gas demand is now forecast to continue to fall in both 2008/09 and 2009/10 due to the economic recession, before beginning to recover again in 2010/11. As noted previously the severity of the current economic slowdown was not fully anticipated when the forecast was being finalised at the end of 2008, and the actual reduction in I/C gas demand may be greater than indicated above.

The latest JCS forecast of I/C demand is lower than that presented in the previous 2008 GCS, being 10.8% lower by 2014/15. This is explained by the fact that the 2008 GCS was obviously prepared during very different economic circumstances, when most economic forecasters were still predicting a soft-landing for the Irish economy (as opposed to the outturn, which is the worst recession in decades).

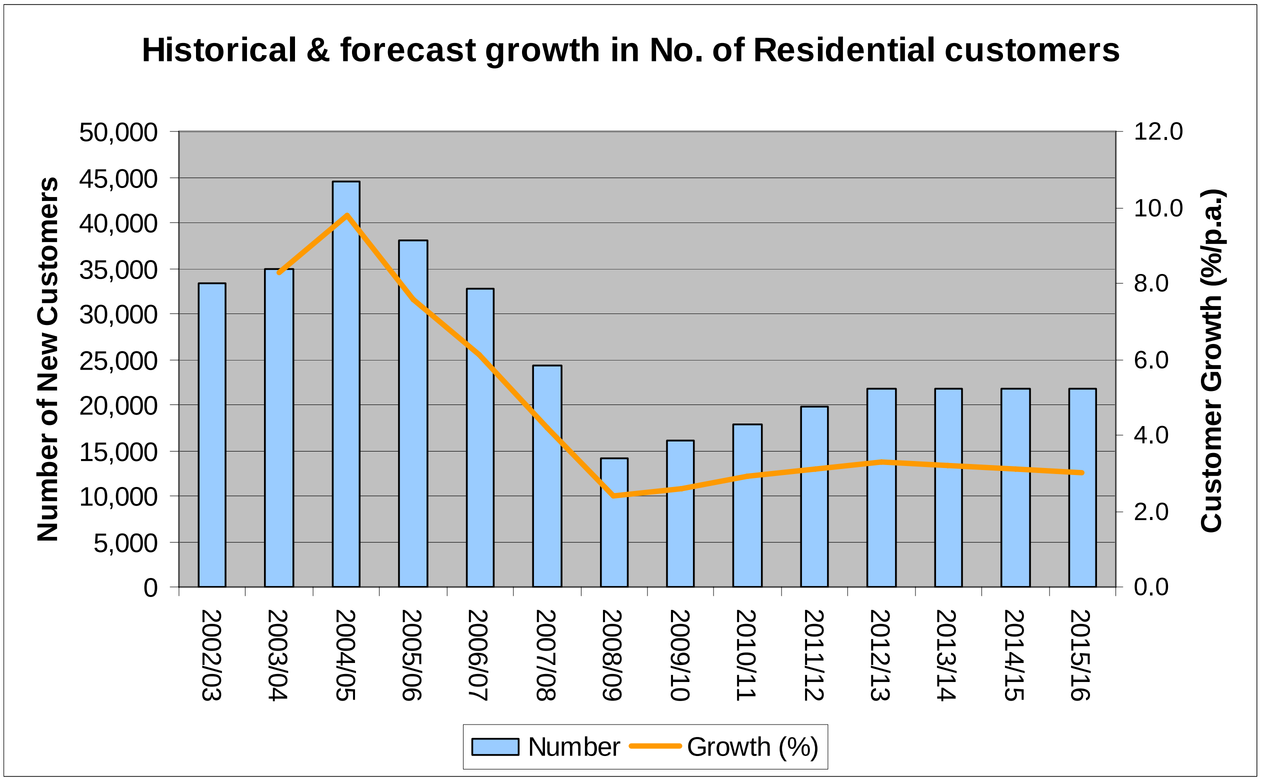
3.2.5 Irish Residential gas demand

There were approximately 595,740 residential customers connected to the Irish distribution system at the end of the 2007/08 gas year. The total number of residential gas customers has increased substantially by 41.4% over the period (see Fig. 3.8), growing from 421,453 at the end of 2002/03 to 595,740 at the end of 2007/08.

The annual residential gas demand on the other hand only increased by 23.0% over the same period, growing from 6,700.6 GWh/y in 2002/03 to 8238.5 GWh/y in 2007/08. 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.

Fig. 3.8: Growth in new residential customer numbers



The growth in residential gas demand going forward is going to 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 has been provided by BGN.

The BGN forecast assumes that the number of new residential connections will fall-off substantially, given the current state of the economy and the construction sector in particular. The forecast assumes that new residential connections will drop to 14,100 in 2008/09 before climbing again to 21,700 p.a. by the end of the period.

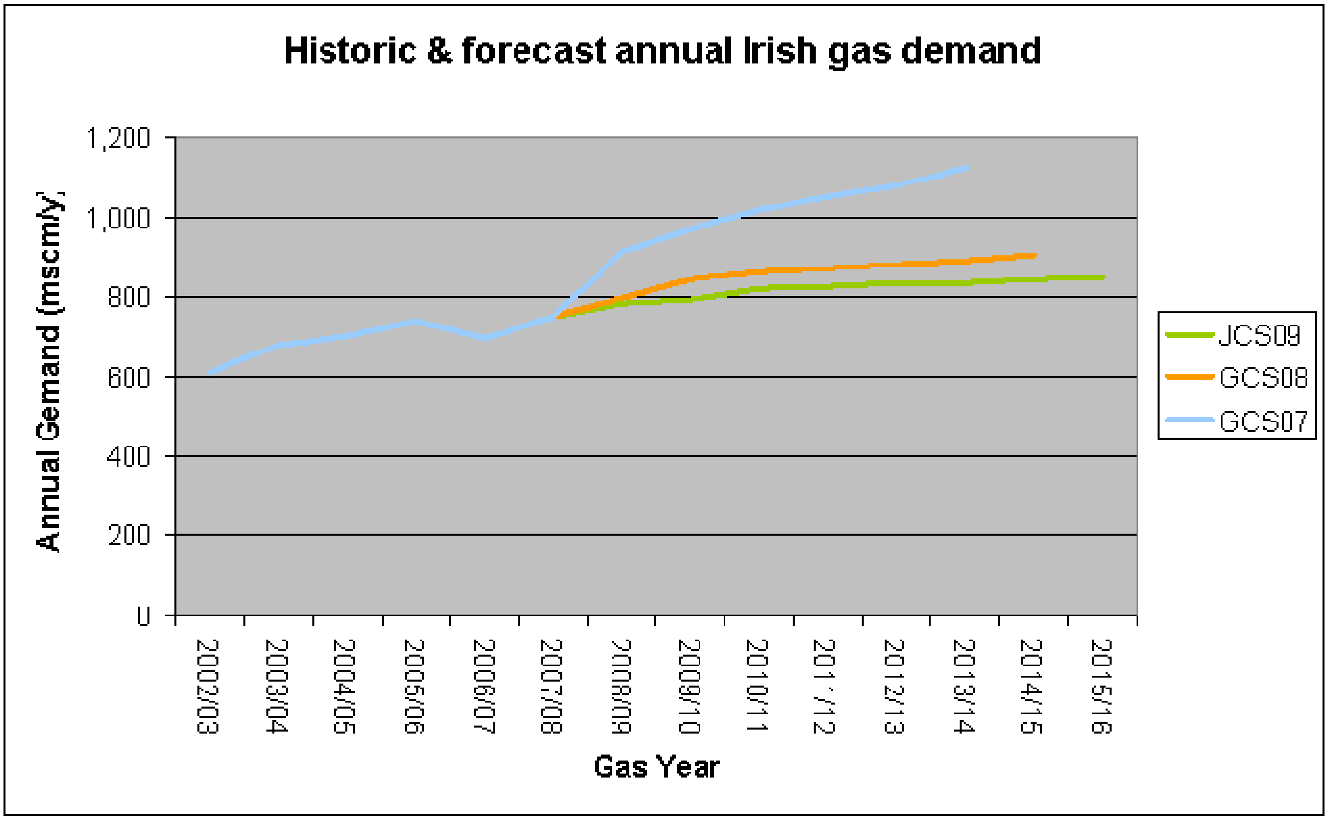
The incremental demand from each new connection is also expected to reduce over the period due to enhanced building regulations, which are designed to reduce the typical energy consumption of a new home by c. 40%. The JCS residential annual demand forecast is summarised in Table 3.6 and illustrated in Fig. 3.9), together with the corresponding GCS forecasts from previous years.

Table 3.6: Forecast annual gas demand of the Irish residential sector

	Unit	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
ENERGY									
JCS09	GWh/y	8,569	8,698	8,828	8,945	9,055	9,170	9,285	9,400
VOLUME									
JCS09	mscm/y[1]	780	801	823	831	836	838	842	847
GCS08	mscm/y	797	846	861	873	883	892	904	
GCS07	mscm/y	916	969	1,016	1,049	1,078	1,123		

[1]*Volumes have been derived from the energy values by assuming a weighted GCV based on the peak day No Larne supply scenario.*

Fig. 3.9: Historical and forecast Irish annual residential gas demand



The latest JCS forecast is lower than that published in the 2008 GCS, being c. 7.5% lower by 2014/15. 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.

3.2.6 Total Irish annual gas demand

The forecast total Irish annual gas demand is summarised in Table 3.7 and illustrated in Fig. 3.10, together with the corresponding forecast published in previous versions of the GCS. The total Irish annual gas demand is forecast to grow at an average rate of 1.2% p.a. over the period.

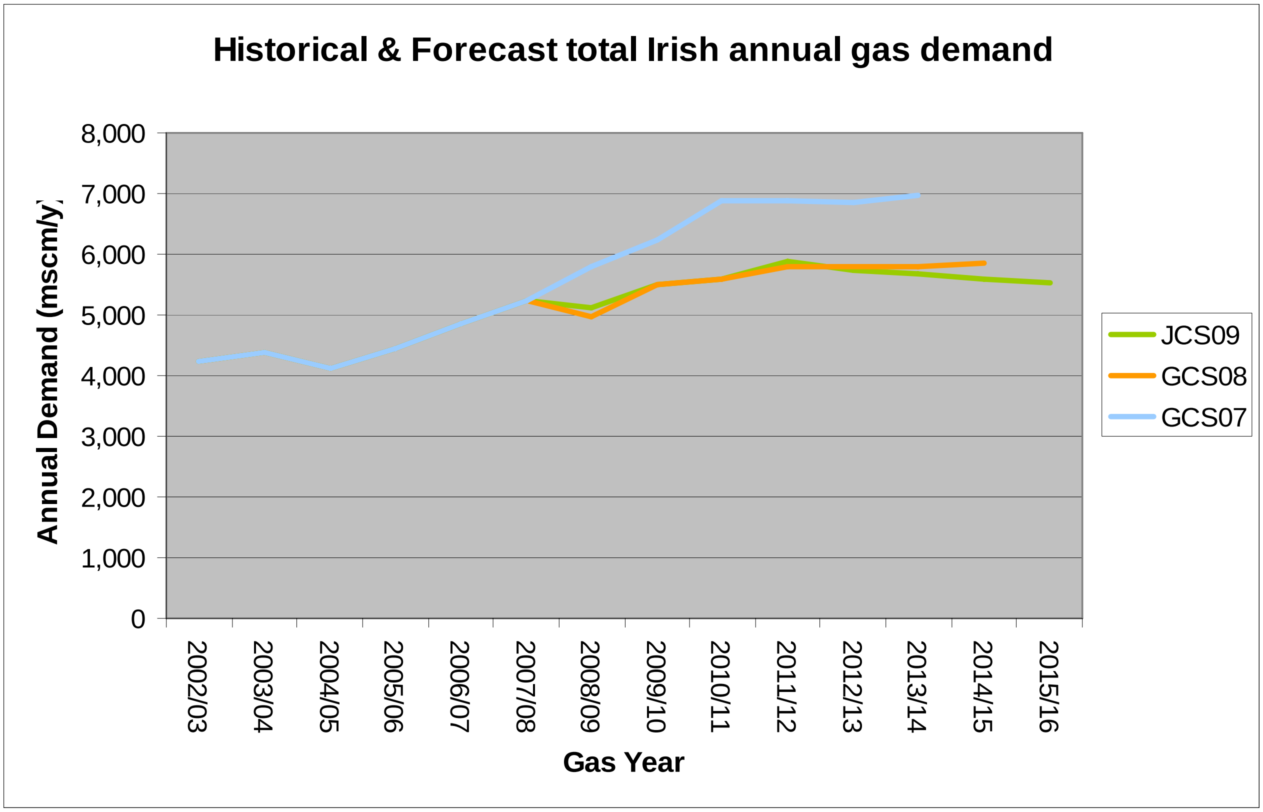
The latest JCS forecast is lower than that presented in 2008 GCS, particularly towards the end of the period (being -4.5% lower by 2014/15). The main reasons for this are the ongoing economic recession, and also the forecast of lower electricity demand going forward (which obviously has a follow-on impact on the power sector gas demand).

Table 3.7: Forecast total Irish annual gas demand

	Unit	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
ENERGY									
JCS09	GWh/y	56,306	60,591	60,517	63,760	62,477	62,432	61,561	61,285
VOLUME									
JCS09	mscm/y[1]	5,122	5,580	5,642	5,920	5,769	5,706	5,583	5,523
GCS08	mscm/y	4,956	5,509	5,582	5,798	5,799	5,799	5,847	
GCS07	mscm/y	5,791	6,249	6,877	6,886	6,849	6,966		

[1]*Volumes have been derived from the energy values by assuming a weighted GCV based on the peak day No Larne supply scenario.*

Fig. 3.10: Historical & forecast total Irish annual gas demand



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

3.3 The NI gas demand forecast

3.3.1 Historic NI annual gas demand

The historic NI gas demand is summarised by sector in Table 3.8 and shown in Fig. 3.11. The distribution category includes the gas demand of the Phoenix Gas, Firmus Energy and Stranraer distribution systems, while the power sector includes the Ballylumford and Coolkeeragh power stations. The NI annual demand has grown by 43.7% over the period (or 7.5% p.a.):

- The power sector grew by 7.6% p.a. with the combined effect of the commissioning of one new CCGT at Coolkeeragh and the displacement of 600MW of open cycle generation with a 600MW CCGT at Ballylumford; *and*
- The distribution sector grew by 7.2% p.a. with the expansion of the Phoenix distribution system in the Belfast area and the Firmus distribution systems along the North West Pipeline (NWP).

