Joint Gas Capacity Statement 2011
Contents

Foreword ......................................................................................................................................................... 5

1 Introduction ................................................................................................................................................. 8

1.1 Background Information .................................................................................................................. 8

1.2 Overview of Supply Demand and Analysis ................................................................................... 8

1.2.1 Supply Scenarios ......................................................................................................................... 9

1.2.2 Network Modelling .................................................................................................................... 11

1.3 Report Structure .................................................................................................................................... 12

2 Transmission network ............................................................................................................................ 13

2.1 Overview of the gas transmission system in Ireland and Northern Ireland .................................... 13

2.2 Scottish onshore system and subsea system .................................................................................... 14

2.3 Onshore Transmission System in Ireland ....................................................................................... 14

2.4 The Northern Ireland Gas Transmission System ............................................................................ 15

2.5 Planning the Transmission System ................................................................................................. 16

2.6 Planned Network Components ......................................................................................................... 16

2.6.1 Supply Sources ............................................................................................................................ 16

2.6.2 Gas Flows ........................................................................................................................................ 17

2.6.3 Network Development .................................................................................................................. 17

2.6.4 Network Reinforcement/Refurbishment .................................................................................... 18

2.6.5 Compressed Natural Gas ............................................................................................................. 19

2.7 Overview of the gas distribution systems in Ireland and Northern Ireland ....................................... 19

3 Gas Demand ............................................................................................................................................... 20

3.1 Introduction ........................................................................................................................................... 20

3.2 Historic Irish Annual Gas Demand .................................................................................................... 20

3.2.1 Overview .......................................................................................................................................... 20

3.2.2 Power Generation Gas Demand .................................................................................................. 22

3.2.3 I/C Gas Demand ............................................................................................................................. 23

3.2.4 Residential Gas Demand ............................................................................................................... 24

3.3 Historic NI Annual Gas Demand ....................................................................................................... 25

3.3.1 Overview .......................................................................................................................................... 25

3.3.2 Power Generation Gas Demand .................................................................................................. 26

3.3.3 Distribution Gas Demand .............................................................................................................. 27

3.4 Peak Gas Demand in Winter 2010/2011 ............................................................................................. 27

3.4.1 Winter 10/11 Peak Demand in Ireland ......................................................................................... 27

3.4.2 Winter 10/11 Peak Demand in Northern Ireland ......................................................................... 28

3.4.3 Gas Market Response in Ireland, NI and GB ............................................................................. 29

3.5 The Irish Gas Demand Forecast ........................................................................................................... 30

3.5.1 Introduction ....................................................................................................................................... 30

3.5.2 Irish gas demand forecast methodology ....................................................................................... 30

3.5.3 Power sector demand ...................................................................................................................... 31
6.3.2 Gas Demand in Ireland ..........................................................65
6.3.3 Gas Demand in Northern Ireland .........................................65
6.3.4 Gas Demand by Sector ..........................................................65
6.4 Longer Term Issues ..................................................................66
  6.4.1 Flows from GB ..................................................................66
  6.4.2 Reverse Flows at Moffat ......................................................66
6.5 Conclusion and Recommendations of the Regulatory Authorities .................................................................67
Appendix 1: Peak Day Demand Forecasts .......................................68
  Irish Peak-day demand forecast ..................................................68
  NI Peak-day demand .................................................................68
  IOM Peak-day forecast ...............................................................68
Appendix 2: System Modelling Approach ........................................73
Appendix 3: System Configuration ..................................................74
Appendix 4: Network Schematics ....................................................76
Appendix 5: Energy Efficiency Assumptions ....................................84
Appendix 6: Glossary ...................................................................86
Foreword

Background Information

The 2011 Joint Gas Capacity Statement (JGCS) presents an assessment of the ability of the all-island transmission network to meet forecast gas demand and potential supply scenarios over the next ten years (2010/11 to 2019/20). The network analysis presented in the JGCS has been principally prepared by Bord Gáis Networks (BGN) with input from the Transmission System Operators (TSOs) in each jurisdiction.¹

The 2011 JGCS is the third annual report produced by the Commission for Energy Regulation and the Northern Ireland Authority for Utility Regulation as part of the Common Arrangements for Gas (CAG) project under the All-island Energy Market Development Framework. The Commission for Energy Regulation (‘the CER’) is required to publish this analysis, including a 7 year demand projection, under section 19 of the Gas (Interim) (Regulation) Act, 2002, as amended by the European Communities (Security of Natural Gas Supply) Regulations 2007 (S.I. No. 697 of 2007). The TSOs in Northern Ireland (NI) are obliged through their codes and licences to produce an annual pressure report/network forecast for presentation to the Northern Ireland Authority for Utility Regulation (‘the Utility Regulator’).

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

The JGCS is the third such report to have been prepared on an all-island basis. In previous years the Utility Regulator published an annual Pressure Report and the CER published its annual Gas Capacity Statement. Both publications presented separate gas supply and demand scenarios and separate assessments for the transmission systems in each jurisdiction. The principal divergence from previous national reporting is that all flows are considered from the current and future entry points in Ireland and Northern Ireland to an integrated all-island system.

The 2010 and 2011 JGCS differ from reports produced in previous years as the scope of the analysis has been extended to ten years. This change was undertaken in order to align the analysis of Ireland and Northern Ireland with that of the European 10-Year Network Development Plan produced by the European Network of Transmission System Operators for Gas every two years under EC Regulation No. 715 of 2009. The 2011 JGCS therefore includes updated analysis and modelling of the impact of forecast gas supply and demand on the island’s transmission systems for the period 2010/11 to 2019/20.

Gas Supply Scenarios

The 2011 JGCS diverges from the analysis undertaken in previous years in terms of the principal supply sources under consideration. The scenarios in this year’s Statement are more limited in terms of the flows taken as being available from the Inch Entry Point. For the three supply scenarios in the 2011 JGCS, the RAs have examined the potential for storage operations at Inch to cease in 2012/2013 with Inch supply comprising production and cushion gas from 2013/14 until 2015/16.

The JGCS takes into account the delivery of gas from the Corrib field and also examines the potential introduction of gas storage at Larne in Northern Ireland and from the Kish Bank Basin, offshore Dublin. The system modelling

¹ The following parties were involved in the preparation of this analysis: Bord Gáis Networks on behalf of Gaslink; Premier Transmission Limited & Belfast Gas Transmission Limited (both owned by Mutual Energy Limited); Bord Gáis Éireann (UK) Limited working with Bord Gáis Networks.
² The Memorandum of Understanding is available on both the websites of the CER and the Utility Regulator.
undertaken by BGN also takes into account flows from GB through the Scotland to Northern Ireland Pipeline (SNIP) and the two BGE subsea Interconnectors, as well as on flows via the South North Pipeline (SNP). The potential for reverse flows through the Scotland to Northern Ireland Pipeline (SNIP) to Ireland are also examined.

In addition to a base case scenario, two supply scenarios have been developed in light of potential flows from storage in the Larne area and in the Kish Bank Basin in order to assess the capacity of the all-island transmission system to function safely.

Taking into account these three supply scenarios and incorporating additional demand assumptions, an important result of the network modelling carried out by BGN is that capacity limits at the Beattock Compressor Station in onshore Scotland may potentially be breached in 2015/16 if flows from Inch decline and cease in 2016 and if there is a further significant delay to the Corrib project. The capacity of the onshore Scotland network is not expected to be breached on the 1-in-50 year peak days for the forthcoming winters.