Fig. 3.11: Historic NI annual gas demand

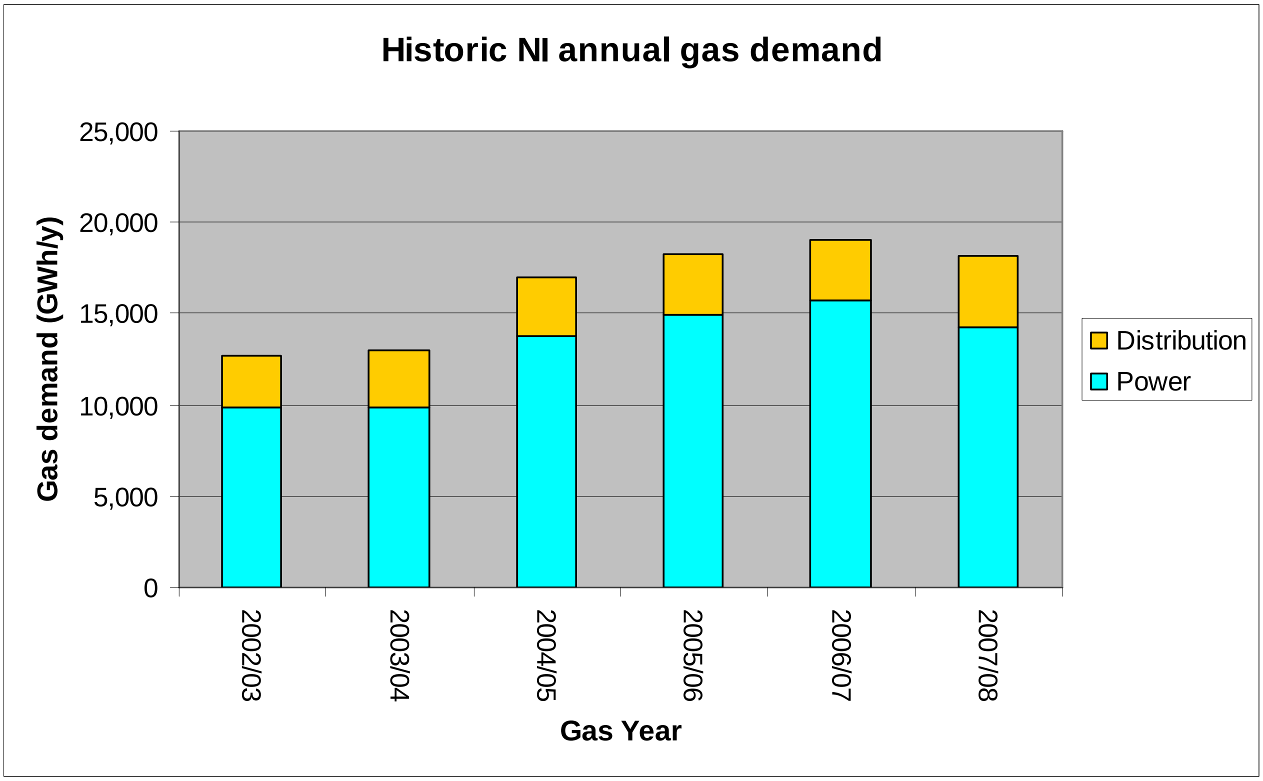


Table 3.8: Historic NI annual demand summarised by sector

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

[1]Volumes have been derived from the energy values by assuming a GCV of 40 MJ/m^3 for Moffat & 37.5 MJ/m^3 for Inch for 2002/03 to 2006/07, and 39.7 MJ/m^3 and 37.8 MJ/m^3 respectively for 2007/08

3.3.2 NI gas demand forecasting methodology

The NI shippers are required to provide an estimate of their future capacity requirements and commodity throughput, as part of the postalised tariff arrangements. This information has been collated by the Utility Regulator and projected forward to the end of the period (where necessary).

3.3.3 NI forecast of annual gas demand

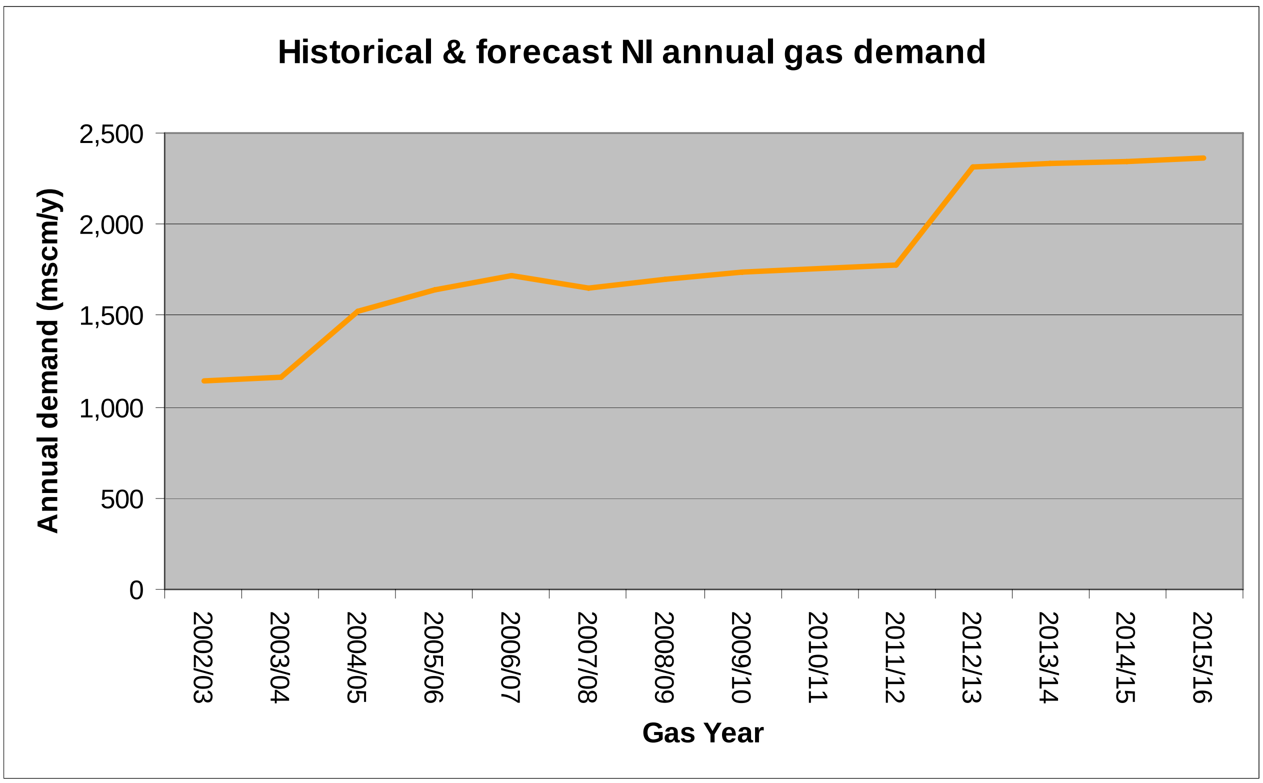
The forecast NI annual demand is summarised is Table 3.9. The distribution forecasts have been taken from information provided to the Utility Regulator by Greater Belfast Shippers and firmus energy. The power forecasts are based on information provided in the 2008/09 postalised tariff calculation for the Ballylumford and Coolkeeragh CCGT power stations.

In addition to the existing Ballylumford and Coolkeeragh power stations, provision has also been made for the construction of a new 430 MW CCGT by AES at the site of their existing Kilroot coal-fired power station. It is assumed that the Kilroot CCGT will commence commercial operation by 2012/13.

Table 3.9: Forecast NI annual gas demand

	Unit	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
ENERGY									
Power	GWh/y	14,919	15,017	15,039	15,039	20,789	20,789	20,789	20,789
Distribution	GWh/y	3,862	4,141	4,336	4,550	4,737	4,919	5,097	5,264
Total NI	GWh/y	18,781	19,158	19,375	19,589	25,526	25,708	25,886	26,053
VOLUME									
Power	mscm/y	1,353.0	1,362.0	1,364.0	1,364.0	1,885.0	1,885.0	1,885.0	1,885.0
Distribution	mscm/y	350.0	368.0	394.0	412.0	430.0	446.0	462.0	477.0
Total NI	mscm/y	1,703.0	1,738.0	1,758.0	1,776.0	2,315.0	2,331.0	2,347.0	2,362.0

Fig. 3.12: Historical and forecast NI annual gas demand



4 Gas Supplies

4.1 Overview

The majority of the gas demand in Ireland and Northern Ireland is currently supplied with GB gas imports from Moffat, with the remainder being supplied from Inch with Kinsale production and storage gas. This supply outlook is set to change going forward with a number of new supply projects, which are at various stages of development. These include:

- The Corrib gas field off the West Coast is currently being developed by the Corrib partners (i.e. Shell, Statoil and Marathon);
- The Shannon LNG terminal have received planning permission for their proposed LNG re-gasification terminal near Ballylumford in Co. Kerry;
- Islandmagee Storage Limited and BGSI are currently evaluating the technical and commercial feasibility of developing salt-cavity gas storage in the Larne area in NI; *and*
- Further gas prospects have been identified in the Celtic Sea, and off the North West coast.

4.2 Sources of supply

4.2.1 Indigenous 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.

The main source of future indigenous production will be the Corrib gas field, which is currently being developed by the Corrib partners. Work is currently ongoing on the Bellanaboy terminal in Co. Mayo (which will process the Corrib gas), and the infrastructure required to connect the offshore gas field to the Bellanaboy terminal.

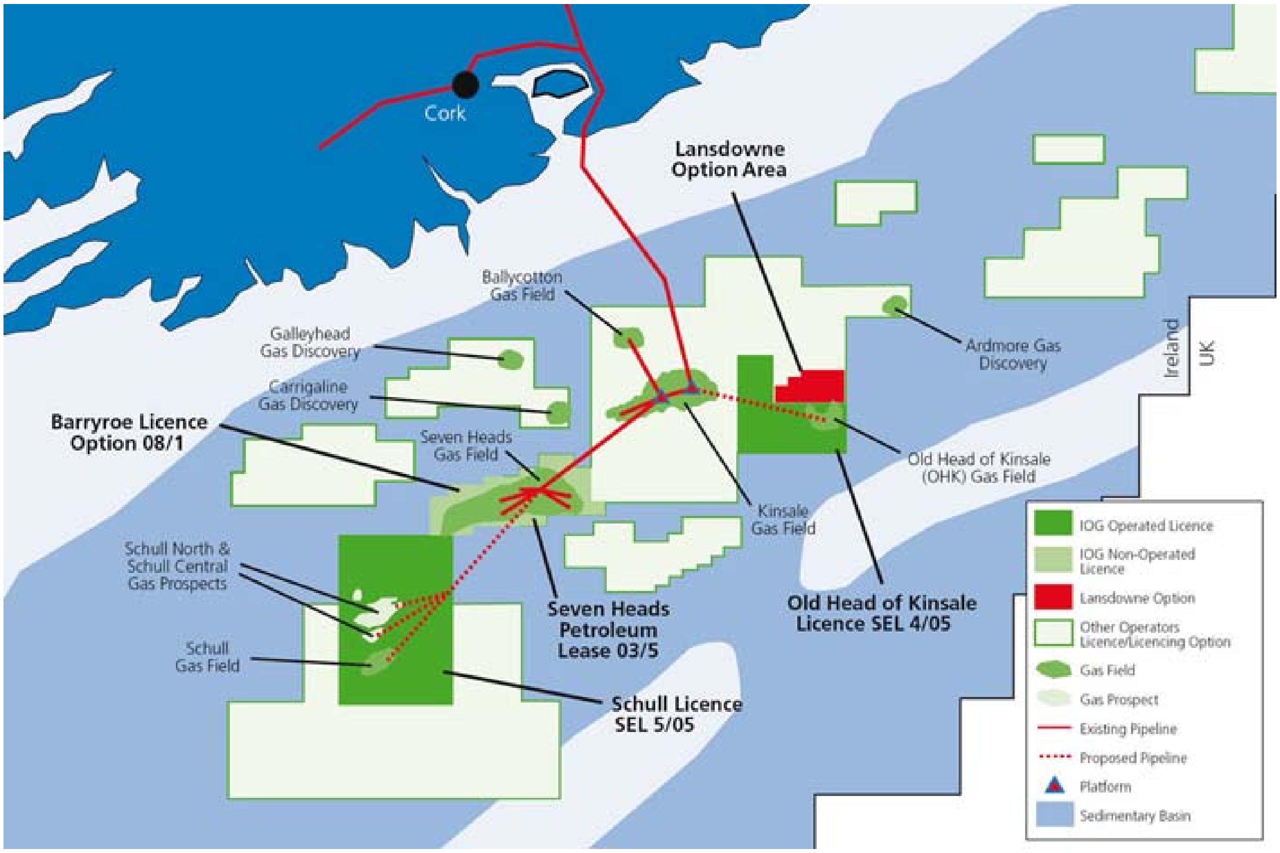
Commercial production of Corrib gas is assumed to commence during Q2 2010, and will make a major contribution to the Irish security of supply situation. Corrib gas is expected to meet 39.4% of the forecast 1 in 50 peak-day demand, and 62.8% of the Irish annual demand in 2010/11.

The production profile provided by the Corrib partners, however, declines quite quickly and reduces to less than 50.0% of its peak-production within 6years. The Irish dependence on GB imports will begin to rise again as Corrib production declines, unless new sources of supply are brought on stream.

A number of other potential gas prospects have also been identified in the Celtic Sea. Island Oil & Gas have confirmed the presence of gas in both the Old Head of Kinsale and Schull prospects, and is currently evaluating 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 be kept under review in future JCS publications.

Figure 4.1: Existing Celtic Sea production and gas prospects



Source: Island Oil & Gas website

4.2.2 Gas Storage

The Kinsale storage facility was developed by Marathon using the depleted SWL gas field. It has a working volume of c. 200 mscm (2,092.7 GWh), a maximum withdrawal rate of 2.8 mscm/d (29.3 GWh/d) and a maximum injection rate of 1.8 mscm/d (18.8 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 to PSE Kinsale Energy Ltd in 2009. However, there is the potential for further developments. These will be considered in subsequent Statements. There is still uncertainty surrounding the longer-term viability of Kinsale storage as a “standalone” facility. A scenario based approach has been used to manage this uncertainty, with some scenarios assuming Kinsale production and storage activities cease by 2013/14, and others assuming they continue beyond 2013/14.

A number of project developers are also looking at the technical and commercial viability of developing salt-cavity storage in the Larne area of NI. Islandmagee Storage Limited is looking at developing a salt-cavity storage facility underneath Larne Lough, while BGSI is looking at developing an onshore salt-cavity storage facility near Larne.

Both projects are still at the preliminary stages of development. Islandmagee Storage Limited has completed seismic testing and plans to submit a planning application by Q4 2009, with first gas operations expected to begin in 2014. The BGSI project is understood to be following a similar timeline.

A “generic” salt-cavity in the Larne area has been modelled for the purposes of the JCS, based on a [500 mscm (5,513.1 GWh)] working volume, a maximum withdrawal rate of 24.1 mscm/d (265.7 GWh/d) and a maximum injection rate of 12.1 mscm/d (133.4 GWh/d).

Gas injections into the salt-cavity facility is assumed to commence during the summer of 2013/14, and commercial withdrawals are assumed to commence during winter 2014/15. The salt-cavities are assumed to be developed on a phased-basis, with the maximum withdrawal rate assumed to increase from 12.0 mscm/d (132.3 GWh/d) in 2014/15 to 24.1 mscm/d (265.7 GWh/d) by 2016/17.

4.2.3 Liquefied Natural Gas (LNG)

Shannon LNG received planning permission during 2008 for their proposed LNG re-gasification facility on the Shannon Estuary (near Ballylongford in Co. Kerry). Shannon LNG are currently progressing the remaining outstanding approvals, including a CER consent for construction of a gas pipeline from the Irish transmission system to the LNG terminal, and a foreshore licence.

Shannon LNG have indicated that the proposed LNG terminal will be developed on a phased basis. Phase I commercial operations are assumed to commence by 2013/14. The maximum Phase I send-out will ramp-up from 5.3 mscm/d (59.8 GWh/d) in 2013/14 to 17.0 mscm/d (191.1 GWh/d) by 2016/17 (based on the profile provided by Shannon LNG).

The Shannon LNG terminal has been designed to facilitate future expansion at a later date, through the installation of additional LNG storage tanks and re-gasification facilities. The maximum Phase II send-out will be 28 mscm/d (314.7 GWh/d).

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 was (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 is also used to supply gas to the town of Stranraer in Scotland.

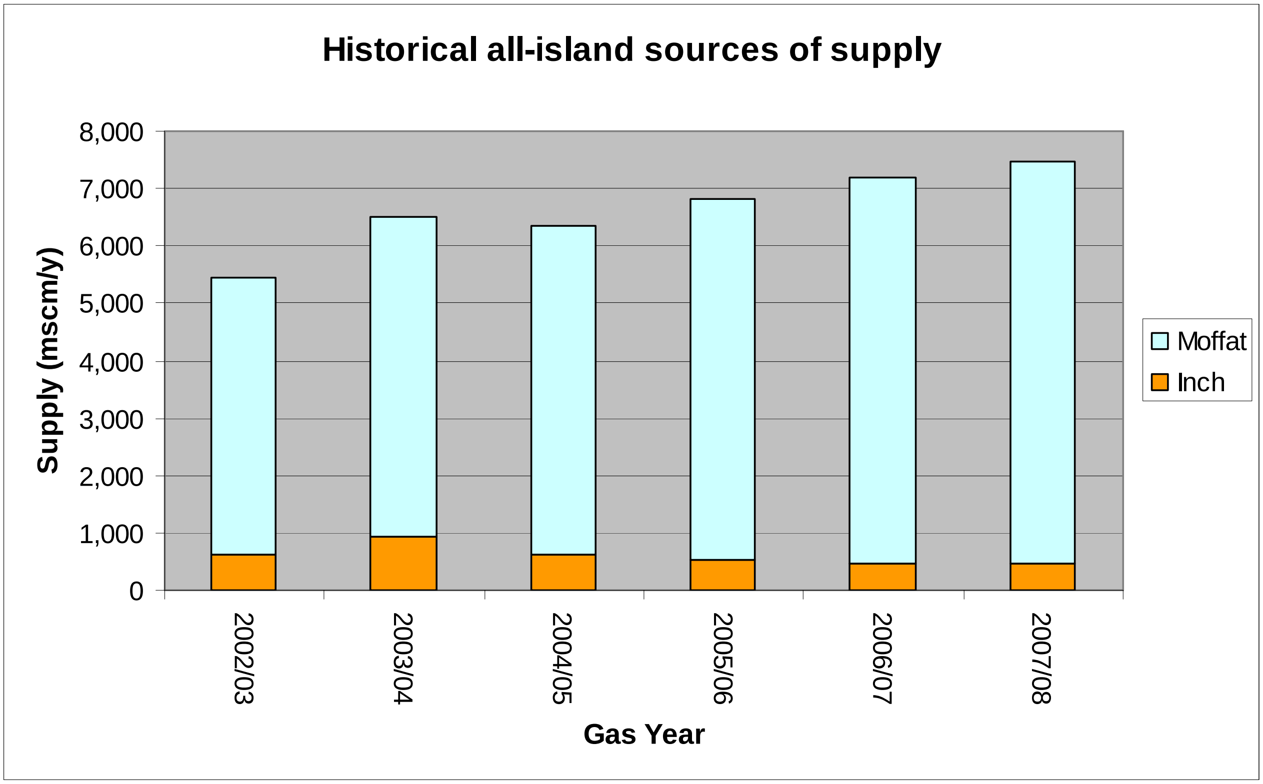
The first GB gas imports through IC1 in 1995 were quite small, however, they increased rapidly over time and accounted for c. 91.7% of total Irish annual demand in 2007/08. The historical breakdown of indigenous production and GB gas imports is given in Table 4.1 (for both Ireland and Northern Ireland).

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
ENERGY							
Inch	GWh/y	6,637	9,705	6,397	5,451	4,976	4,772
Moffat	GWh/y	53,221	51,982	56,890	64,023	69,236	72,665
Total supply	GWh/y	59,858	61,687	63,287	69,474	74,212	77,437
VOLUME[2]							
Inch	mscm/y	637	932	614	523	478	455
Moffat	mscm/y	4,790	4,678	5,120	5,762	6,231	6,591
Total I/C	mscm/y	4,234	4,391	4,122	4,448	4,858	7,046

[1]Includes Irish, NI and IOM gas demand plus any Inch Exit to refill Kinsale Storage
[2]Volumes have been derived from the energy values by assuming a GCV of 40 MJ/m^3 for Moffat & 37.5 MJ/m^3 for Inch for 2002/03 to 2006/07, and 39.7 MJ/m^3 and 37.8 MJ/m^3 respectively for 2007/08

Fig. 4.2: Historical all-island sources of supply



4.3 Supply scenarios

There is considerable uncertainty surrounding the potential timing of some of the above projects. There is also uncertainty about the long-term commercial viability of the Kinsale offshore gas storage facility due to the decline in gas production. 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 **Central Case** ('Extended Inch') scenario: Assumes Corrib gas from April 2010, that the Kinsale production and storage facilities remain in operation beyond October 2013 and that there are no further new sources of supply within the forecast period;
- The **High Supply** scenario: Assumes Corrib gas from April 2010, Shannon LNG from October 2013, a NI salt-cavity storage facility from October 2014 and the cessation of Kinsale gas production and storage activities by October 2013;
- The **Low Supply** scenario: Assumes that Corrib gas is delayed by a year to April 2011, no new other new sources of supply and the cessation of Kinsale gas production and storage activities by October 2013;
- The **No Shannon** scenario: Is a variant to the High Supply scenario, but assumes that the Shannon LNG terminal is not operational within the forecast period; *and*
- The **No Larne** scenario: Is again a variant of the High Supply scenario, but assumes that there is no salt-cavity gas storage facility operational in the Larne area within the forecast period.

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. In these scenarios the various sources of supply are assumed to be despatched in the following order, for modelling purposes:

- Indigenous production will be despatched first (i.e. Inch and Corrib production gas);
- Followed by storage gas (i.e. Inch and Larne storage gas);
- Followed by LNG gas imports; *and*
- With any remaining shortfall in supply being imported through the interconnector system.

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 Introduction

Network analysis modelling was used to determine whether the Irish and NI transmission systems could carry the gas flows that result from the above demand and supply scenarios. The network analysis was carried out using a hydraulic model of both the Irish and NI transmission systems, using "Pipeline Studio®" modelling software (see Appendix 2 for more details of the network analysis modelling).

The peak-day and minimum-day was modelled for each scenario. The hourly transient behaviour of the all-island system was modelled over a 3-day period for each day on an energy basis. The ability of the combined transmission systems to transport the resultant flows of gas was validated using the following criteria:

- Maintaining the specified minimum and maximum operating pressures at key points on the transmission systems:
  - Minimum of 55 bar-g at the Dublin City gates;
  - Minimum of 45 bar-g at Ballyveelish (for Waterford area)
  - Minimum of 25 bar-g at Ballineen (West Cork);
  - Minimum of 30 bar-g at Coolkeeragh;
  - Minimum of 56 bar-g at the inlet to Twynholm; *and*
  - Not to exceed the Maximum Operating Pressure (MOP) of the onshore transmission systems, currently 70 bar-g in Ireland and 75 bar-g 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

Although the Irish and NI systems are physically connected through the South/North (S/N) Pipeline, they are currently operated as separated systems. The two systems are effectively isolated by the current system configuration at Gormanston. The current configuration at Gormanston is shown in Fig. 5.1 (CAG Closed):

- 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; *and*
- The combined effect of this configuration is that the two systems are essentially physically separated for operational purposes, and have separate pressure control regimes.

This arrangement would change with the advent of CAG, where the two transmissions would be operated as a single all-island system in order to minimise operating costs. It is assumed in the 2009 JCS that the CAG arrangement will come into force from 2010/11 and this will be reviewed in the preparation of future Statements. The corresponding configuration for Gormanston is shown in Fig. 5.2 (CAG Open):

- Both BV A and BV B at Gormanston are open; *and*
- The S/N regulator 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.

It is envisaged under the existing CAG Closed arrangement that gas would only flow from IC2 into the S/N Pipeline in the event of an emergency or if there was insufficient capacity available on the SNIP. In the CAG Open scenario gas flows will be determined by system conditions, subject to the requirement to maintain the minimum and maximum specified system pressures identified above.

Fig. 5.1: CAG Closed system configuration at Gormanston

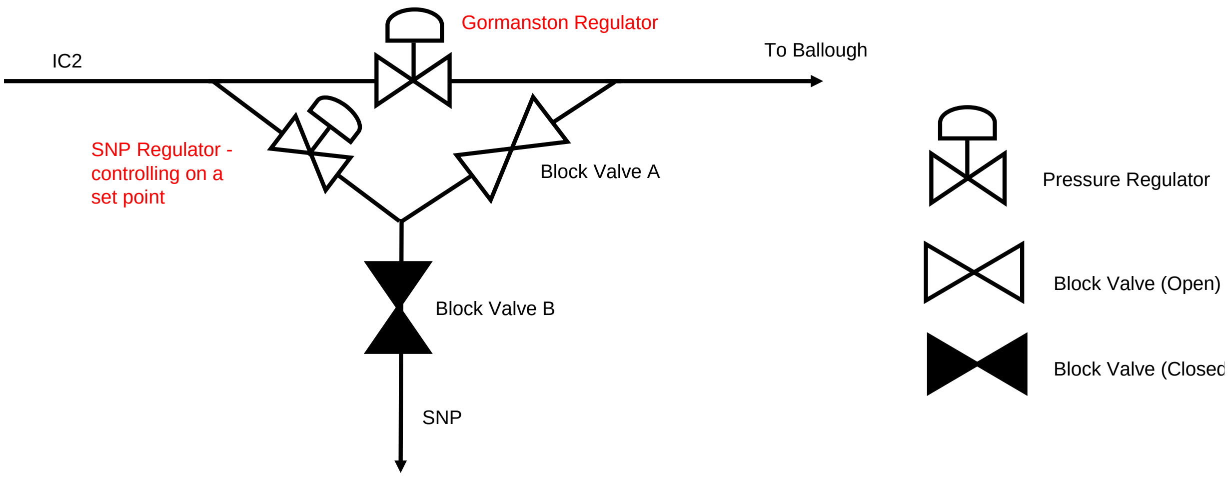
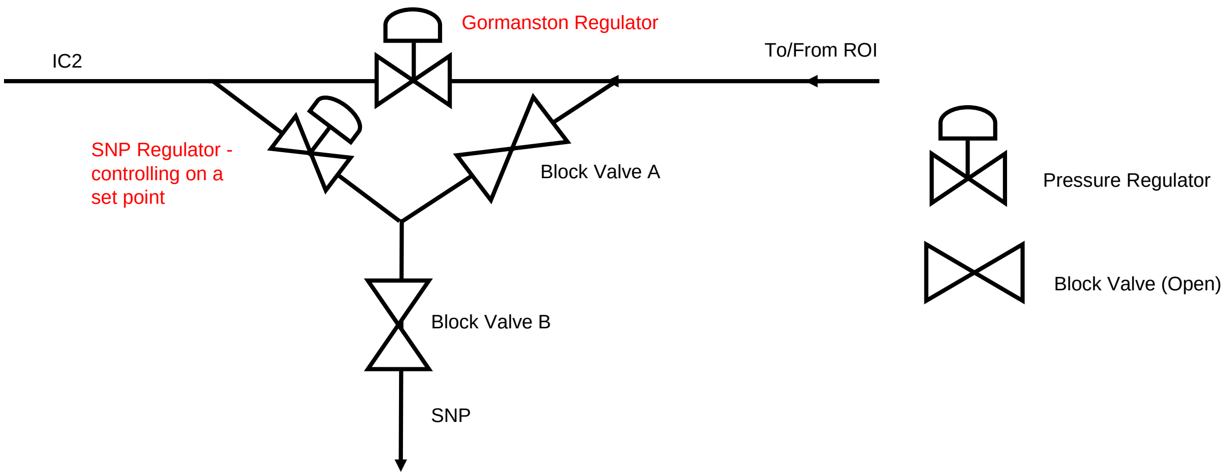


Fig. 5.2: CAG Open system configuration at Gormanston



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 bar-g.

5.3 Entry Point assumptions

The main Entry Point assumptions in terms of gas pressures and Gross Calorific Value (GCV) and flow profiles are summarised in Table 5.1. This shows both the contractual minimum pressures and the pressures assumed for network analysis purposes, as sometimes these are different for the reasons explained below.

The Pressure Maintenance Agreement (PMA) requires National Grid (NG) to provide a minimum pressure of 42.5 bar-g at Moffat. NG have also advised that the Anticipated Normal Operating Pressure (ANOP) at Moffat will be 47.0 bar-g (and actual pressures have been higher again, in gas year 2007/08 pressures varied between 50 and 60 bar-g). The ANOP pressure of 47.0 bar-g has been used for network analysis modelling, therefore, rather than the PMA pressure.

Table 5.1: Summary of main Entry Point assumptions

	Unit	Moffat	Inch	Corrib	Shannon
PRESSURE					
Contractual	bar-g	42.5	30.0	Up to 85	N/A
Assumed	bar-g	47.0	30.0	Up to 85	Up to MOP
OTHER					
GCV	MJ/m^3	39.69	37.67	37.64	40.46
Profile		Flat	Flat	Flat	Flat

The Inch Connected Systems Agreement (CSA) specifies a minimum pressure of 30 bar-g at Inch and the Corrib Operator is required to provide pressure up to 85 bar-g at Bellanaboy. No contractual arrangements have been finalised with Shannon LNG yet, but it is assumed that that they will be able to deliver at up to the MOP of the ring-main system.

It is assumed that the daily flows at each Entry Point would follow a “flat-flow” profile (i.e. the hourly flow would be $1/24^{th}$ of the daily flow), with the diurnal swing in the load profile being absorbed by the system line-pack.

5.4 Compressor station capacities

The maximum theoretical capacity assumption for the two compressor stations in Scotland is based on independent consultant reports for the Beattock and Brighouse Bay compressor stations respectively. It was concluded from those reports that:

- The maximum theoretical capacity of the Beattock compressor station is 31.0 mscm/d (341.8 GWh/d) based on an inlet pressure of 45 bar-g and discharge pressure of 85 bar-g in series mode configuration (higher capacities are possible, but result in the discharge pressure dropping below 85.0 bar-g); *and*
- The maximum theoretical capacity of the Brighouse Bay compressor station to be 23 mscm/d (253.6 GWh/d), based on a minimum inlet of 56.0 bar-g and a maximum discharge of 128 bar-g.

The above study indicated that there was sufficient power at the two compressor stations to compress the above flows, which exceed the original design capacities.

Independent consultants have been recently appointed to carryout additional performance testing on both compressor stations, and in particular to determine whether it is possible to increase the capacity of these stations.

Results from ongoing performance testing are required to confirm these theoretical capacities and to determine whether other components of the compressor stations such as pipework or the after-coolers are sufficient to accommodate these theoretical capacities.

5.5 Twynholm & SNIP

It was assumed in the 2009 JCS study that there would continue to be flow control at Twynholm and, therefore, the gas entering SNIP would follow a flat flow profile. The MOP of the SNIP system is currently 75 bar-g, but PTL are investigating whether it is possible to raise this to 85 bar-g.

The 75 bar-g MOP has been retained in the Low Case, Extended Inch and No Larne supply scenarios. In both the High Case and No Shannon scenarios, it was assumed that SNIP MOP could be raised to 85 bar-g, in order to investigate the scope for maximising the Larne Storage withdrawal rates.

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. NI also has an option to increase these entitlements to 12.0 mscm/d (132.3 GWh/d). No NI capacity limit was imposed at Twynholm during the network analysis modelling.