However, based on current market arrangements, BGN’s results also show that there may be little flexibility in terms of system operation in the onshore Scotland network as early as 2013/14. BGN have also noted that the required limits at Beattock could be shown as being breached by 2013/14 in the event that certain primary assumptions were not to hold true as part of the current forecasts. These potential constraints are evident in all three of the chosen supply scenarios. The RAs will consult on potential mitigation measures in the coming months with a view to implementing the most economic and flexible solution(s) as soon as reasonably practicable.

**Gas Demand**

As regards Irish gas demand, the JGCS shows that, in contrast with 2008/09, Irish annual gas demand grew by 6.8% in 2009/10 largely on account of increased power sector gas demand which was driven by favourable gas prices, generally low levels of wind powered generation and the extended periods of exceptionally cold weather. Annual demand is forecast to have decreased by approximately 8% by 2012/13 but is expected to have returned to 2007/08 levels by 2014/15.

Irish peak day gas demand grew by 9% in 2009/10 and remained around this level in 2010/11 due to a second cold winter period in December 2010. Peak day gas demand is not expected to increase considerably from this level until the latter half of the forecast period. Overall, natural gas continues to be an important fuel for power generation, and remains the fuel of choice for new thermal power station projects.

Annual gas demand in 2009/10 in Northern Ireland has fallen by 4.8% largely due to a reduction in gas supplied to the power sector. However, the distribution sector has grown by 11.2% over the year. Since power stations account for 72% of the gas volumes used in Northern Ireland any reduction in volumes shipped to power stations will have a significant impact on the overall figure, hence the overall reduction.

The overall forecast for gas demand in Northern Ireland is to grow relatively slowly over the next ten years (less than 1% on average). This is due to a relatively stable demand for gas consumption in the power station sector combined with growth within the distribution sector which is forecast to grow at an average of 2.8% each year.

The JGCS 2011 also notes the all time record for peak flows on the island’s transmission system as a whole (including onshore Scotland, onshore Ireland and Northern Ireland) occurred on the 8th of December 2010, as a result of the exceptionally cold weather conditions experienced during the month of December.
The Regulatory Authorities would like to thank all those who contributed to the development of this Joint Gas Capacity Statement, especially Bord Gáis Networks, Mutual Energy\(^3\) and Gaslink. The Regulatory Authorities also acknowledge the assistance of many other parties in producing this Statement, including shippers, gas producers, power producers and large consumers, interested parties and industry observers.

We hope you will find the information it provides helpful.

\(^3\) Mutual Energy Limited is the ultimate holding company for Premier Transmission Limited and Belfast Gas Transmission Limited, the owners and operators of the Scotland to Northern Ireland Pipeline and the Belfast Gas Transmission Pipeline respectively.
1 Introduction

1.1 Background Information

The JGCS 2011 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 2010/11 to 2019/20. The JGCS therefore provides up to date information to interested parties on the ability of the all-island gas transmission network to meet forecast gas demand and potential supply scenarios. The JGCS also sets out the next steps of the RAs where the network analysis undertaken by BGN has identified that the transmission system may not be able to meet potential future requirements.

The CER is obliged under Section 19 of the Gas (Interim) (Regulation) Act, 2002, as amended by the European Communities (Security of Natural Gas Supply) Regulations 2007 (S.I. No. 697 of 2007), to monitor and report on the security of supply of natural gas in Ireland. As part of this requirement, a gas capacity statement must be published each year and submitted to the European Commission in accordance with Article 5 of EU Directive 2009/73/EC. The CER also has safety functions set out in legislation\(^4\) that govern the downstream and upstream gas industry in Ireland; these functions are not addressed in this document.

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

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

1.2 Overview of Supply Demand and Analysis

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

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

- economic growth forecasts provided by the Economic and Social Research Institute (ESRI), which are used to forecast industrial and commercial customers’ requirements for gas\(^5\).
- gas connection figures for 2009 and 2010 from BGN and projected new housing constructions based upon data from the ESRI and the Department of the Environment, which were used to forecast residential demand for gas.
- sources for fuel and commodity prices as required inputs for a merit order electricity model run by BGN. Prevailing spot and forward prices for the UK National Balancing Point (NBP) have been used.\(^6\)

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\(^5\) This incorporates data presented in Economic and Social Research Institute, Quarterly Economic Commentary, Winter 2010 (20 January 2011, as well as further discussions with the ESRI.

\(^6\) It should be noted that fuel-price variations, which may create some additional uncertainty, have been taken into account as part of BGN’s power generation forecasting model.
the gas-fired power stations assumed to be connected to the network in Ireland and Northern Ireland during the forecast period as provided by EirGrid & SONI.

- forecast electricity demand on the island in light of peak electricity demand in December 2010 and modelling results of EirGrid and SONI as noted in their Median Base Scenario.\(^7\)

- assessments of the likely impact on residential gas consumption of measures to improve energy efficiency based in part upon initiatives set out in the Irish Government’s National Energy Efficiency Action Plan 2009–20 (NEEAP).\(^8\)

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

- a questionnaire from the Regulatory Authorities seeking information from industry participants related to current and projected levels of supply and demand;
- general economic and industry forecasts. In particular, the JGCS used information provided from the ESRI about macro-economic factors and changes in the housing market;
- the number of new load connection enquiries and the current year’s operating experience as provided by BGN.
- NI power and distribution demand forecasts provided by the distribution companies and power stations.
- The SONI & EirGrid All Island Generation Capacity Statement 2011-2020.\(^9\)

As regards Irish gas demand, key sources utilised in the preparation by Gaslink of this year’s Transmission Development Statement (e.g. GDP rate, energy efficiency, electricity demand) have also been used for this year’s JGCS.

In the preparation of the JGCS, the Regulatory Authorities received information regarding the timing/duration of certain developments. Based on this information, the following start/end dates were utilised as part of BGN’s network modelling.

- Gas from the Corrib field was taken as being available in Q4 2013.
- Final injections to the existing Inch storage facility are assumed to take place in the summer 2012, and withdrawal of this injection gas is assumed during the 2012/13 winter. Inch supply post March 2013 is assumed to be a combination of cushion gas and production gas, until final cessation of supply in September 2016.
- Gas from a salt cavity storage at Larne was taken as coming online in Q4, 2015.
- Gas from a storage facility in Kish Bank Basin in offshore Dublin has been taken as coming online in Q4, 2018.

The potential timings of these projects have been used to develop three supply scenarios.

Following discussions with Shannon LNG, flows from the proposed facility have not been included as part of this year’s network modelling. Network analysis which includes the impact of supplies from the proposed Shannon LNG facility is available in previous Joint Gas Capacity Statements.

1.2.1 Supply Scenarios

The approach taken to address uncertainties associated with the timing of new indigenous gas sources or in the rates of demand growth was to model three supply scenarios and to conduct a full network analysis to assess the transmission network on the island over the subsequent ten years (2010/11 to 2019/20).

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\(^7\) EirGrid & SONI, All-island Generation Capacity Statement 2011-2020 (December 2010).


The three main supply scenarios discussed in the 2011 JGCS are set out below:

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<tbody>
<tr>
<td>Inch</td>
<td>Ceases September 2016¹</td>
<td>Ceases September 2016</td>
<td>Ceases September 2016</td>
</tr>
<tr>
<td>Corrib</td>
<td>Start October 2013²</td>
<td>Start October 2013</td>
<td>Start October 2013</td>
</tr>
<tr>
<td>Larne Storage</td>
<td>Unavailable</td>
<td>Start October 2015³</td>
<td>Unavailable</td>
</tr>
<tr>
<td>Kish Bank Storage</td>
<td>Unavailable</td>
<td>Unavailable</td>
<td>Start October 2018⁴</td>
</tr>
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¹Final injections are assumed to take place in the summer 2012 and withdrawal of this injection gas is assumed during the winter of 2012/13. Inch supply post March 2013 is assumed to be a combination of cushion gas and production gas, until cessation of supply in 2016.
²Base case modelling also includes a sensitivity for a 1 year delay to Corrib (Oct’ 2014)
³Larne injections are assumed to commence in the Gas Year 2015/16
⁴Kish Bank injections are assumed to commence in the Gas Year 2018/19

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

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

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

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

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<tbody>
<tr>
<td>1</td>
<td>Inch &amp; Corrib Production</td>
<td>Inch &amp; Corrib Production</td>
<td>Inch &amp; Corrib Production</td>
</tr>
<tr>
<td>2</td>
<td>Inch Existing Storage</td>
<td>Inch Existing Storage</td>
<td>Inch Existing Storage</td>
</tr>
<tr>
<td>3</td>
<td>Moffat</td>
<td>Larne Storage</td>
<td>Kish Bank Storage</td>
</tr>
<tr>
<td>4</td>
<td>n/a</td>
<td>Moffat</td>
<td>Moffat</td>
</tr>
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The Regulatory Authorities note that the despatch of the various sources of supply for the three scenarios has been ordered so as to focus on the impact of flows from particular infrastructure project(s) on the all-island system. It should be emphasised that these orders have been applied solely for demand/supply modelling and network analysis purposes. The actual orders in which supplies will be despatched will be determined by shipper nominations and the commercial arrangements between shippers and producers/suppliers at the various Entry Points.

The input assumptions for these scenarios were developed by a working group, which included the CER, the Utility Regulator, Gaslink, Mutual Energy Limited and BGN. The detailed demand modelling was then carried out by BGN using the agreed input assumptions and the information provided by industry stakeholders as noted above.

The CER and the Utility Regulator have engaged with developers in Ireland and Northern Ireland on the status of various gas supply projects. Where sufficient information is available, potential supply sources have been modelled with the permission of the relevant developers. The Regulatory Authorities have sought not to take a view on the commercial viability of existing or proposed projects. The inclusion of data for these projects as part of the
modelling for the JGCS is based on information provided by producers/storage operators and is not intended to refer to the likelihood of these infrastructure projects being progressed.

1.2.2 Network Modelling

Hydraulic models of the combined Irish and NI transmission systems, which are utilised to analyse the three supply scenarios, simulate a 3-day 24 hour demand cycle of the all-island transmission system. Modelling was carried out using “PipelineStudio®” simulation software which was configured to analyse the transient 24 hour demand cycle over a minimum period of three days to obtain consistent steady results.

Information relating to measured daily pressures and profiles of consumption have been used to form this model. This model was subsequently run for the ten years of the JGCS from 2010/11 – 2019/20 inclusive and focused on insufficient capacity and on any resulting increases or decreases in operating pressures outside of acceptable parameters.

The hydraulic models for 1-in-50 demand flows were recalibrated by BGN in light of the record flows on the all-island’s transmission system which occurred on the 8th of December 2010. The network modelling assumes that the physical separation of the two jurisdictions’ transmission networks (referred to as ‘CAG Closed’) can be removed and that the necessary operational and commercial requirements are in place as part of the CAG project to facilitate the potential transported of surplus gas from NI into Ireland and from Ireland into NI as required (referred to as ‘CAG Open’).

In relation to Irish demand, the individual market sectors have been combined to form annual demand projections. As regards Northern Ireland, the demand projections are based upon a power and non power division. Corresponding peak-day demands were calculated for 1-in-50 winter peak-day conditions.

In order to assess the system on days of different demand patterns, three sample demand type day scenarios were analysed for each supply scenario over the 10 year period from 2010/11 – 2019/20 inclusive as part of the modelling: 1-in-50 year winter peak day, average year winter peak day and average year summer minimum. The demand profiles adopted a single gas demand forecast by combining the forecasts for both Ireland and Northern Ireland.

These demand type days represent the best case scenario regarding maximum possible withdrawal rates on peak days and maximum possible injection rates on summer minimum days, assuming the various proposed storage facilities included in the analysis operate on a seasonal basis, i.e. injecting gas during the summer months and withdrawing gas during the winter months.

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

As part of the development of the CAG project, analysis is also being undertaken by the TSOs on the capability of the transmission networks, subject to some modifications, to deliver services on an all island basis under certain scenarios. This network analysis is ongoing in parallel with the JGCS at the request of the RAs.

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10 See Appendix 3 for further information.
1.3 Report Structure

The remainder of the JGCS is set out as follows:

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

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

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

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

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

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

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

Appendix 3 provides information on separate and integrated network systems as part of CAG.

Appendix 4 provides network schematics for each of the supply scenarios.

Appendix 5 sets out information on the Irish Government’s energy efficiency savings targets and their assumed impact on Irish gas demand.

Appendix 6 is a glossary of the terms used in the JGCS.
2 Transmission network

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

Gas supply in Ireland is delivered via a network of c. 13,150km of pipelines. The integrated supply network is subdivided into 2,380km of high pressure sub-sea and cross-country transmission pipe and in excess of 10,750km of lower pressure distribution pipe connecting customers to the system. The Bord Gáis Éireann (BGÉ) onshore high pressure transmission network consists of approximately 1,971km of pipe and the sub-sea Interconnectors account for circa 409km of transmission pipeline.

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

Source: BGN

<table>
<thead>
<tr>
<th>Pipeline Key</th>
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<tbody>
<tr>
<td>Existing Pipelines (BGÉ/BGÉ UK)</td>
</tr>
<tr>
<td>S. N. I. P. (PTL) &amp; BGTP (BGTL)</td>
</tr>
<tr>
<td>Pipelines Planned/Under Construction</td>
</tr>
</tbody>
</table>
The system conveys gas from two Entry Points at Inch in County Cork and Moffat in western Scotland to directly connected customers and distribution networks throughout Ireland, as well as to connected systems at exit points at Twynholm in Scotland (the Scotland to Northern Ireland Pipeline, ‘SNIP’), and to the Isle of Man (IOM). The Moffat Entry Point, located onshore in Scotland, connects the Irish natural gas system to the National Grid system in GB, so that gas can be imported via the GB pipeline system to Ireland through two sub-sea Interconnectors. The Inch Entry Point connects the Kinsale and Seven Heads gas fields and the Kinsale storage facility to the onshore network. The Irish system has three compressor stations: Beattock and Brighouse Bay in southwest Scotland, and Midleton in southern Ireland near Cork.