5.6 Results of peak-day network analysis modelling

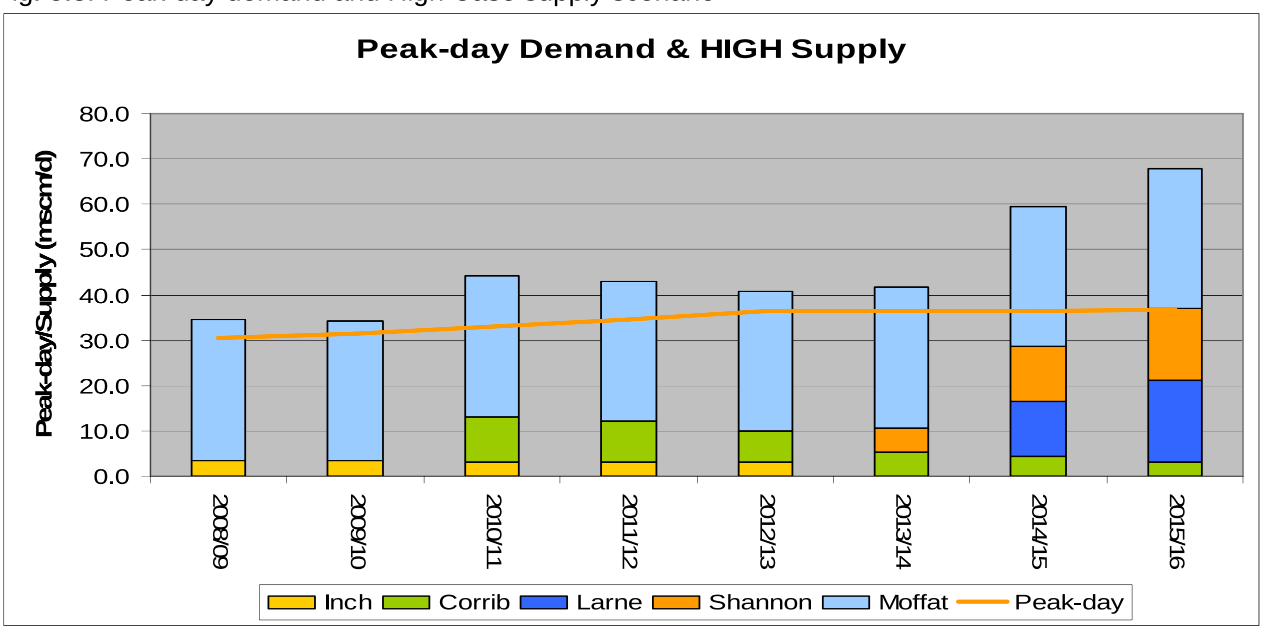
5.6.1 High Case supply scenario

The peak-day demand and supply balance for the High Case supply scenario is shown in Figure 5.3. It can be seen that the aggregate supply capacity in this scenario substantially exceeds the forecast peak-day demand and, therefore, it has been necessary to make the following assumptions about the order in which supplies will be despatched to meet demand for network analysis purposes:

- Indigenous production will be despatched first (i.e. Inch and Corrib production gas);
- Followed by storage gas (i.e. Larne);
- Followed by LNG gas imports; *and*
- With any remaining shortfall in supply being imported through the interconnector system.

The actual order in which supplies will be despatched in practice will obviously be determined by the shipper nominations and their contractual arrangements with producers and suppliers etc. It can be seen from Fig. 5.3 that there is more than sufficient aggregate supply capacity to meet the forecast peak-day demand.

Fig. 5.3: Peak-day demand and High Case supply scenario



The maximum potential withdrawal rate of Larne Storage in 2015/16 in this scenario is projected to be 18.1 mscm/d (199.6 GWh/d), which is substantially higher than the forecast NI peak-day demand of 10.1 mscm/d (111.4 GWh/d). If Larne withdrawals were to be maximised, it would be necessary to export the remaining 8.1 mscm/d (89.3 GWh/d) to the Ireland using either:

- The S/N Pipeline; *and/or*
- "Reverse-flowing" the Larne Storage gas through the SNIP Pipeline to Twynholm in Scotland and then sending the gas to Ireland through Brighouse Bay and the IC subsea system.

It was assumed that the NI MOP could be raised to 85 bar-g, and that the system would have a CAG Open configuration. The maximum S/N flow is constrained to 4.3 mscm/d (47.4 GWh/d) by the requirement to maintain a minimum pressure of 55 bar-g at the Dublin City gates, with 1.8 mscm/d (19.7 GWh/d) going to the Quinn CCGT and the remaining 2.5 mscm/d (27.6 GWh/d) to Gormanston.

The network analysis modelling showed that it is "theoretically" possible to reverse-flow the remaining 3.8 mscm/d (41.9 GWh/d) through the SNIP and the IC systems, and ensure compliance with all of the specified system performance criteria, namely:

- The Beattock discharge pressure is reduced to 68.0 bar-g, which is above the minimum discharge pressure for the scenario of 61.0 bar-g (i.e. based on a minimum inlet pressure of 45 bar-g and a minimum compressor lift of 16 bar-g); Results of the ongoing performance testing are required to confirm the capability of Beattock Compressor Station to operate under such low flow conditions. (0.61mscmd of a throughput); *and*
- The minimum inlet pressure at Brighouse Bay is 68.0 bar-g, which is above the minimum design inlet pressure of 52.0 bar-g.

A number of practical issues will need to be addressed in relation to the reverse-flow scenario, for e.g. PTL will need to confirm that the NI MOP can be raised from 75 bar-g to 85 bar-g, and modifications may be required to existing Above Ground Installations (AGIs) to facilitate the reverse-flow of gas.

If there is no requirement for compression at Beattock then the limiting factor for maximising the reverse flow becomes the requirement to maintain a minimum inlet pressure of 52.0 bar-g at Brighouse Bay. Preliminary studies indicates that maximum reverse-flow in this particular scenario is 9.2 mscm/d (101.4 GWh/d).

5.6.2 Low Case supply scenario

The peak-day demand and supply balance for the Low Case supply scenario is shown in Figure 5.4. The network modelling analysis for this scenario shows that the existing transmission systems have sufficient capacity, to cope with a 1-year delay to the Corrib project. It is worth noting that if Corrib was delayed further to beyond 2011/12, then the peak-day flows through Moffat are predicted to reach 31.4 mscm/d in 2011/12.

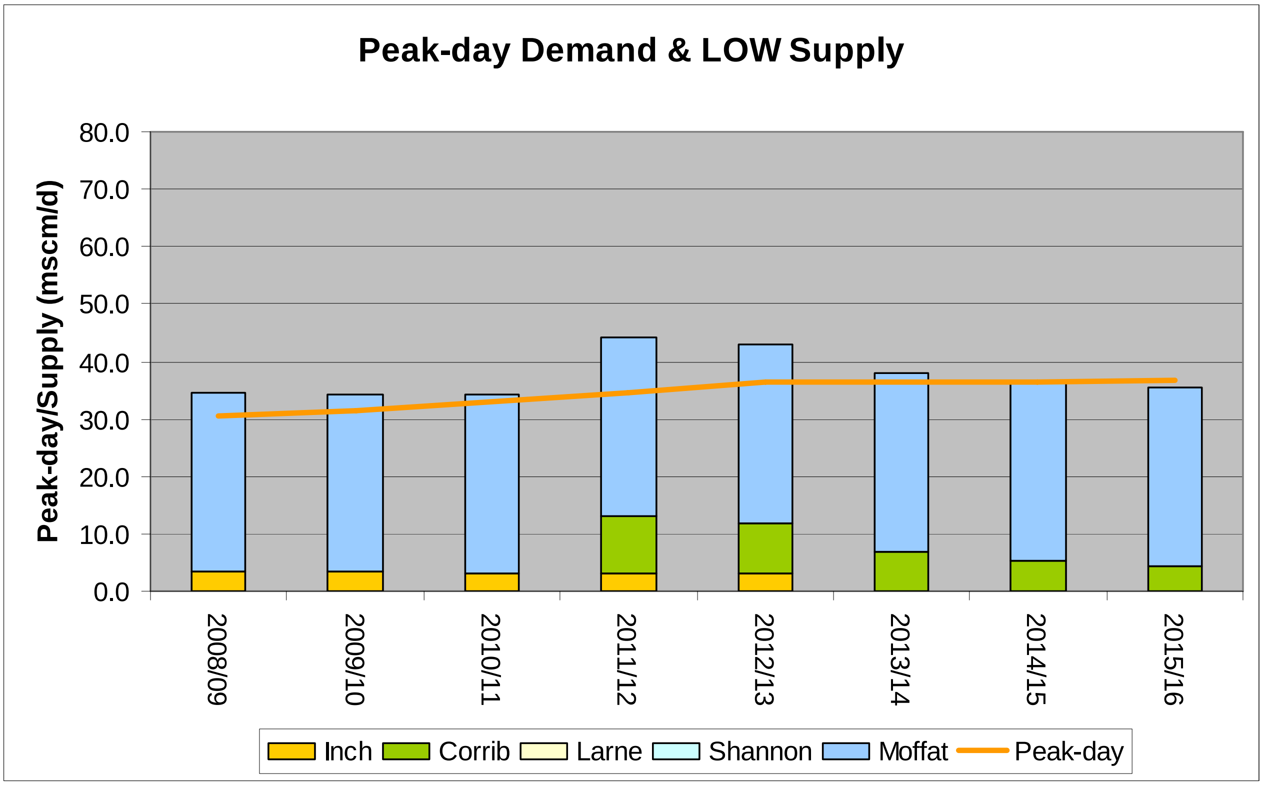
The assumption in Low Case supply scenario of no new sources of supply after Corrib and no Inch gas after 2013/14, inevitably leads to a very substantial increases in GB imports through the IC and SNIP systems over time. The forecast peak-day flows through Moffat exceed the assumed maximum capacity of the two compressor stations in Scotland by 2015/16:

- The peak-day flows through Moffat are predicted to reach c. 31.7 mscm/d (349.5 GWh/d) by 2014/15 and 32.9 mscm/d (362.8 GWh/d) by 2015/16, which exceed the assumed maximum capacity for Beattock of 31.0 mscm/d; *and*
- The peak-day flows through Brighouse Bay are predicted to reach c. 23.4 mscm/d (258.0 GWh/d) by 2014/15 and 25.6 mscm/d (282.3 GWh/d) by 2015/16, which again exceeds the assumed maximum capacity for Brighouse Bay of 23.0 mscm/d (253.6 GWh/d).

Previous studies indicate that it may be possible to compress flows of 32.9 mscm/d (362.8 GWh/d) at Beattock, but only at the expense of a reduced discharge pressure (c. 83.2 bar-g). Results of the performance testing are required to confirm the stations capability to flow in excess of 31mscmd. If the stations are capable of such flows then the network analysis shows it is possible to maintain satisfactory pressures on the NI and Irish transmission systems with this reduced Beattock discharge pressure, however, there are implications for the SNIP capacity, and the potential for export via the SNP (see below).

Although the projected Brighouse Bay flows of 25.6 mscm/d (282.3 GWh/d) in 2015/16 exceeds the assumed maximum capacity, it requires a smaller pressure lift (i.e. average lift of 59.1 to 117.8 bar-g, versus 56.0 to 128 bar-g assumed in the capacity calculation). Ongoing performance testing will clarify whether the station can compress the higher flows with a reduced pressure lift.

Fig. 5.4: Peak-day demand and Low Case supply scenario



Flows through the SNIP in this scenario were maximised subject to maintaining the minimum specified pressures on the transmission systems. The maximum SNIP flow achieved was 10.2 mscm/d (112.5 GWh/d) in 2012/13. Most of the SNIP flow is absorbed by the NI demand of 9.9 mscm/d (109.2 GWh/d), with only 0.3 mscm/d (3.3 GWh/d) available to export to Ireland through the S/N Pipeline. The NI flows include 1.7mscm/day for Kilroot.

This level of export through the S/N Pipeline is insufficient, however, to meet the demand of the Quinn CCGT. Given the demand at Quinn and Kilroot CCGT, it was necessary in this scenario to revert to the CAG closed system configuration and to supply the Quinn CCGT from IC2 gas from Gormanston.

The assumption that Kinsale gas production and storage activities cease by 2013/14 leads to a further increase in Moffat flows from 2013/14 onwards. These higher Moffat flows lead to higher pressure drops between Beattock and Twynholm, and have a follow-on impact on the SNIP capacity:

- The maximum SNIP flows reduce to 8.9 mscm/d (98.1 GWh/d) in 2013/14 and 8.3 mscm/d (91.5 GWh/d) in 2014/15; *and*

- They reduce below the current contractual entitlement to 7.3 mscm/d (80.5 GWh/d) in 2015/16 due to the combination of increasing Moffat flows and the reduction in Beattock discharge pressure (with the binding constraint on the NWP capacity being the requirement to maintain a minimum operating pressure of 30 bar-g at Coolkeeragh).

It will be necessary to await the results of the ongoing performance testing to confirm whether there would be a requirement to reinforce the IC system in Scotland for this scenario. In any case, the reinforcement will not be required until the end of the period, which allows sufficient time for any required reinforcement (4-5 year lead time assumed).

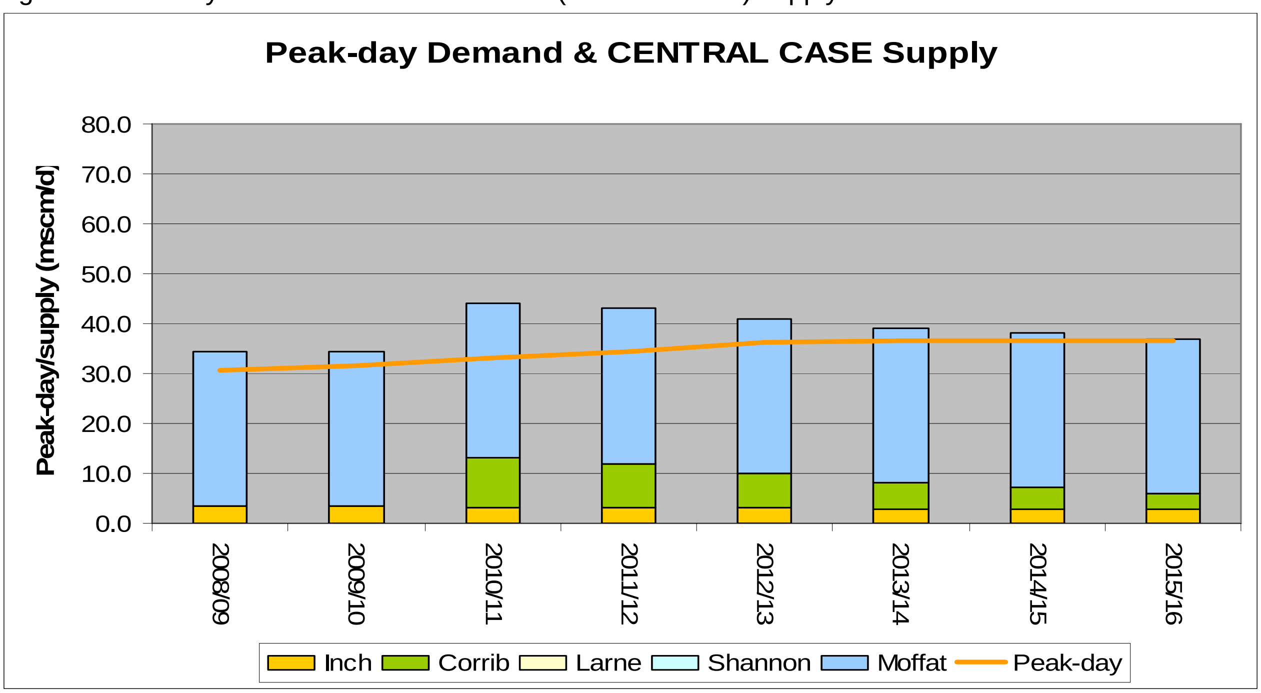
Finally it is worth noting that this scenario includes some severe assumptions in relation to future supplies, i.e. no new sources of supply after Corrib and no Inch gas after 2013/14. This scenario may be overly pessimistic given Star Energy decision to purchase the Kinsale offshore facilities, and the new supply and storage projects being pursued by Shannon LNG, Islandmagee Storage Limited and BGSI. It also assumes demand growth figures which may too be optimistic based on current economic climate and forecasts.

5.6.3 The Central Case ('Extended Inch') supply scenario

The demand and supply balance for the Central Case is shown in Fig. 5.5. The network analysis modelling indicates that satisfactory pressures are maintained at all points on the two transmission systems, although the projected Moffat and IC system flows marginally exceed the assumed maximum capacity of the two compressor stations in Scotland at the end of the period:

- Flows through Beattock reach 31.5 mscm/d (347.3 GWh/d) in 2015/16; *and*
- Flows through Brighouse Bay reach 23.1 mscm/d (254.7 GWh/d).

Fig. 5.5: Peak-day demand and Central Case (Extended Inch) supply scenario

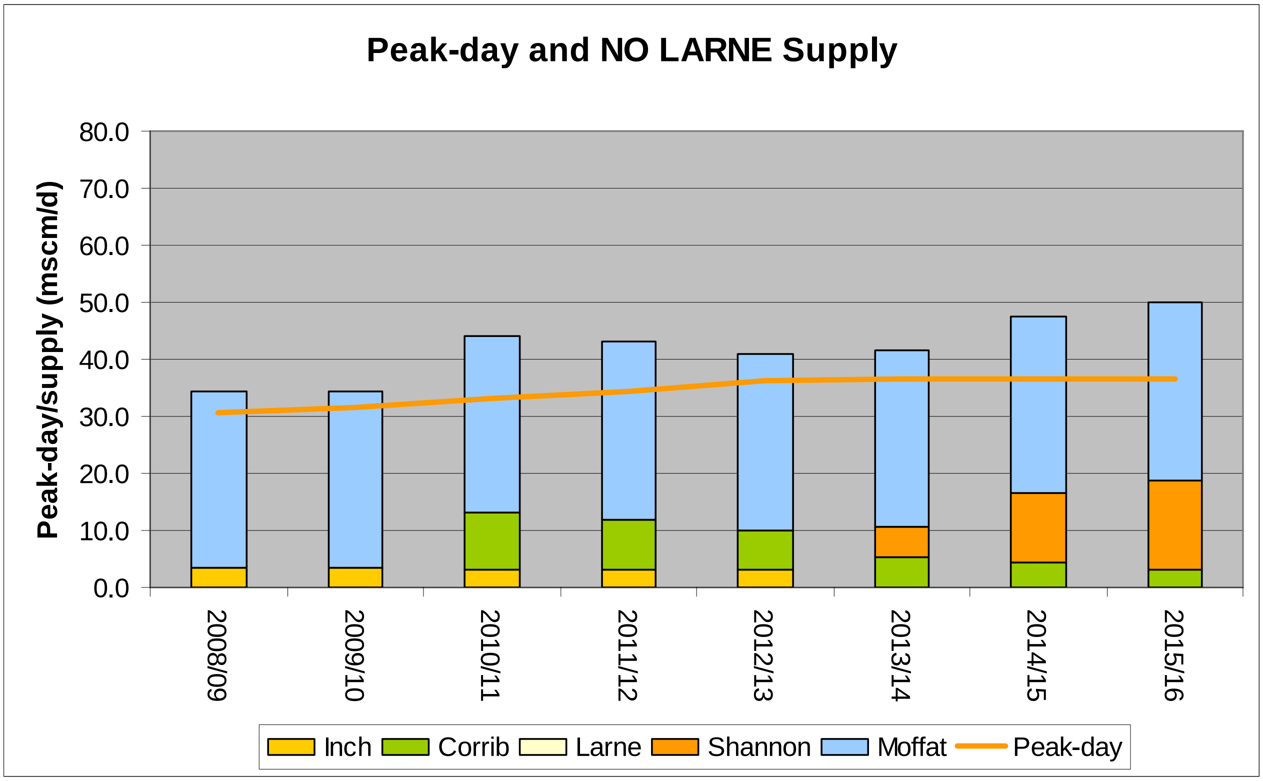


The amount by which the flows exceed the station capacity is very minor in both cases. In any event the additional Moffat flows can still be compressed at Beattock by accepting a slight reduction in the discharge pressure below 85 bar-g. The modelling indicates that all minimum pressure requirements are still maintained, with the reduced discharge pressure at Beattock.

5.6.4 No Larne supply scenario

The peak-day demand and No Larne supply balance is shown in Fig. 5.6. In this scenario the aggregate supply capacity exceeds the forecast peak-day demand. The network analysis modelling indicates that satisfactory pressures are maintained on the Irish and NI transmission systems in this scenario, although the minimum specified pressure of 55 bar-g for the Dublin City gates is reached.

Fig. 5.6: Peak-day demand and No Larne supply scenario



In this scenario there is a large transfer of West Coast gas from Corrib and Shannon LNG to the main natural gas markets along the East Coast. The combined West Coast flow in 2015/16 is 18.9 mscm/d (210.0 GWh/d), and the corresponding minimum pressure at the Dublin City gates is 54.8 bar-g – i.e. just below the minimum required pressure of 55.0 bar-g.

The combined West Coast flow of 18.9 mscm/d (210.0 GWh/d), therefore, essentially represents the maximum West Coast gas flow that can be accommodated by the existing Irish transmission system, while maintaining the minimum specified pressures for the Dublin City Gates (based on the existing Irish MOP of 70 bar-g).

System reinforcement will probably be required in the event of higher combined West Coast gas flows. The main constraint on the existing Irish transmission is the relatively small-diameter (400 mm nominal) pipeline between Goat Island and Curraleigh West. Preliminary high-level studies indicate that this will probably need to be twinned, to accommodate higher West Coast gas flows.

The flows through the SNIP Pipeline were again maximised in this scenario (in order to reduce the fuel-gas usage at the Brighouse Bay compressor station). The maximum SNIP flow achieved was 10.5 mscm/d (115.8 GWh/d) in 2015/16, based on a SNIP MOP of 75 bar-g. The maximum SNIP flow could be increased to 11.0 mscm/d (121.3 GWh/d), if the SNIP MOP could be increased to 85 bar-g.

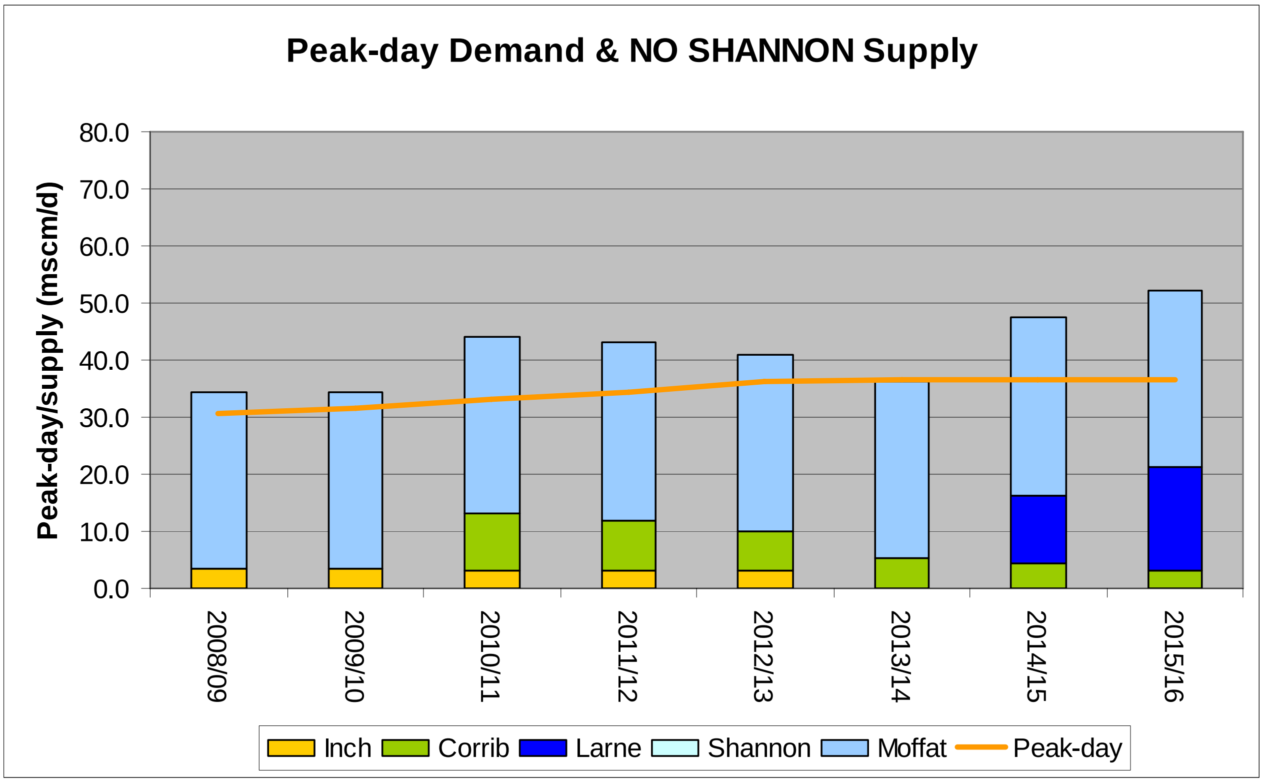
These SNIP flows are obviously higher than the current NI capacity entitlement at Twynholm, and are also higher than the design capacity of the Twynholm AGI. Further reinforcement and modification to the Twynholm AGI may be required to accommodate these higher flows.

5.6.5 No Shannon supply scenario

The peak-day demand and No Shannon supply balance are shown in Fig. 5.7. The network analysis modelling for this scenario initially assumed a CAG Open system configuration at Gormanston, however, this resulted in the minimum pressure requirement of 45 bar-g at Ballyveelish being breached.

A CAG Closed system configuration was then assumed, whereby, Larne Storage was supplying the NI demand plus the Quinn CCGT down the S/N Pipeline and exporting any surplus gas to Ireland, by reverse-flow through the SNIP and IC systems.

Fig. 5.7: Peak-day demand and No Shannon supply scenario



The maximum assumed Larne send-out in 2015/16 is 18.1 mscm/d (199.6 GWh/d), while the NI peak-day demand is 10.1 mscm/d (111.4 GWh/d) and the Quinn CCGT is assumed to take 1.8 mscm/d (19.7 GWh/d). This leaves a surplus of 6.2 mscm/d (68.4 GWh/d) to be exported to Ireland by reverse-flow through the SNIP.

There is also a significant Moffat flow required in this scenario of 15.9 mscm/d (175.3 GWh/d). The network analysis indicates it is possible to reverse-flow the required 6.2 mscm/d (68.4 GWh/d) through the SNIP in this particular scenario, since:

- The required Beattock discharge pressure of 69.5 bar-g, is above the minimum discharge pressure of 61.0 bar-g; *and*
- The minimum inlet pressure to Brighouse Bay was 61.4 bar-g, which is above its minimum design inlet pressure of 52.0 bar-g.

There is an important caveat, however, associated with this particular scenario. A minimum-case scenario has been assumed in relation to the Moffat inlet pressure, i.e. the ANOP pressure of 47.5 bar-g has been assumed.

The actual pressure at Moffat has recently been 60 bar-g or above. In this case the minimum discharge pressure of the Beattock compressor station would increase to 76 bar-g (i.e. the assumed 60 bar-g inlet pressure at Moffat plus a minimum compressor lift of 16 bar-g).

The higher Beattock discharge pressure would result in a higher system pressure at the upstream inlet to the Twynholm AGI, which would reduce the amount of Larne gas that could be reverse-flowed through the SNIP Pipeline.

A number of high-level reinforcement scenarios were modelled using compression on either the S/N or SNIP Pipelines to overcome the potential reverse-flow limitations imposed by the Moffat pressure regime and associated Beattock discharge pressures. The results of this modelling may be summarised as follows:

- It is possible to export all of the surplus Larne Storage gas by building two compressor stations along the S/N Pipeline:
  - In this scenario 1.8 mscm/d (19.7 GWh/d) would be taken by Quinn CCGT and the remaining 6.2 mscm/d (68.4 GWh/d) sent to Gormanston; *and*
  - High-level studies based on the “absorbed-power” indicated that a 10.6 MW and 2.8 MW compressor station would be required on the S/N Pipeline in this scenario, however, further more detailed studies would be required to identify the optimum compressor station power;
- Alternatively it would be possible to reverse-flow all of the 6.2 mscm/d (68.4 GWh/d) through the SNIP by building a compressor station on the Scottish side of the SNIP, which would allow Beattock compressor station to discharge up to 82.3 bar-g without restricting the SNIP reverse-flows:
  - Again high-level studies based on the absorbed-power indicated that a 2.0 MW compressor station would be required, but more detailed studies would be required to identify the optimum compressor station power.

5.6.6 Peak-day and Local Reinforcement requirements

The ability of the local area 40 and 19 bar-g 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 forecast peak-day demand over the period in all the local area networks, except for:

- The 19 bar-g pipeline to the Limerick Gas AGI; *and*
- Potentially the 19 bar-g pipeline to Priorland AGI in Dundalk, depending on the timing of the load development at the proposed Mullagharlin IDA business park.

The need to reinforce the 19 bar-g transmission pipeline to the Limerick Gas AGI had been already identified in previous network analysis studies, and a general reinforcement plan for the area has been prepared.

Priorland AGI system in Dundalk will need to be reinforced to accommodate the proposed Mullagharlin IDA business park.

5.7 Results of the Minimum-day network analysis modelling

5.7.1 Low Case and Central Case supply scenarios

The network analysis modelling results indicated that satisfactory network pressures were maintained at all specified points on the Irish and NI transmission systems during the minimum demand-days, for both the Low Case and Central Case (Extended Inch) scenarios.

5.7.2 No Larne supply scenario

There is more than sufficient West Coast gas available from Corrib and Shannon LNG to supply both the Irish demand on the minimum day, and potentially a significant proportion of the NI demand as well. There are no pressure issues as such on the minimum-day, but the question arises as to how the NI demand would be supplied in a CAG Open scenario.

The potential combined West Coast gas deliveries from Corrib and Shannon LNG are potentially 6.9 mscm/d (76.1 GWh/d) above the forecast Irish minimum-day demand in 2015/16. One option would be to export the surplus gas to NI via the S/N Pipeline.

The network analysis modelling showed, however, that the maximum amount of gas that could be exported through the S/N Pipeline while maintaining a minimum specified pressures would be 4.9 mscm/d (54.0 GWh/d), with 1.8 mscm/d (19.7 GWh/d) going to the Quinn CCGT and 3.1 mscm/d (34.2 GWh/d) going to NI.

5.7.3 No Shannon supply scenario

The network analysis on the central case demand assumptions showed that it would not be possible to achieve the maximum injection rate of 12.0 mscm/d (132.3 GWh/d) for Larne Storage on the summer minimum-day, without reinforcement.

The aggregated potential demand of NI and the S/N Pipeline on the 2015/16 minimum-day is 19.0 mscm/d (209.5 GWh/d), consisting of 5.8 mscm/d (64.3 GWh/d) for NI, 1.2 mscm/d (13.2 GWh/d) for the Quinn CCGT on the S/N Pipeline and 12.0 mscm/d (132.3 GWh/d) injection into Larne Storage.

The network analysis modelling, however, shows that the combined S/N and SNIP Pipeline flows are limited to 16 mscm/d (176.4 GWh/d) by the requirement to maintain a minimum operating pressure of 30 bar-g at Coolkeeragh. This means that the maximum Larne Storage injection rate is restricted to 9.0 mscm/d (99.2 GWh/d) in this scenario.

High-level studies (again based on the absorbed-power) indicate that a 13 MW compressor station on the Scottish side of SNIP would allow 19.0 mscm/d (209.5 GWh/d) to be supplied to NI and the S/N Pipeline, with 14.4 mscm/d (158.8 GWh/d) from the SNIP and 4.6 mscm/d (50.7 GWh/d) from the S/N Pipeline. More detailed studies are required to identify the optimal compressor station power and location.

It was possible to flow 12.0 mscm/d (132.3 GWh/d) through the existing SNIP into NI, due to the higher system pressures available at the upstream inlet to Twynholm. These higher pressures are possible due to the lower Irish demand on the summer minimum-day. These flows would exceed the Twynholm AGI capacity, which may require reinforcement works.