The Northern Ireland transmission network is made up of 438km of high pressure pipeline which connects the on-land system in Scotland with the two power stations in NI at Ballylumford and Coolkeeragh. Gas initially arrived in NI in 1996 with the completion of the SNIP and pipelines of Belfast Gas Transmission Limited (BGTL) which delivered gas to the Ballylumford power station and to the Phoenix distribution network in Greater Belfast. The North West (NWP) and South North (SNP) pipelines were completed in 2004 and 2006 respectively allowing the development of distribution networks in the ten towns along the pipelines which are 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 SNP; 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 Transmission System in Ireland

The onshore transmission system has been developed over a 33-year period and conveys gas from two Entry Points to customers supplied directly from the system and distribution networks throughout Ireland. The original part of the system was built in 1978 to supply the Cork area from the Kinsale Head gas field. The connecting subsea pipeline is owned and operated by PSE Kinsale Energy Ltd (formerly known as Marathon Oil Ireland Limited). The main Cork to Dublin trunk pipeline was built in 1982, with pipeline spurs constructed to intermediate locations. The onshore Irish system was expanded in 2002/3 by the completion of the Pipeline to the West which has a design pressure of 85barg. This created a ring main pipeline system which connects eastern, western and southern regions. The ring main pipeline contributes to continuity of supply by allowing customers to be supplied from an alternative direction, providing a more secure gas transportation system. It also provides some flexibility to cope with increased flows from the West coast of Ireland to demand centres in the East. The Inch entry terminal is
connected directly to the Cork system and the only compressor station in the onshore Ireland system is at Midleton to boost the gas flow from Inch.

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

2.4 The Northern Ireland Gas Transmission System

The Scotland to Northern Ireland 600mm pipeline (SNIP) connects to the BGÉ system at Twynholm in Scotland and has a maximum operating pressure of 75 barg. The pipeline is 135 km long and runs towards the coast near Stranraer and crosses the Irish Sea to terminate at Ballylumford Power Station, Island Magee. The SNIP is owned and operated by PTL.

Figure 2.2: The transmission network in Northern Ireland

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

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

2.5 Planning the Transmission System

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

The EU Directive 2009/73/EC, as part of the Third Energy Package, contains unbundling provisions designed to separate the supply and networks activities of Vertically Integrated Utilities (VIUs), such as BGE, in order to facilitate non-discriminatory access to gas transmission networks. The Directive outlines a number of models by which Member States can achieve compliance with the unbundling requirements. The Minister for Communications, Energy and National Resources has advised that he and the Government have chosen to implement the ITO (Independent Transmission Operator) model in respect of BGE and the necessary regulations will be implemented shortly. Under the ITO model, a legally separate and ring-fenced independent subsidiary of BGE will own and operate the gas transmission system. This change essentially involves an amalgamation of Gaslink and BGN functions.

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. Information compiled for the Network Development Statement has been utilised in the preparation of this year’s JGCS and also covers the period 2010/11 to 2019/20.

Northern Ireland has three transmission system operators, namely MEL, 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. The publication of the JCS meets these requirements.

2.6 Planned Network Components

2.6.1 Supply Sources

There are a number of prospective projects still at an early stage of development, which may have a significant impact on the system. These include the potential construction of gas storage in salt cavity layers at Larne, as well as in the Kish Bank basin in Dublin Bay, the proposed Liquefied Natural Gas (LNG) import terminal on the Shannon Estuary, and the proposed expansion of storage by PSE Kinsale Ltd (see also Section 4.2).

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

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

It should be noted that data submitted by Islandmagee has been utilised for modelling purposes as it is the larger of the two storage projects at Larne and therefore constitutes the greater stress on the transmission systems in Ireland and Northern Ireland.
Shannon LNG propose to develop an LNG terminal at Ballylongford in Co. Kerry, which will be connected to the existing transmission system by c. 26km of pipeline. The construction of the terminal has received planning permission (subject to certain conditions), and the necessary consent for the pipeline to the transmission system was granted by the CER in December 2009.\textsuperscript{12}

Eirgas Ltd, a subsidiary of Providence Resources, are currently examining the feasibility of gas storage in the Irish Sea as part of the Ulysses Project. The Ulysses Project, which commenced in 2008, is focused on potential gas storage and carbon sequestration in the Kish Bank Basin, offshore Dublin.

PSE Kinsale Energy has informed the CER that it is currently undertaking engineering studies with a view to expanding its existing Southwest Kinsale gas field storage facility. PSE Kinsale Energy's Ballycotton gas storage project, detailed in the 2010 JGCS, has been put on hold due to engineering difficulties and current economic uncertainty.

### 2.6.2 Gas Flows

Currently gas flows primarily from the East Coast in Ireland where the interconnectors reach Ireland and from the South coast through the Inch Entry Point to the main centres of demand in Dublin and Cork, and also to new towns along the Pipeline to the West. Gas flows from Corrib, as well as other proposed projects, are expected to displace gas coming through the Interconnectors. In this event, gas may flow from the West of Ireland to centres of demand in the East and the South. Gas may also increasingly flow from Northern Ireland depending on the timing of the Larne storage projects. In NI all demands are currently supplied from Moffat via the SNIP.

Depending on the timing of the various supply projects, there is also the potential for gas demand on the island to be increasingly or wholly dependent on supplies from Moffat. The network modelling undertaken by BGN has therefore tested the implications of potential major changes in the operation of the network and examined the potential for increased flows through the Moffat Entry point to Northern Ireland and Ireland. Therefore, the supply and demand scenarios in the JGCS serve to indicate whether or not reinforcements or other mitigation measures will be needed to accommodate these projected flows. The supply and demand cases and the scenarios also identify whether supplies from the major supply projects in Ireland and Northern Ireland would physically flow to the other jurisdiction.

### 2.6.3 Network Development

In April 2010, the CER approved the connection of Kells in Co. Meath to the natural gas network, Tipperary Town in Co. Tipperary and Kinsale and Innishannon in Co. Cork as part of the new Towns Analysis Phase 3.\textsuperscript{13} To date this year both Tipperary Town and Kinsale have received gas, while Kells in Co. Meath is due to receive gas in September 2011. In September 2010, the CER also approved the connection of Macroom in Co. Cork to the network and the town is expected to receive gas in early 2012.

The CER’s approval of the connection of new towns to the network is based upon economic analysis developed by BGN in light of the criteria outlined in the Gaslink Connection Policy. The Connection Policy is designed to encourage new customer uptake to the gas network in a manner which would be economic, efficient and transparent, while at the same time minimising adverse impacts on gas network charges. It should be noted that in light of the general economic downturn and evidence from previous phases, the CER has required a more prudent interpretation of the Connections Policy than in previous phases.

In March 2010, the Department of Enterprise Trade and Investment (DETI) published a consultation paper on the potential for extending the natural gas market in Northern Ireland.\textsuperscript{14} The consultation paper identifies the benefits of extending the natural gas network in Northern Ireland: providing a greater choice for consumers, shifting the dependence on coal and oil for household heating and increasing the potential for businesses and the public sector.

\textsuperscript{12} Flows from Shannon LNG have not bee included as part of network modelling for the JGCS 2011. See section 5.1.

\textsuperscript{13} Full details on the New Towns Analysis – Phase 3 Report can be found on the Gaslink website at [www.gaslink.ie](http://www.gaslink.ie)

\textsuperscript{14} DETI publication – [Consultation on the potential for extending the natural gas market in Northern Ireland, June 2011](http://www.gaslink.ie)
to use a cleaner more efficient fuel. The paper also seeks respondents’ views on the towns in Northern Ireland where it would be appropriate to develop new natural gas infrastructure.

The consultation paper was informed by a 2010 feasibility study\textsuperscript{15} which examined a number of options for taking gas to the remaining towns in the West and North West which are not currently covered by the natural gas network. The study also identified possible ways of financing these potential projects. Further detail is provided in the links below. The department will set out the next steps following the end of the consultation period (September 2011).

\subsection*{2.6.4 Network Reinforcement/Refurbishment}

Subject to regulatory review and approval in the relevant jurisdictions, the TSOs carry out reinforcement of the existing gas transmission network to ensure system demand is met, to facilitate local development and/or to upgrade old pipelines etc. Reinforcement projects that were completed by Gaslink/BGN during gas year 2009/10 include:

- Completion of the new 24\textdegree{} Curraleigh West to Midleton Pipeline and the associated Midleton to Loughcarrig Lodge Pipeline. These pipelines were commissioned during the latter end of 2010.
- Volume control was installed in Midleton Compressor Station to increase the operating envelope of the turbo compressor units to accommodate the recent pipeline reconfiguration in the Cork area.
- Completion of capacity upgrades to a number of transmission AGIs including Glebe West (Blessington) & Loughboy (Kilkenny).
- A bypass system was installed in Brighouse Bay Compressor Station connecting the Onshore IC1 system to subsea IC2 to allow a complete bypass of Brighouse Bay Compressor Station.

There is a continuous programme in both jurisdictions to review and refurbish the gas transmission system in order to ensure that it continues to comply with all of the relevant legislation, technical standards and Codes of Practice. This refurbishment work is coordinated with reinforcement work (where possible) in order to minimise overall costs and to limit disturbance to local communities.

The following refurbishment and diversion projects were undertaken by Gaslink/BGN during gas year 2009/10:

- The Dublin-4 pipeline light-wall refurbishment project is due for completion in the coming months – this project was a 2 year build that replaces the existing light-wall pipeline with a heavy wall pipeline
- A remotely actuated emergency bypass was installed around Midleton Compressor Station (MCS) for the purposes of supplying the 30 Bar Cork network in the event of a failure of the MCS Pressure Reduction System;
- Completion of Kilshane Block Valve refurbishment.

The following transmission system refurbishment and diversion projects are planned for the 2010/11 gas year:

- Detailed integrity assessments have been carried out on the Limerick 19 barg network and it has been identified that it is necessary to eliminate the risk posed by light-wall pipe in Limerick City. In conjunction with the integrity analysis, it has been determined that there is a need to reinforce the 19 barg network in Limerick due to capacity limitations. Following approval by the CER, preliminary engineering is progressing with a view to construction commencing next year. It should be noted that the proposed solution for Limerick pushes out the need to reinforce the Limerick 70 barg network.
- Santry – Eastwall pipeline light-wall refurbishment project in Dublin City; Optimal solution for the refurbishment of the 6.5kms Santry – Eastwall pipeline is being progressed;
- Waterford Pipeline replacement project; Optimal solution for the refurbishment of 2.6kms of the Waterford City pipeline is being progressed;

\textsuperscript{15} DETI publication – Executive Summary of the Natural Gas Feasibility Study
Four diversions are required to facilitate the M20 Cork to Limerick motorway. The 1st of these diversions, on the 6” pipeline near Mallow Hospital, is due to be carried out this year with the remaining 3 diversions to follow.

2.6.5 Compressed Natural Gas

BGN is currently investigating the development of an Irish market for the use of natural gas as a fuel in transport. Natural Gas as a transport fuel - known as Compressed Natural Gas (CNG) – is used across the world within Natural Gas Vehicles (NGV). Since 2000, there has been substantial growth of NGVs worldwide, with approximately 30% annual growth mainly on account of the economic and environmental benefits associated with CNG. Currently, BGN is analysing CNG within its own fleet. BGN is also liaising with interested parties to commercially use CNG within captive fleets and has commenced work with organisations such as the NSAI to develop a CNG refuelling station standard for Ireland.

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

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

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

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

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

3.1 Introduction

This chapter provides a review of both the historical and forecast annual and peak gas demands for Ireland and Northern Ireland respectively. A breakdown of the overall demand by sector is presented along with a review of the high gas demand which was experienced over the winter period 2010 – 2011. Similarly, the forecast gas demands are broken-down by sector for both Ireland and Northern Ireland as per the 10 year period modelled in the JGCS.

3.2 Historic Irish Annual Gas Demand

3.2.1 Overview

Irish annual gas demand grew by 6.8% in 2009/10 with the largest percentage increase of 9.3% occurring in the power generation sector. Irish peak day gas demand grew by 8.8% in 2009/10 and is forecast to remain at this level in 2010/11 due to a second severe cold winter period in December 2010.

The growth in annual gas demand may be attributed to an increase in power sector gas demand driven by favourable gas prices, generally lower levels of wind powered generation and the extended periods of exceptional cold weather. I/C gas demand grew by 0.8%, and residential demand grew by 3.3%. The increase in I/C and residential gas demand is as a consequence of the strong performance of export lead industries and the colder winter weather period.

Table 3.1 summarises Irish annual gas demand for the period 2002/03 to 2009/10. Despite demand contraction in 2008/09, Irish annual gas demand has grown by 3.5% p.a. over the eight year period. Contraction in 2008/09 was primarily due to a reduction in the power sector gas demand and to a lesser extent by a decrease in the I/C gas demand. Most of average annual demand growth can be attributed to the power generation sector and to a lesser extent from the residential sector:

- Power sector gas demand grew by 4.6% p.a. due to the growth in overall electricity demand and the construction of new gas-fired stations, e.g. Aughinish Combined Heat & Power (CHP), the Tynagh and Huntstown II Combined Cycle Gas Turbine (CCGT) stations and the opening of the Aghada CCGT and Whitegate CCGT in April and August 2010 respectively;
- Residential gas demand grew by 3.6% p.a. since 2002/03, however, this was less than the corresponding growth in customer numbers, due to a combination of increased energy efficiency, higher gas prices, smaller dwelling sizes, greater vacancy rates and the recent economic downturn. Since 2007/08 average growth has slowed to 2.1% p.a.; and
- The I/C gas demand has begun to see a recovery in 2009/10 but the annual trend since 2002/03 remains relatively flat. This pattern could be attributed to the emergence of less energy intensive industry.
Table 3-1: Historic Irish annual gas demand expressed in volume (mscm/y) and energy (GWh/y)

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<tr>
<td>Power</td>
<td>GWh/y</td>
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<td>28,845</td>
<td>25,630</td>
<td>29,775</td>
<td>34,688</td>
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<td>36,007</td>
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<td>I/C</td>
<td>GWh/y</td>
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<td>11,127</td>
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<td>10,486</td>
<td>10,507</td>
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<td>7,757</td>
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<td>Own-use</td>
<td>GWh/y</td>
<td>617</td>
<td>735</td>
<td>878</td>
<td>815</td>
<td>779</td>
<td>814</td>
<td>823</td>
<td>900</td>
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<td>Total Irish</td>
<td>GWh/y</td>
<td>46,630</td>
<td>48,168</td>
<td>45,392</td>
<td>49,091</td>
<td>53,669</td>
<td>57,318</td>
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<tr>
<td>Power</td>
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<td>2,629</td>
<td>2,327</td>
<td>2,698</td>
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<td>I/C</td>
<td>mscm/y</td>
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<td>1,010</td>
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<td>958</td>
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<td>952</td>
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<td>RES</td>
<td>mscm/y</td>
<td>608</td>
<td>678</td>
<td>704</td>
<td>738</td>
<td>699</td>
<td>751</td>
<td>754</td>
<td>779</td>
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<tr>
<td>Own-use</td>
<td>mscm/y</td>
<td>56</td>
<td>67</td>
<td>80</td>
<td>74</td>
<td>71</td>
<td>74</td>
<td>75</td>
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<tr>
<td>Total Irish</td>
<td>mscm/y</td>
<td>4,234</td>
<td>4,391</td>
<td>4,122</td>
<td>4,448</td>
<td>4,858</td>
<td>5,225</td>
<td>5,038</td>
<td>5,381</td>
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<td><strong>GCV</strong></td>
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<tr>
<td>Moffat</td>
<td>GJ/m³</td>
<td>40.00</td>
<td>40.00</td>
<td>40.00</td>
<td>40.00</td>
<td>40.00</td>
<td>39.69</td>
<td>39.84</td>
<td>39.82</td>
</tr>
<tr>
<td>Inch</td>
<td>GJ/m³</td>
<td>37.50</td>
<td>37.50</td>
<td>37.50</td>
<td>37.50</td>
<td>37.50</td>
<td>37.79</td>
<td>37.92</td>
<td>37.94</td>
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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. GCV has decreased year to year since 2006/07. This may be an indication of higher imports in the GB supply mix.