5.7.4 High Case supply scenario

All of the minimum-day issues identified in the No Larne and No Shannon supply scenarios would also arise in the High Case supply scenario. The following issues would again potentially arise in this supply scenario:

- Insufficient capacity on the existing transmission systems to supply the forecast NI minimum-day withdrawal and inject 12.0 mscm/d (132.3 GWh/d), while maintaining a minimum operating pressure of 30 bar-g at Coolkeeragh; *and*
- Insufficient capacity on the existing S/N Pipeline to allow all of the surplus Shannon LNG gas (over and above the forecast Irish minimum-day demand) to be exported to NI.

6 Conclusions

The 2009 Joint Capacity Statement is the first to have been produced by the Regulatory Authorities on an all-island basis. It constitutes an important step in developing a harmonised approach to security of supply on the island under the CAG project. The management of the transmission system in Ireland and Northern Ireland on an all-island basis under the CAG from 2010/11 will allow for the more efficient use of network assets and reduced operation costs in the coming years. The analysis of the *aggregate* gas demand of Ireland and Northern Ireland, as well as the available supplies needed to meet this demand, have been utilised to prepare this joint Statement. The 2009 JCS also includes modelling of the impact of forecast gas supply and demand on integrated all-island system for the period 2008/09 to 2015/16. In light of the modelling undertaken, the Statement provides the best estimate of the adequacy of the network to meet demand growth in Ireland and Northern Ireland.

6.1 Gas Demand

In comparison with previous analysis carried out separately by the Commission and the Utility Regulator, the results of this year's JCS are largely positive in relation to security of supply on the island. The Statement sets out that the network in Ireland and Northern Ireland has sufficient capacity for supplies to meet the reasonable medium-term demand growth of the Central Case. The demand forecast in the JCS is lower than that presented in 2008 GCS and NI Pressure report due to the current economic downturn and due to the projected decrease in electricity demand over the coming years. The outlook for future gas demand is also more uncertain compared to previous years, due to the deepening economic recession. Although slowing economic growth was factored into the forecast, the severity of the downturn was not fully appreciated when it was being carried out at the end of last year.

In relation to the power sector, the outlook for gas demand is similar to that presented in the previous 2008 GCS and NI Pressure report. Natural gas continues to be the preferred fuel for power generation with over two and a half thousand megawatts of new gas-fired CCGT and OCGT capacity forecast to be commissioned during the next seven years in order to meet the future growth in electricity demand and replace older and less efficient gas-fired stations. There will also continue to be a substantial requirement for conventional thermal generation (CCGT and OCGT) to back-up the wind generation, especially on calm days.

Increases in gas demand in the power sector have been offset by reductions in the I/C sector. As a result of the economic recession, the annual I/C gas demand is forecast to continue to fall over the next two years. This will be partially offset by the planned construction of new gas-fired power stations. The downturn has also effected projections for residential gas demand which is forecast to be c. 7.5% lower by 2014/15 than that published in the 2008 GCS.

6.2 Sources of Gas

As noted in the 2008 GCS, security of gas supply on the island is enhanced by the potential for the development of further gas sources on the island. In relation to the introduction of Corrib gas, discussions are ongoing between Shell, its partners, An Bord Pleanála and the local community on the route of the onshore pipeline. In 2008 planning permission was granted to Shannon LNG for its LNG terminal subject to certain conditions. An Bord Pleanála gave permission for the pipeline from the terminal to BGÉ's network in February 2009. Shannon LNG has applied to the Commission for consent to construct this pipeline and the decision on this will be made in summer 2009. BGSI and Islandmagee Storage Limited are also investigating the technical and commercial feasibility of developing salt-cavity gas storage in the Larne area.

The long-term commercial viability of the Kinsale offshore gas storage facility and the commissioning of these new projects constitute the defining issues in enhancing security of gas supply on the island. The Commission and the Utility Regulator are particularly mindful of the significant impact of these developments on the island's transmission system. They consequently form the basis for the scenario planning agreed upon by the Regulatory Authorities and carried out by BGN in order to assess the adequacy of the transmission network on the island.

It should be taken into account that additional supply points add considerably more complexity to the modelling of the transmission systems. Depending on the introduction and timing of new gas infrastructure noted in this JCS, the potential flows between Ireland and Northern Ireland, as well as between the west and east of the island, varies significantly. Changes in gas flows correspondingly impact upon demands for reinforcement of the onshore and offshore systems over the coming years. The Regulatory Authorities note, therefore, the importance of timely information in relation to the commissioning of future gas developments.

It should also be noted that while this Statement examines potential gas flows from various entry points, actual flows will be determined by shipper nominations. Future Statements need to consider more carefully how these might impact upon network design.

6.3 Results of Modelling

As noted above, the proposed developments in the coming years will significantly alter the direction and nature of flows on the transmission network across the island. In light of the scenario analysis undertaken, the Commission and Utility Regulator 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. In relation to the modelling of the Central Case (Inch Extended) the network has sufficient capacity for supplies to meet the reasonable medium-term demand growth. However, towards 2015/16 the projected flows from Moffat and the IC system marginally exceed the assumed maximum capacity of the two compressor stations in Scotland. BGN is currently carrying out performance testing on its two compressor stations in Scotland to determine whether or not there is a requirement to reinforce the system in Scotland.

In last year's GCS it was noted that the ability of the system to meet peak-day demands would be jeopardised should the Corrib project be further delayed. The network modelling analysis in the JCS indicates that the existing transmission systems have sufficient capacity to cope with a 1-year delay to the Corrib project. In the event of such a delay and no new sources of supply after Corrib, it may also be necessary to reinforce the IC system in Scotland towards the end of the period given the substantial increases in GB imports through the IC and SNIP systems, where flows materially exceed the current theoretical capacity of the two compressor stations in Scotland. The Regulatory Authorities are awaiting the results of continued performance testing in this regard. This will need to be reviewed in next year's JCS to ensure there is sufficient lead time to carry out any necessary reinforcement, should it be required. Modification to the Twynholm AGI may also be required in order to accommodate higher flows through the SNIP.

In the No Shannon supply scenario, the available gas from Larne is likely to substantially exceed 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 were examined:

- Studies show that it would be possible to reverse flow through the SNIP via Twynholm and route the export gas through the interconnector system and into Ireland, using existing infrastructure. The volume of export is dependent upon the supply flows and pressure available in onshore Scotland. The ability to reverse flow through the SNIP is, however, dependent upon the supply scenario.

- Adding compression to the SNIP would guarantee the ability to reverse flow all of the required gas regardless of the supply scenario. However, this would require substantial additional expenditure.
- Studies have also shown that it was possible to export all gas through the SNP by building additional compression on the SNP. This would obviously involve substantial capital expenditure.

In summary, the requirement for future investment will depend upon the size and timing of new supply sources. If new sources of supply are developed after Corrib comes online, there may not be significant requirements for substantial investment in the short to medium term. The Commission and Utility Regulator will continue to review this issue in the preparation of future Joint Capacity Statements.

6.4 Longer Term Issues

The longer term prospects for security of supply remain relatively positive due to the operation of the transmission system on an all-island basis, the potential progression of the CAG project, and the proposed introduction of new sources of supply.

The integration of the two systems and the proposed introduction of gas storage at Larne will have significant effects in relation to the movement of gas on the island and 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.

While it is not yet certain that indigenous storage will be further developed on the island, it should be noted that the Commission and the Utility Regulator are mindful of the importance of both the facilities at Inch and the proposed project at Larne to the security of gas supply. Moreover, the Regulatory Authorities appreciate that the linepack in the interconnectors, the potential LNG facility at Shannon and possible new finds of commercially viable gas would increase the contribution of indigenous gas to meet demand on the island.

6.5 Interaction with the GB

GB imports through Moffat will remain an integral aspect of the island's transmission system. The reliance on such imports will continue until supplies from the proposed projects are brought on stream. In addition, while a number of the scenarios examined involve a reduced dependence on gas through Moffat due to the commencement of the proposed developments previously noted, it remains likely that a significant proportion of gas will be sourced from Moffat. Once supplies from the Corrib gas field decline from their initial peak, the substantial dependence on supplies through Moffat to meet peak demand will re-emerge. The introduction of salt cavity storage at Larne will 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.

6.6 Conclusion of the Regulatory Authorities

The Commission and the Utility Regulator are pleased with the process of developing this first Joint Capacity Statement and the changed focus of the modelling which supports planning and development on an all-island basis. We thank all parties for their support and look forward to continuing co-operation within the framework of the CAG project.

Appendix 1: Peak-day demand forecasts

Irish Peak-day demand forecast

The Irish peak-day demands are summarised in Tables A1.1 to A1.5. 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 A1.6.

Isle of Man (IOM) Peak-day forecast

The peak-day demand forecast for the IOM was based on information provided by the Manx Electricity Authority, 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.

Table A1.1: Peak-day Base Case Demand & HIGH CASE Supply Scenario

	Unit	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
ENERGY									
Power	GWh/d	124.4	133.5	143.5	156.0	156.0	158.8	159.4	160.2
I/C	GWh/d	50.7	50.5	51.0	51.8	52.6	53.4	54.2	55.1
RES	GWh/d	64.6	65.6	66.5	67.4	68.3	69.1	70.0	70.9
Own-use	GWh/d	5.1	5.1	3.7	4.1	4.5	4.4	3.1	1.8
Total Irish	GWh/d	244.7	254.7	264.7	279.3	281.3	285.8	286.7	287.9
IOM	GWh/d	5.7	5.7	5.8	6.2	6.3	6.4	6.5	6.6
NI	GWh/d	83.9	84.8	85.8	87.1	106.9	108.1	109.2	110.3
Total CAG	GWh/d	334.3	345.1	356.2	372.6	394.5	400.2	402.3	404.8
Inch	GWh/d	36.7	34.4	33.2	32.1	31.8	0.0	0.0	0.0
Corrib	GWh/d	0.0	0.0	104.2	92.6	71.8	55.6	46.3	32.4
Larne	GWh/d	0.0	0.0	0.0	0.0	0.0	0.0	132.8	199.2
Shannon	GWh/d	0.0	0.0	0.0	0.0	0.0	59.8	135.6	166.5
Moffat	GWh/d	297.6	310.8	218.8	247.9	290.9	284.8	87.6	6.7
Total	GWh/d	334.3	345.1	356.2	372.6	394.5	400.2	402.3	404.8
VOLUME									
Power	mscm/d	11.3	12.2	13.3	14.4	14.3	14.5	14.5	14.5
I/C	mscm/d	4.6	4.6	4.7	4.8	4.8	4.9	4.9	5.0
RES	mscm/d	5.9	6.0	6.2	6.2	6.3	6.3	6.3	6.4
Own-use	mscm/d	0.5	0.5	0.3	0.4	0.4	0.4	0.3	0.2
Total Irish	mscm/d	22.3	23.2	24.5	25.8	25.9	26.0	26.0	26.0
IOM	mscm/d	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6
NI	mscm/d	7.7	7.7	7.9	8.0	9.8	9.9	9.9	10.0
Total CAG	mscm/d	30.5	31.5	33.0	34.4	36.3	36.5	36.5	36.6
Inch	mscm/d	3.5	3.3	3.2	3.1	3.0	0.0	0.0	0.0
Corrib	mscm/d	0.0	0.0	10.0	8.9	6.9	5.3	4.4	3.1
Larne	mscm/d	0.0	0.0	0.0	0.0	0.0	0.0	12.0	18.1
Shannon	mscm/d	0.0	0.0	0.0	0.0	0.0	5.3	12.1	14.8
Moffat	mscm/d	27.0	28.2	19.8	22.5	26.4	25.8	7.9	0.6
Total	mscm/d	30.5	31.5	33.0	34.4	36.3	36.5	36.5	36.6

Table A1.2: Peak-day Base Case Demand & LOW CASE Supply Scenario

	Unit	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
ENERGY									
Power	GWh/d	124.4	133.5	143.5	156.0	156.0	158.8	159.4	160.2
I/C	GWh/d	50.7	50.5	51.0	51.8	52.6	53.4	54.2	55.1
RES	GWh/d	64.6	65.6	66.5	67.4	68.3	69.1	70.0	70.9
Own-use	GWh/d	5.1	5.1	5.3	4.0	4.2	5.1	5.4	5.6
Total Irish	GWh/d	244.7	254.7	266.3	279.1	281.0	286.5	289.0	291.7
IOM	GWh/d	5.7	5.7	5.8	6.2	6.3	6.4	6.5	6.6
NI	GWh/d	83.9	84.8	85.8	87.1	106.9	108.1	109.2	110.3
Total CAG	GWh/d	334.3	345.1	357.9	372.4	394.2	400.9	404.7	408.6
Inch	GWh/d	36.7	34.4	33.2	32.1	31.8	0.0	0.0	0.0
Corrib	GWh/d	0.0	0.0	0.0	104.2	92.6	71.8	55.6	46.3
Larne	GWh/d	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shannon	GWh/d	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moffat	GWh/d	297.6	310.8	324.7	236.1	269.8	329.1	349.1	362.3
Total	GWh/d	334.3	345.1	357.9	372.4	394.2	400.9	404.7	408.6
VOLUME									
Power	mscm/d	11.3	12.2	13.1	14.4	14.4	14.5	14.6	14.6
I/C	mscm/d	4.6	4.6	4.7	4.8	4.9	4.9	5.0	5.0
RES	mscm/d	5.9	6.0	6.1	6.2	6.3	6.3	6.4	6.5
Own-use	mscm/d	0.5	0.5	0.5	0.4	0.4	0.5	0.5	0.5
Total Irish	mscm/d	22.3	23.2	24.3	25.8	25.9	26.2	26.4	26.6
IOM	mscm/d	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6
NI	mscm/d	7.7	7.7	7.8	8.1	9.9	9.9	10.0	10.1
Total CAG	mscm/d	30.5	31.5	32.6	34.4	36.4	36.7	37.0	37.3
Inch	mscm/d	3.5	3.3	3.2	3.1	3.0	0.0	0.0	0.0
Corrib	mscm/d	0.0	0.0	0.0	10.0	8.9	6.9	5.3	4.4
Larne	mscm/d	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shannon	mscm/d	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moffat	mscm/d	27.0	28.2	29.4	21.4	24.5	29.8	31.7	32.9
Total	mscm/d	30.5	31.5	32.6	34.4	36.4	36.7	37.0	37.3

Table A1.3: Peak-day Base Case Demand & CENTRAL CASE (Extended Inch) Supply Scenario

	Unit	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
ENERGY									
Power	GWh/d	124.4	133.5	143.5	156.0	156.0	158.8	159.4	160.2
I/C	GWh/d	50.7	50.5	51.0	51.8	52.6	53.4	54.2	55.1
RES	GWh/d	64.6	65.6	66.5	67.4	68.3	69.1	70.0	70.9
Own-use	GWh/d	5.1	5.1	3.7	4.1	4.5	4.9	5.1	5.4
Total Irish	GWh/d	244.7	254.7	264.7	279.3	281.3	286.3	288.7	291.5
IOM	GWh/d	5.7	5.7	5.8	6.2	6.3	6.4	6.5	6.6
NI	GWh/d	83.9	84.8	85.8	87.1	106.9	108.1	109.2	110.3
Total CAG	GWh/d	334.3	345.1	356.2	372.6	394.5	400.7	404.4	408.3
Inch	GWh/d	36.7	34.4	33.2	32.1	31.8	30.6	29.7	29.0
Corrib	GWh/d	0.0	0.0	104.2	92.6	71.8	55.6	46.3	32.4
Larne	GWh/d	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shannon	GWh/d	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moffat	GWh/d	297.6	310.8	218.8	247.9	290.9	314.5	328.4	346.9
Total	GWh/d	334.3	345.1	356.2	372.6	394.5	400.7	404.4	408.3
VOLUME									
Power	mscm/d	11.3	12.2	13.3	14.4	14.3	14.6	14.6	14.6
I/C	mscm/d	4.6	4.6	4.7	4.8	4.8	4.9	5.0	5.0
RES	mscm/d	5.9	6.0	6.2	6.2	6.3	6.3	6.4	6.5
Own-use	mscm/d	0.5	0.5	0.3	0.4	0.4	0.4	0.5	0.5
Total Irish	mscm/d	22.3	23.2	24.5	25.8	25.9	26.3	26.5	26.7
IOM	mscm/d	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6
NI	mscm/d	7.7	7.7	7.8	8.1	9.9	9.9	10.0	10.1
Total CAG	mscm/d	30.5	31.5	33.0	34.4	36.3	36.8	37.0	37.3
Inch	mscm/d	3.5	3.3	3.2	3.1	3.0	2.9	2.8	2.8
Corrib	mscm/d	0.0	0.0	10.0	8.9	6.9	5.3	4.4	3.1
Larne	mscm/d	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shannon	mscm/d	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moffat	mscm/d	27.0	28.2	19.8	22.5	26.4	28.5	29.8	31.5
Total	mscm/d	30.5	31.5	33.0	34.4	36.3	36.8	37.0	37.3