Figure 3-1: Composition of historical Irish annual gas demand

Natural gas continues to occupy a dominant position within the power generation fuel mix. This is reflected in the number of gas power stations. The assumptions regarding future power generation plant are presented in Section 3.5.3. The power sector share of total gas demand has grown from 61.7% in 2002/03 to 66.3% in 2009/10 (see Figure 3-1).

The power sector’s increasing share of total gas demand has resulted in a reduction in the proportion occupied by the I/C sector. The I/C share reduced from 22.6% in 2002/03 to 17.7% in 2009/10 (see Figure 3-1).

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

Table 3-2 presents the annual peak daily gas demand. 2010/11 peak day analysis has been included as the 2010/11 winter period has already occurred. The peak daily demand fell slightly in 2010/11 but has increased by...
7.3% per annum since 2004/05. The growth in peak demand is largely due to an increase in the peak power gas demand which has increased by 10.3% per annum. The peak non power sector has also seen an increase of 3.8% per annum over this time period. It should also be noted that the peak demands for both 2009/10 and 2010/11 occurred during periods of extreme cold weather. It is likely that the cold weather periods coincidental with low levels of wind resulted in higher peak demands than would otherwise have occurred.

Since 2004/05 the power sector has continuously accounted for a greater portion of the peak day gas demand. Power accounted for 45% of peak day demand in 2004/05 and in 2010/11 this grew to 55%. The non power sector portion has contracted accordingly with the ratio of IC to residential remaining relatively constant. This variation in peak day demand is presented in Figure 3-2.

Table 3-2: Breakdown of the Historical Irish Peak Day Gas Demand

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<td><strong>ENERGY</strong></td>
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<tr>
<td>Power</td>
<td>GWh/d</td>
<td>73.6</td>
<td>96.8</td>
<td>111.2</td>
<td>119.7</td>
<td>126.4</td>
<td>134.3</td>
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<tr>
<td>IC</td>
<td>GWh/d</td>
<td>45.5</td>
<td>43.4</td>
<td>43.1</td>
<td>43.4</td>
<td>44.4</td>
<td>46.3</td>
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<td>RES</td>
<td>GWh/d</td>
<td>47.0</td>
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<td>50.4</td>
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<td>56.7</td>
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<td>Own-use</td>
<td>GWh/d</td>
<td>3.9</td>
<td>3.2</td>
<td>4.0</td>
<td>3.6</td>
<td>4.5</td>
<td>5.2</td>
</tr>
<tr>
<td>Total Irish</td>
<td>GWh/d</td>
<td>164.4</td>
<td>193.4</td>
<td>208.0</td>
<td>219.7</td>
<td>231.1</td>
<td>252.0</td>
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<tr>
<td><strong>VOLUME</strong></td>
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<tr>
<td>Power</td>
<td>mscm/d</td>
<td>6.7</td>
<td>8.8</td>
<td>10.1</td>
<td>10.9</td>
<td>11.5</td>
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<td>4.0</td>
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<td>mscm/d</td>
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<td>5.1</td>
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<td>0.4</td>
<td>0.3</td>
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<td>Total Irish</td>
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<tr>
<td>Average GJ/m³</td>
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<td>39.5</td>
<td>39.6</td>
<td>39.7</td>
<td>39.8</td>
<td>39.5</td>
<td>39.7</td>
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</table>

Figure 3-2 Breakdown of Historical Irish Peak Day Gas Demand

3.2.2 Power Generation Gas Demand
Power generation gas demand on the peak day grew by 6.25% in 2009/10 giving an overall growth of 82.5% since 2002/03.
Gas demand from the power sector has been driven primarily by growth in the Irish demand for electricity (the Total Electricity Requirement has grown by 12.8% since 2002) and the construction of new gas-fired stations. Gas-fired generation accounted for 40.5% of electricity production in 2002, increasing to 63.7% in 2010.

The contraction in gas demand during 2004/05 can be explained by the sector fuel-switching from gas to Low Sulphur Fuel Oil (LSFO) in response to high gas prices (see Figure 3-3). The high gas prices recorded in March 2005 and over the winter period of 2005/06 are as a result of UK supply constraints combined with higher demands which increased the UK National Balancing Point gas price. Despite record high gas prices, demand recovered in 2005/06 due to the construction of new gas fired stations at Aughinish and Tynagh. The growth in the power sector gas demand is set to continue due to a number of factors including the recent commissioning of Aghada CCGT and Whitegate CCGT power stations and the replacement of old stations with gas-fired stations.

A combination of lower gas prices and electricity demand growth resulted in power sector gas demand growth for subsequent years until 2008/09, when gas demand contracted due to the fall-off in electricity demand by c.-4.0% (based on EirGrid’s 2008/09 Total System Demand). 2009/10 Total System electricity demand fell by a further 1.7% but this trend was not reflected in the power sector gas demand. Power sector gas demand increased in 2009/10 despite the overall reduction in electricity demand due to favourable gas prices, a low level of wind powered generation and a prolonged cold weather period.

Peak ROI electricity demand of 5,090MW occurred on the 21st December 2010. The power sector gas demand recorded for the 21st December was suppressed due to both Tynagh and Whitegate gas burning power stations being unavailable on the peak day. Power generation peak day demand would likely have been increased by 15-20% (i.e. rising from 121GWh to c. 144GWh) if the two stations had been running.