Table A1.4: Peak-day Base Case Demand & NO SHANNON Supply Scenario

	Unit	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
ENERGY									
Power	GWh/d	124.4	133.5	143.5	156.0	156.0	158.8	159.4	160.2
I/C	GWh/d	50.7	50.5	51.0	51.8	52.6	53.4	54.2	55.1
RES	GWh/d	64.6	65.6	66.5	67.4	68.3	69.1	70.0	70.9
Own-use	GWh/d	5.1	5.1	3.7	4.1	4.5	5.4	5.2	4.5
Total Irish	GWh/d	244.7	254.7	264.7	279.3	281.3	286.7	288.8	290.5
IOM	GWh/d	5.7	5.7	5.8	6.2	6.3	6.4	6.5	6.6
NI	GWh/d	83.9	84.8	85.8	87.1	106.9	108.1	109.2	110.3
Total CAG	GWh/d	334.3	345.1	356.2	372.6	394.5	401.2	404.5	407.4
Inch	GWh/d	36.7	34.4	33.2	32.1	31.8	0.0	0.0	0.0
Corrib	GWh/d	0.0	0.0	104.2	92.6	71.8	55.6	46.3	32.4
Larne	GWh/d	0.0	0.0	0.0	0.0	0.0	0.0	132.8	199.2
Shannon	GWh/d	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moffat	GWh/d	297.6	310.8	218.8	247.9	290.9	345.6	225.4	175.8
Total	GWh/d	334.3	345.1	356.2	372.6	394.5	401.2	404.5	407.4
VOLUME									
Power	mscm/d	11.3	12.2	13.3	14.4	14.4	14.5	14.6	14.6
I/C	mscm/d	4.6	4.6	4.7	4.8	4.8	4.9	5.0	5.0
RES	mscm/d	5.9	6.0	6.2	6.2	6.3	6.3	6.4	6.5
Own-use	mscm/d	0.5	0.5	0.3	0.4	0.4	0.5	0.5	0.4
Total Irish	mscm/d	22.3	23.2	24.5	25.8	25.9	26.2	26.4	26.5
IOM	mscm/d	8.2	8.2	8.5	8.6	10.4	10.5	10.6	10.6
NI	mscm/d								
Total CAG	mscm/d	30.5	31.5	33.0	34.4	36.3	36.7	36.9	37.1
Inch	mscm/d	3.5	3.3	3.2	3.1	3.0	0.0	0.0	0.0
Corrib	mscm/d	0.0	0.0	10.0	8.9	6.9	5.3	4.4	3.1
Larne	mscm/d	0.0	0.0	0.0	0.0	0.0	0.0	12.0	18.1
Shannon	mscm/d	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moffat	mscm/d	27.0	28.2	19.8	22.5	26.4	31.3	20.4	15.9
Total	mscm/d	30.5	31.5	33.0	34.4	36.3	36.7	36.9	37.1

Table A1.5: Peak-day Base Case Demand & NO LARNE Supply Scenario

	Unit	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
ENERGY									
Power	GWh/d	124.4	133.5	143.5	156.0	156.0	158.8	159.4	160.2
I/C	GWh/d	50.7	50.5	51.0	51.8	52.6	53.4	54.2	55.1
RES	GWh/d	64.6	65.6	66.5	67.4	68.3	69.1	70.0	70.9
Own-use	GWh/d	5.1	5.1	3.7	4.1	4.5	4.4	3.4	3.0
Total Irish	GWh/d	244.7	254.7	264.7	279.3	281.3	285.8	287.0	289.1
IOM	GWh/d	5.7	5.7	5.8	6.2	6.3	6.4	6.5	6.6
NI	GWh/d	83.9	84.8	85.8	87.1	106.9	108.1	109.2	110.3
Total CAG	GWh/d	334.3	345.1	356.2	372.6	394.5	400.2	402.7	406.0
Inch	GWh/d	36.7	34.4	33.2	32.1	31.8	0.0	0.0	0.0
Corrib	GWh/d	0.0	0.0	104.2	92.6	71.8	55.6	46.3	32.4
Larne	GWh/d	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shannon	GWh/d	0.0	0.0	0.0	0.0	0.0	59.8	135.6	177.6
Moffat	GWh/d	297.6	310.8	218.8	247.9	290.9	284.8	220.8	196.0
Total	GWh/d	334.3	345.1	356.2	372.6	394.5	400.2	402.7	406.0
VOLUME									
Power	mscm/d	11.3	12.2	13.3	14.4	14.3	14.5	14.5	14.5
I/C	mscm/d	4.6	4.6	4.7	4.8	4.8	4.9	4.9	5.0
RES	mscm/d	5.9	6.0	6.2	6.2	6.3	6.3	6.3	6.4
Own-use	mscm/d	0.5	0.5	0.3	0.4	0.4	0.4	0.3	0.3
Total Irish	mscm/d	22.3	23.2	24.5	25.8	25.9	26.0	26.0	26.1
IOM	Mscm/d	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6
NI	mscm/d	7.7	7.7	7.9	8.0	9.8	9.9	9.9	10.0
Total CAG	mscm/d	30.5	31.5	33.0	34.4	36.3	36.5	36.5	36.7
Inch	mscm/d	3.5	3.3	3.2	3.1	3.0	0.0	0.0	0.0
Corrib	mscm/d	0.0	0.0	10.0	8.9	6.9	5.3	4.4	3.1
Larne	mscm/d	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shannon	mscm/d	0.0	0.0	0.0	0.0	0.0	5.3	12.1	15.8
Moffat	mscm/d	27.0	28.2	19.8	22.5	26.4	25.8	20.0	17.8
Total	mscm/d	30.5	31.5	33.0	34.4	36.3	36.5	36.5	36.7

Table A1.6: Peak-day demand for NI

	Unit	08/09	09/10	10/11	11/12	12/13	13/14	14/15	15/16
ENERGY									
Total DX	GWh/d	27.1	27.9	28.9	30.2	31.5	32.6	33.7	34.8
Total Power	GWh/d	56.9	56.9	56.9	56.9	75.5	75.5	75.5	75.5
Total NI	GWh/d	83.9	84.8	85.8	87.1	106.9	108.1	109.2	110.3
VOLUME									
Total DX	mscm/d	2.5	2.6	2.6	2.8	2.9	3.0	3.1	3.1
Total Power	mscm/d	5.2	5.2	5.2	5.2	6.9	6.9	6.9	6.9
Total NI	mscm/d	7.7	7.8	7.8	8.0	9.8	9.9	10.0	10.0

Appendix 2: System modelling approach

A hydraulic model of the combined Irish and NI transmissions was constructed using the Pipeline Studio® software. This is a transient pipeline simulator, which can solve the resultant system flows and pressures on a given transmission system.

The hourly transient behaviour of the all-island transmission system was then modelled over a three day period for each of the sample-days, i.e. the peak-day and summer minimum-day for each gas year, for each supply scenario.

The "all-island" hydraulic model includes all the major components of the Irish and NI transmission systems, including the Irish 70 bar-g system, the Dublin City 40 bar-g systems, the S/N, North/West and SNIP Pipelines. The Irish 19 bar-g transmission systems are modelled separately. The 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), Cappagh South, 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 bar-g;
  - Carrickfergus is modelled with a differential-pressure control of 0.5 bar-g 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 bar-g 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 bar-g in all scenarios, except where the flows exceed 31.0 mscm/d (341.8 GWh/d) where the target discharge pressure is adjusted downwards per the independent consultant reports;
  - 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.

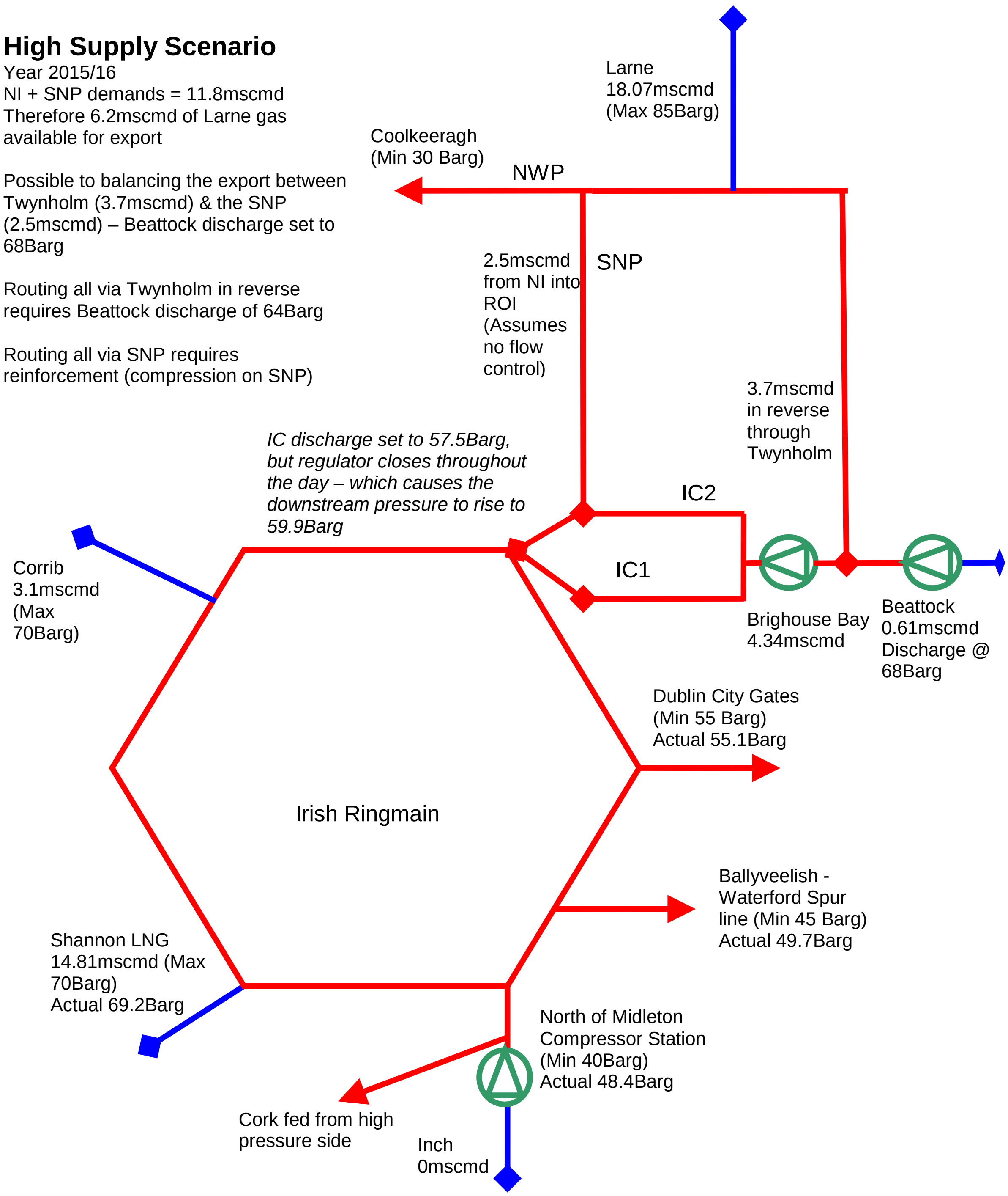
The hourly peak-day and minimum-day demands for each AGI off-take are entered into the hydraulic model on an energy basis. These are derived from the national peak-day and minimum-day forecasts using the following process:

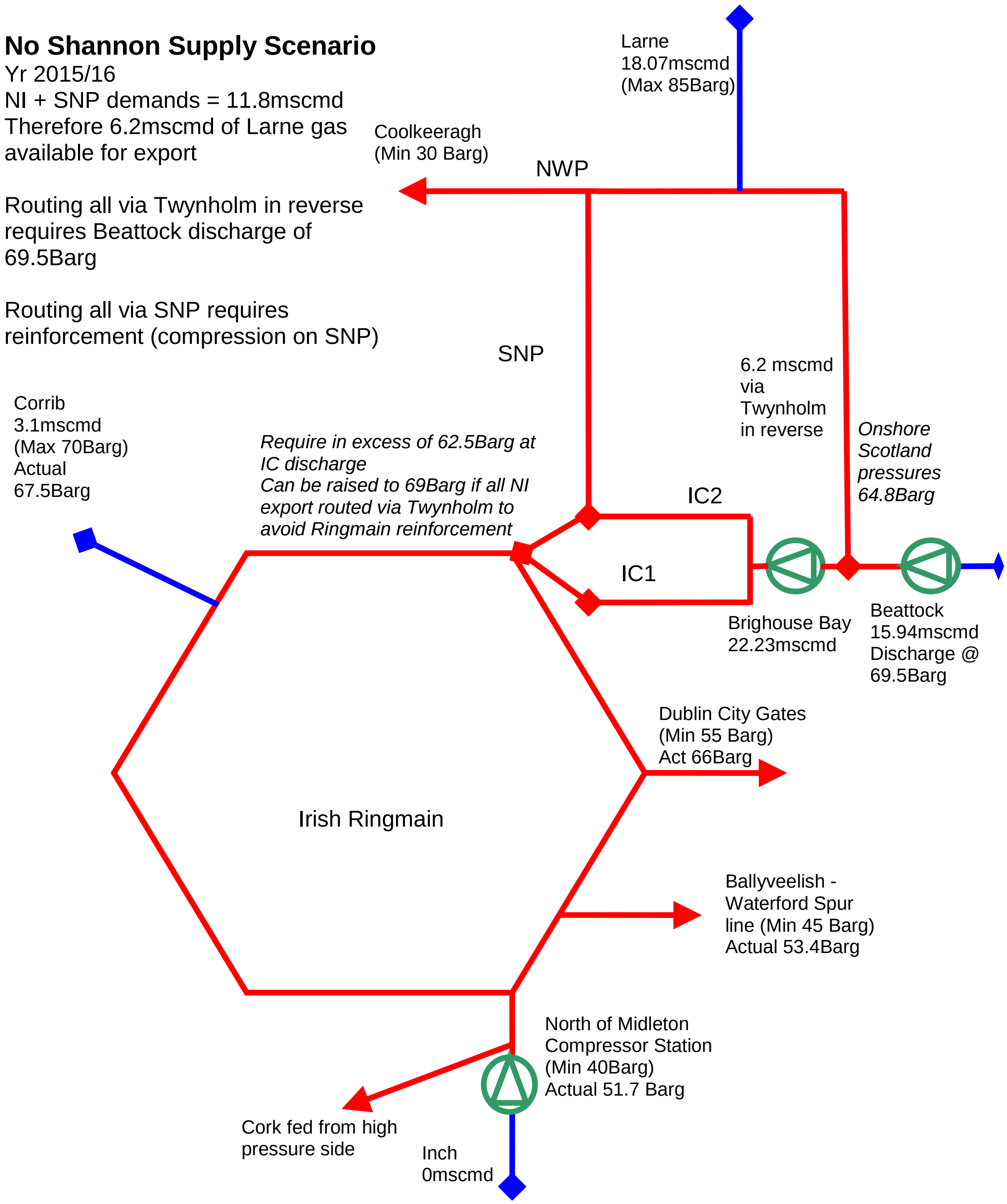
- The hourly gas demand of the Irish power stations is generated directly by the merit-order stack model;
- The hourly gas demand of the NI power stations was provided by PTL and the Utility Regulator using information received from the shippers to the power stations; *and*
- The hourly demand for all 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.