**Figure 3-3: Historic Fuel Prices**

**3.2.3 I/C Gas Demand**

There were 23,260 I/C customers connected to the Irish gas transmission and distribution systems at the end of the 2009/10 gas year. A breakdown of the total annual I/C gas demand by category is given in Table 3-3 in both energy and volume terms:

- **TX DM I/C:** The larger transmission connected Daily Metered (DM) I/C sites accounted for 35.3% of total I/C demand in 2009/10 and includes the larger factories and co-ops etc;

- **DX DM I/C:** The larger distribution connected DM I/C sites accounted for 27.2% of total I/C demand in 2009/10 and includes the smaller factories, hospitals, universities, prisons etc;

- **DX NDM I/C:** The smaller distribution connected Non-Daily Metered (NDM) I/C sites accounted for 37.5% of total I/C demand in 2009/10 and includes shops, offices, schools and restaurants etc.
Table 3-3: Breakdown of the Historical Irish Annual I/C Gas Demand¹

<table>
<thead>
<tr>
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<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ENERGY</td>
<td>TX DM I/C GWh/y</td>
<td>4,461</td>
<td>4,854</td>
<td>4,953</td>
<td>4,004</td>
<td>4,029</td>
<td>3,792</td>
<td>3,518</td>
<td>3,701</td>
</tr>
<tr>
<td></td>
<td>DX DM I/C GWh/y</td>
<td>107</td>
<td>1,682</td>
<td>2,468</td>
<td>2,597</td>
<td>2,827</td>
<td>2,830</td>
<td>2,835</td>
<td>2,858</td>
</tr>
<tr>
<td></td>
<td>DX NDM I/C GWh/y</td>
<td>5,970</td>
<td>4,618</td>
<td>3,706</td>
<td>3,752</td>
<td>3,629</td>
<td>3,886</td>
<td>4,063</td>
<td>3,940</td>
</tr>
<tr>
<td></td>
<td>Total I/C GWh/y</td>
<td>10,538</td>
<td>11,154</td>
<td>11,127</td>
<td>10,352</td>
<td>10,486</td>
<td>10,507</td>
<td>10,415</td>
<td>10,499</td>
</tr>
<tr>
<td>VOLUME</td>
<td>TX DM I/C mscm/y</td>
<td>405.0</td>
<td>442.4</td>
<td>449.8</td>
<td>362.8</td>
<td>364.7</td>
<td>345.6</td>
<td>319.0</td>
<td>335.7</td>
</tr>
<tr>
<td></td>
<td>DX DM I/C mscm/y</td>
<td>9.7</td>
<td>153.3</td>
<td>224.1</td>
<td>235.3</td>
<td>255.9</td>
<td>257.9</td>
<td>257.1</td>
<td>259.2</td>
</tr>
<tr>
<td></td>
<td>DX NDM I/C mscm/y</td>
<td>542.1</td>
<td>420.9</td>
<td>336.5</td>
<td>340.0</td>
<td>328.5</td>
<td>354.3</td>
<td>368.4</td>
<td>357.4</td>
</tr>
<tr>
<td></td>
<td>Total I/C mscm/y</td>
<td>956.8</td>
<td>1,016.6</td>
<td>1,010.4</td>
<td>938.1</td>
<td>949.1</td>
<td>957.8</td>
<td>944.5</td>
<td>952.3</td>
</tr>
</tbody>
</table>

¹Actual annual gas demand, no weather correction applied
²Many 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
³Volumes have been derived from the energy values by assuming a weighted GCV. Details of the Inch and Moffat GCVs are detailed in Table 3.1 for each of the respective years.

It can be seen that the total I/C demand grew slightly over the period from 2008/09 to 2009/10, with a -3.0% reduction in the distribution connected NDM I/C demand being offset by a 5.2% increase in the transmission connected I/C demand. Distribution connected I/C demand grew slightly. The growth in the transmission connected demand during the period is attributed to the strong performance of the export lead sectors of industry including dairy and food produce.

### 3.2.4 Residential Gas Demand

There were 614,973 residential customers connected to the Irish distribution system at the end of the 2009/10 Gas Year. The growth rate in customer numbers has declined significantly in recent years falling from 6.1% per annum in 2006/07 to 1.0% in 2009/10. The total number of residential gas customers has increased substantially by 45.9% in recent years (see Fig. 3.4), growing from 421,453 at the end of 2002/03 to 614,973 at the end of 2009/10.

The annual residential gas demand on the other hand only increased by 28.2% over the same period, growing from 6,700.6 GWh/y in 2002/03 to 8,589.6 GWh/y in 2009/10. 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.
### 3.3 Historic NI Annual Gas Demand

#### 3.3.1 Overview

The historic NI gas demand is summarised by sector in Table 3-4 and shown graphically in Fig. 3-5. The distribution category includes the gas demand of Phoenix Natural Gas and Firmus Energy, while the power sector includes the Ballylumford and Coolkeeragh power stations. The total NI annual demand has grown by 25.89% over the period 2002/03 – 2009/10 (or 3.24% p.a.).

#### Table 3-4: Historic NI Annual Demand Summarised by Sector

<table>
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</thead>
<tbody>
<tr>
<td><strong>ENERGY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power GWh/y</td>
<td></td>
<td>9,880.9</td>
<td>9,902.8</td>
<td>13,769.6</td>
<td>14,921.6</td>
<td>15,695.6</td>
<td>14,248.8</td>
<td>12,488.9</td>
<td>11,352.3</td>
</tr>
<tr>
<td>Distribution GWh/y</td>
<td></td>
<td>2,766.2</td>
<td>3,040.4</td>
<td>3,208.8</td>
<td>3,326.9</td>
<td>3,393.8</td>
<td>3,923.3</td>
<td>4,161.3</td>
<td>4,568.8</td>
</tr>
<tr>
<td>Total NI GWh/y</td>
<td></td>
<td>12,647.2</td>
<td>12,943.2</td>
<td>16,978.4</td>
<td>18,248.5</td>
<td>19,089.4</td>
<td>18,172.1</td>
<td>16,650.2</td>
<td>15,921.1</td>
</tr>
<tr>
<td><strong>VOLUME</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power mscm/y</td>
<td></td>
<td>889.3</td>
<td>891.2</td>
<td>1,239.3</td>
<td>1,342.9</td>
<td>1,412.6</td>
<td>1,292.4</td>
<td>1,128.4</td>
<td>1,026.4</td>
</tr>
<tr>
<td>Distribution mscm/y</td>
<td></td>
<td>249.0</td>
<td>273.6</td>
<td>288.8</td>
<td>299.4</td>
<td>305.4</td>
<td>355.9</td>
<td>376.0</td>
<td>413.1</td>
</tr>
<tr>
<td>Total NI mscm/y</td>
<td></td>
<td>1,138.3</td>
<td>1,164.8</td>
<td>1,528.1</td>
<td>1,642.3</td>
<td>1,718.0</td>
<td>1,648.3</td>
<td>1,504.4</td>
<td>1,439.5</td>
</tr>
</tbody>
</table>

*Volumes have been derived from the energy values by assuming a Moffat GCV of 40 MJ/m³ for 2002/03 to 2006/07, 39.7 MJ/m³ for 2007/08, 39.8 MJ/m³ for 2008/09 and 2009/10*
The annual peak daily demand is presented in Table 3-5. The peak daily demand fluctuates over the study years with a maximum daily demand of 75.9 GWh/d.

**Table 3-5 Annual NI Peak Daily Gas Demand**

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>ENERGY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total NI</td>
<td>66.2</td>
<td>75.9</td>
<td>74.9</td>
<td>71.9</td>
<td>65.5</td>
<td>75.2</td>
<td>75.6</td>
</tr>
<tr>
<td><strong>VOLUME</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total NI</td>
<td>5.96</td>
<td>6.83</td>
<td>6.74</td>
<td>6.47</td>
<td>5.89</td>
<td>6.82</td>
<td>6.83</td>
</tr>
</tbody>
</table>

**Figure 3-6 Annual NI Peak Day Gas Demand**

### 3.3.2 Power Generation Gas Demand

From 2002/03 – 2009/10 the power sector grew by 1.86% p.a. with the combined effect of the commissioning of one new CCGT at Coolkeeragh and the displacement of a 600MW open cycle generation turbine with a 600MW
CCGT at Ballylumford. However, from 2006/07 to 2009/10 the NI Power gas demand has contracted by -6.92% p.a. as a result of a revised despatch order within the SEM and to a lesser extent the economic recession.