Appendix 3: Network schematics

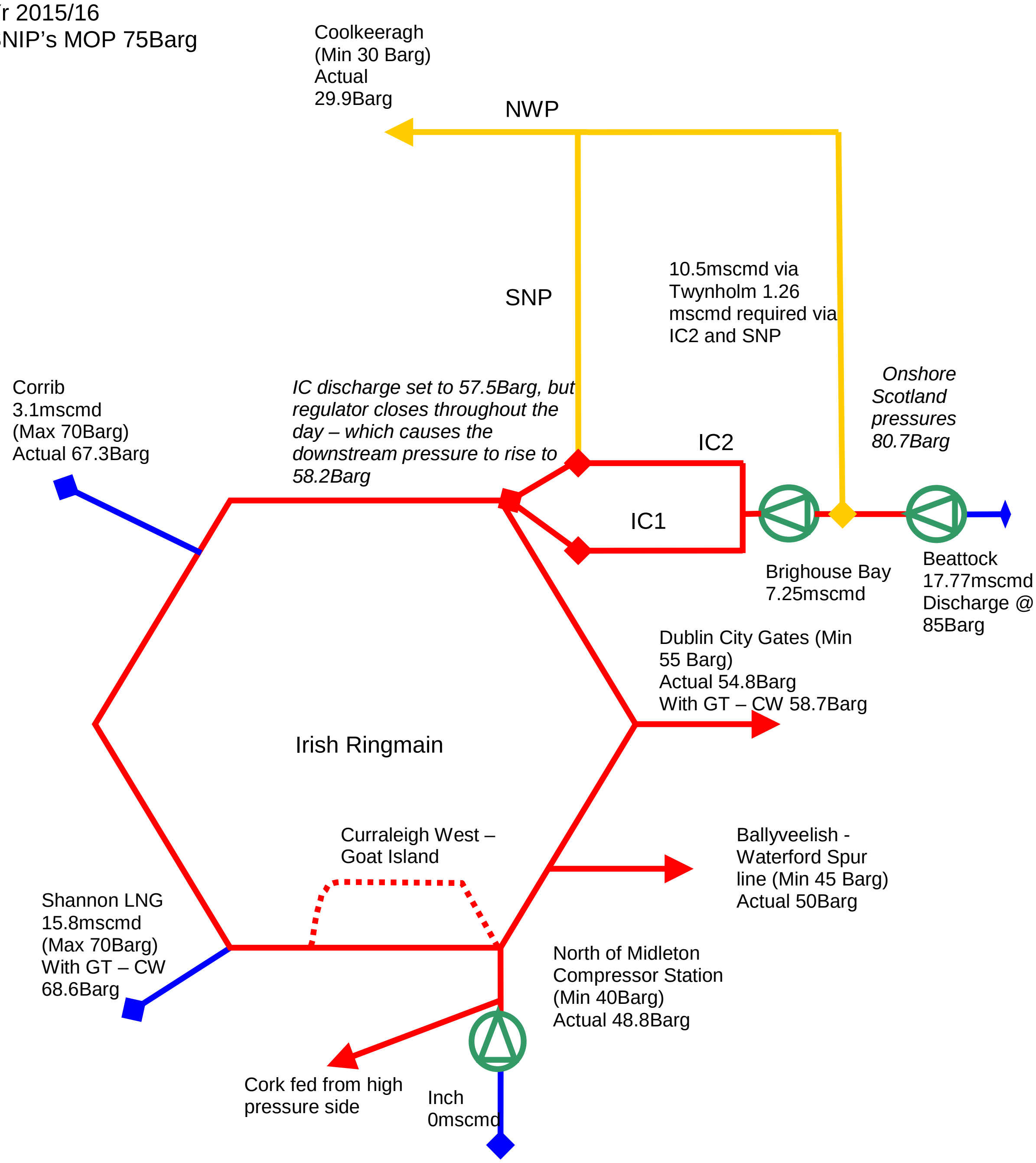




No Shannon Supply Scenario
Yr 2015/16
NI + SNP demands = 11.8mscmd
Therefore 6.2mscmd of Larne gas available for export
Routing all via Twynholm in reverse requires Beattock discharge of 69.5Barg
Routing all via SNP requires reinforcement (compression on SNP)
Larne
18.07mscmd
(Max 85Barg)
Coolkeeragh
(Min 30 Barg)
NWP
SNP
6.2 mscmd
via
Twynholm
in reverse
Onshore
Scotland
pressures
64.8Barg
Corrib
3.1mscmd
(Max 70Barg)
Actual
67.5Barg
Require in excess of 62.5Barg at IC discharge
Can be raised to 69Barg if all NI export routed via Twynholm to avoid Ringmain reinforcement
IC2
IC1
Brighouse Bay
22.23mscmd
Beattock
15.94mscmd
Discharge @
69.5Barg
Dublin City Gates
(Min 55 Barg)
Act 66Barg
Irish Ringmain
Ballyveelish -
Waterford Spur
line (Min 45 Barg)
Actual 53.4Barg
North of Midleton
Compressor Station
(Min 40Barg)
Actual 51.7 Barg
Cork fed from high
pressure side
Inch
0mscmd

No Larne Supply Scenario

Yr 2015/16
SNIP's MOP 75Barg



Inch Extended Supply Scenario

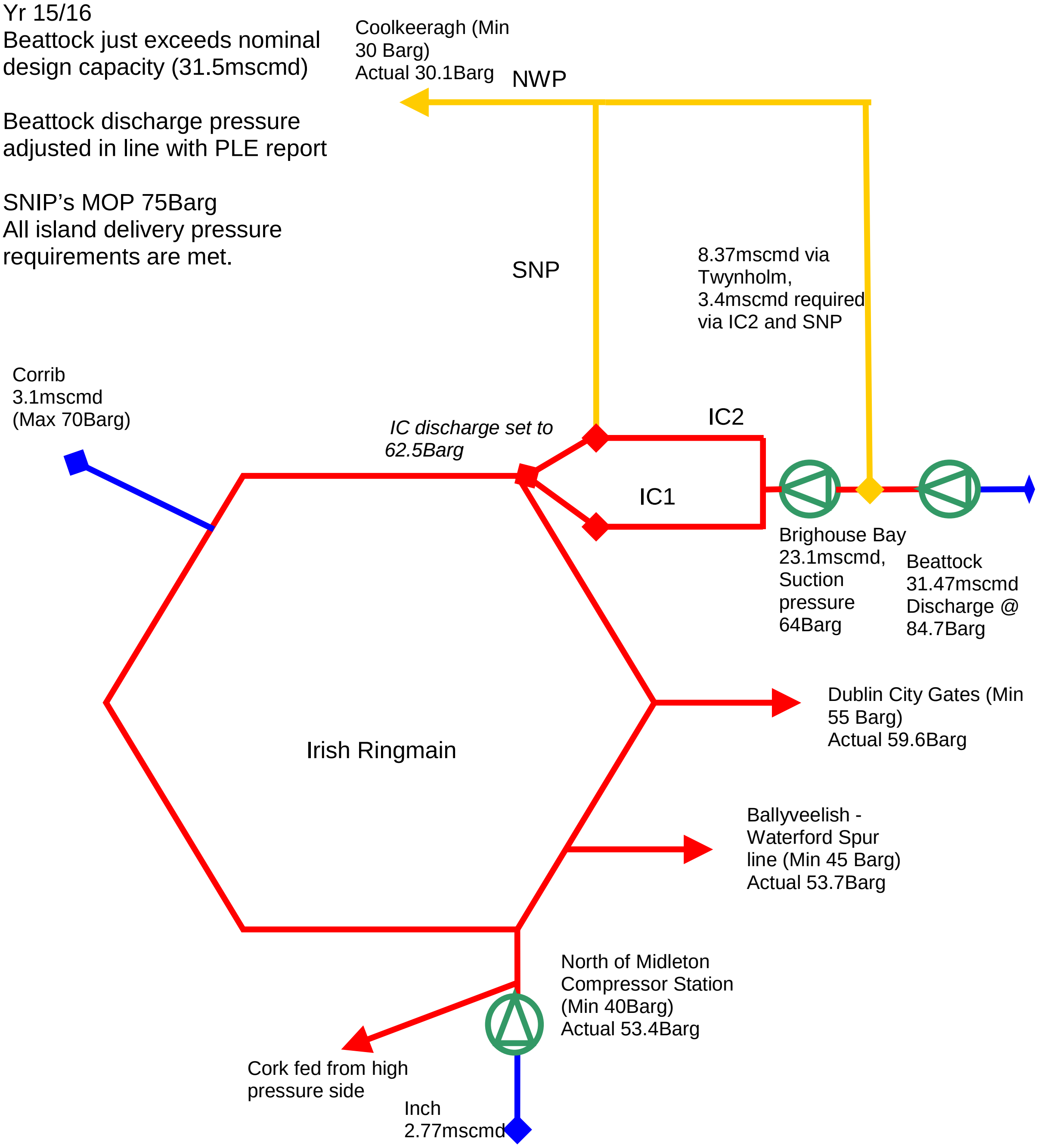
Yr 15/16

Beattock just exceeds nominal design capacity (31.5mscmd)

Beattock discharge pressure adjusted in line with PLE report

SNIP's MOP 75Barg

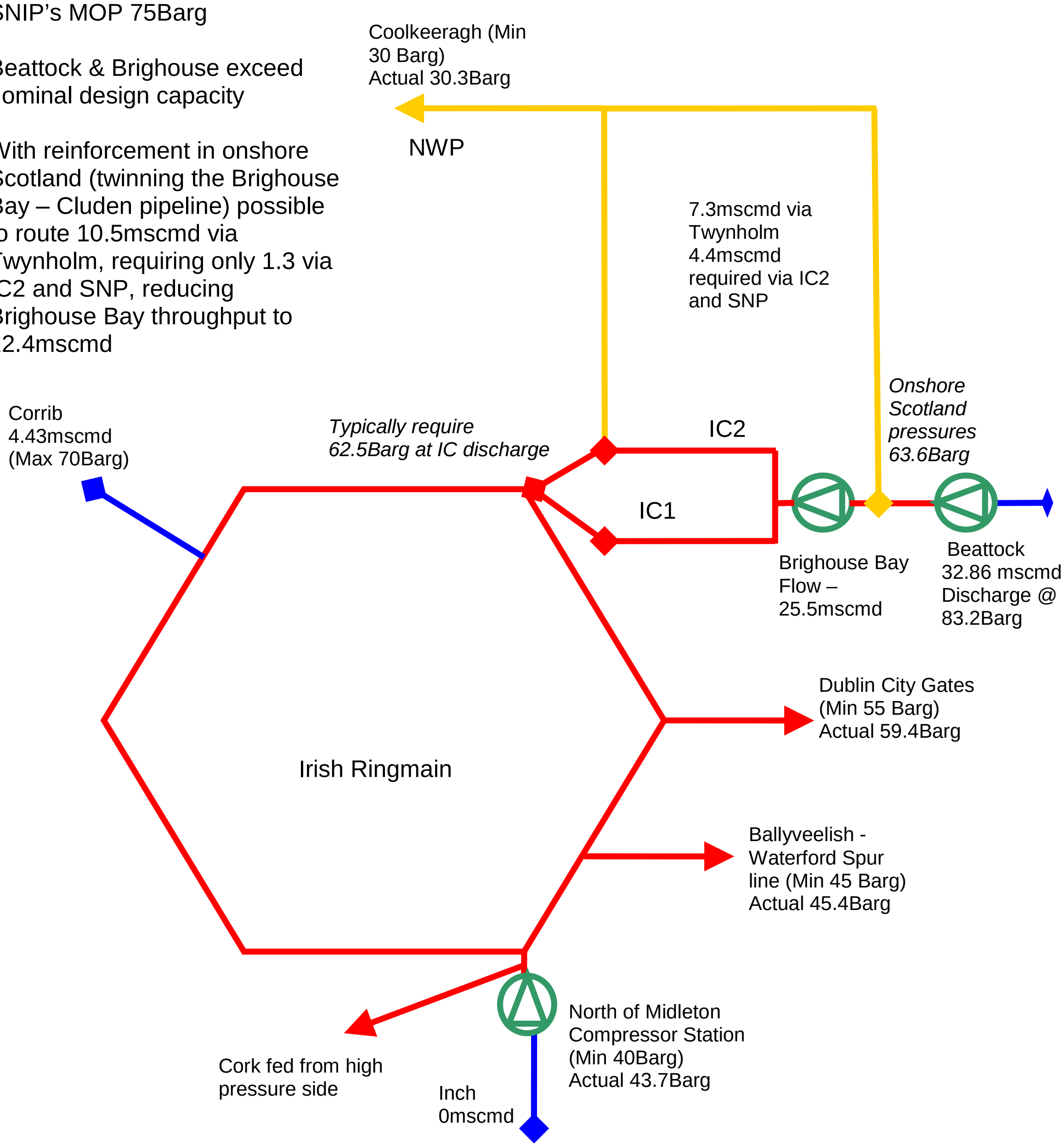
All island delivery pressure requirements are met.



Low Supply Scenario
Yr 2015/16
SNIP's MOP 75Barg

Beattock & Brighouse exceed nominal design capacity

With reinforcement in onshore Scotland (twinning the Brighouse Bay – Cluden pipeline) possible to route 10.5mscmd via Twynholm, requiring only 1.3 via IC2 and SNP, reducing Brighouse Bay throughput to 22.4mscmd



Appendix 4: Glossary

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

BGSI: Bord Gáis Strategic Investments

BGTL: Belfast Gas Transmission Limited

CAG: Common Arrangements for Gas project

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.

Combined Cycle Gas Turbine (CCGT): A unit whereby electricity is generated by a gas powered turbine and also a second 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 uses gas turbine driven gas compressors to boost pressures in the pipeline system. Used to increase transmission capacity and move gas through the network.

Commission: Commission for Energy Regulation

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

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 16 bar with a view to its delivery to customers.

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 kW.

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

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

GCS: Gas Capacity Statement

GCV: Gross Calorific Value

GWh/d: Gigawatt Hour per day. One Gigawatt hour equals 1,000,000kWh

GWh/y: Gigawatt Hour per year

I/C: Industrial/Commercial

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.

IOM: Isle of Man

IPP: Independent Power Producer.

JCS: Joint Capacity Statement 2009.

Kilowatt hour (kWh): The unit of energy used by the gas industry. Approximately equal to 0.0341 therms.

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.

MoU: Memorandum of Understanding

mscm/d: million standard cubic meters per day

mscm/y: million standard cubic meters per year

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.

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 BGÉ 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 2% or 1-in-50 year requirement. Such a year's weather pattern has a 2% probability of occurring and, as such, would be expected to be exceeded only once in 50 years.

PTL: Premier Transmission Limited

Shipper: Any person having an entitlement by way of contract with the Transporter through a 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 or unaccounted for.

SNP: South-North Pipeline

SNIP: The Scotland-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 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 - The 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 9.3%) and adding an estimate of self-consumption.

TSOs: Transmission System Operators

Utility Regulator: Northern Ireland Authority for Utility Regulation