3.3.3 Distribution Gas Demand

The distribution sector grew by 8.15% p.a. with the expansion of the Phoenix distribution system in the Greater Belfast area and the Firmus distribution systems along the North West Pipeline (NWP). The historic distribution demand for the Phoenix Distribution system and Firmus distribution system is summarised below:

- Phoenix Distribution - The distributed gas volume in the Phoenix Natural Gas Ltd (PNG) licensed area of greater Belfast has grown by 35%, averaging 4.4% p.a. over the period 2002/03 to 2009/10. Accounting for temperature correction (5 year average using degree day methodology16), growth has been 25%, or an average of 3.4% p.a. Growth in the PNG licensed area has been driven primarily by the organic growth in consumers of natural gas, the majority of whom are domestic customers.

- Firmus Distribution – Firmus Energy started to supply natural gas in the Firmus distribution Licensed Area17, in 2005, increasing their sales significantly in the following years, mainly in the I&C sector. In 2009 Firmus Energy also started to supply gas in the Greater Belfast area. The significant levels of sales growth can be largely attributed to the low customer base during the initial years of supply.

3.4 Peak Gas Demand in Winter 2010/2011

2010 was a record year for gas demand with December 2010 being a record month for gas demand. This high gas demand coincided with some of the most severe cold weather conditions on record, particularly the month of December, which was the coldest month on record at Dublin Airport, according to Met Éireann.

The month of December 2010 was the coldest December on record, corresponding with the coldest record day at Dublin airport on the 24th of December, since records commenced in 1942. The average temperature over a 24 hour period on the 24th of December was -8.6°C. Similar freezing conditions occurred in early January, particularly on the 7th and 8th of January, with an average temperatures of c. -5.0°C. Gas demand in the month of December 2010, 6,671 GWh (c. 605 mscm/m), grew by 6.0% on January 2010 (the previous record month) and 11.7% on December 2009. The island’s demand on the 8th of December 2010, 329 GWh/d, approached but did not break the record peak demand, 332.9 GWh/d, which occurred on the 7th January 2010, however, there was a requirement for system balancing gas on the 8th December, approximately 8.6 GWh/d, increasing the Island’s gas flows to a record level. The 8th of December 2010 was a record event for peak flows through the Moffat Entry Point, 304 GWh/d (27.2 mscm/d).

The all time record for peak flows onto the island’s transmission system (including onshore Scotland, onshore Ireland and Northern Ireland) of 337.6 GWh/d (30.4 mscm/d) also occurred on the 8th of December 2010. This peak flow is the sum of the ROI demand, Northern Ireland (NI) demand, the Isle of Man (IOM) demand and system balancing gas requirement, which were 249.6 GWh/d (22.4 mscm/d), 74.6 GWh/d (6.7 mscm/d), 4.8 GWh/d (0.4 mscm/d) and 8.6 GWh/d (0.8 mscm/d) respectively.

3.4.1 Winter 10/11 Peak Demand in Ireland

The winter 10/11 system peak day demand for Ireland of 251.2 GWh/d (22.6mscm/d) occurred on the 20th December and coincided with a 19.9 Degree Day (DD) at Dublin Airport, which is short of the 1-in-50 DD of 21.6.

Even though this date and a number of days in December 2010 realised similar levels to the record peak day gas demand of the 7th of January 2010, 253 GWh/d (23.0 mscm/d), these were slightly short on the 7th of January 2010 peak day demand record. The period of high demand during December 2010 was more sustained than that experienced in January 2010.

---

16 A Degree Day (DD) is a temperature unit which indicates the demand for energy required for heating. A decrease in temperature results in an increased degree day and hence increase in heating energy demand.

17 Antrim, Armagh, Ballymena, Ballymoney, Banbridge, Coleraine, Craigavon, L'Derry, Limavady and Newry
The weather sensitive non-daily-metered sector, which comprises of residential and small Industrial and Commercial (I/C) customers, experienced record peak daily demands in both January and December. NDM demand peaked on the 21\textsuperscript{st} of December, 94.9 GWh/d (8.5 mscm/d). However, this NDM demand record does not exceed its highest peak to date which occurred on the 8\textsuperscript{th} of January 2010, 95.2 GWh/d (8.7 mscm/d).

Peak Daily Metered (DM) Industrial & Commercial (I/C) demand occurred on the 2\textsuperscript{nd} December, 25.8 GWh/d (2.3 mscm/d). This was a 24.4\% increase on the peak 09/10 demand.

The electricity system in Ireland experienced record levels of demand during January and December in 2010, with its highest ever system demand peak of 5,090 MW occurring on the 21\textsuperscript{st} of December. The record electricity demands combined with very low wind levels and favourable gas prices relative to coal for electricity generation, resulted in record gas demand for the power generation sector. The 2010/11 peak power generation gas demand occurred on the 8\textsuperscript{th} December with a total demand of 133.0 GWh/d (12.0 mscm/d). However, it is likely the power generation peak day gas demand would have occurred on the 21\textsuperscript{st} of December if the Tynagh and Whitegate gas burning power stations had been available on this day, Modelling indicates, power generation gas demand could have been in the order of 144 GWh.

Gas flows through the subsea Interconnector (IC) System exceeded the design capacity of IC1 on 30 days over the 2009/10 winter period and on 42 days over the 2010/11 winter period, demonstrating the importance of the increased capacity provided by IC2. On the 8\textsuperscript{th} of December 2010 flows of 229.3 GWh/d (20.6 mscm/d) were recorded which exceed the design capacity of the IC1, stated as 188.2 GWh/d (17.0 mscm/d). Taking into account the design capacity of IC2 (22.33mscm/d), the IC system successfully provided for these peak flows into the Irish system.

3.4.2 Winter 10/11 Peak Demand in Northern Ireland

Northern Ireland experienced similarly severe cold weather conditions during November and December 2010 with a record minimum temperature registered: -18.7 °C at Castlederg (County Tyrone) on the morning of 23 December 2010, beating the previous record of -17.5 °C on 1 January 1979 at Magherally (County Down). The normal maritime influence on Northern Ireland’s climate means that temperatures as low as this are exceptional.
Additionally new maximum and minimum temperature records for November and December were set in Northern Ireland (see Table 3.6 below). That new temperature records were set between 25 November and 26 December gives some indication of the severity of this spell, which was broadly comparable to that of late December 2009 to mid-January 2010.

### Table 3.6 Northern Ireland maximum and minimum temperature data

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Location</th>
<th>Date</th>
<th>Record</th>
<th>Location</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>November</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Maximum</strong></td>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-1.6 °C*</td>
<td>Castlederg (County Tyrone)</td>
<td>28 Nov 2010</td>
<td>-1.4 °C</td>
<td>Armagh (County Armagh)</td>
<td>26 Nov 1977</td>
</tr>
<tr>
<td><strong>Minimum</strong></td>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-11.9 °C</td>
<td>Mucker Broughderg (County Tyrone)</td>
<td>28 Nov 2010</td>
<td>-12.2 °C</td>
<td>Lisburn (County Antrim)</td>
<td>15 Nov 1919</td>
</tr>
<tr>
<td><strong>December</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Maximum</strong></td>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-11.3 °C*</td>
<td>Edenfel (County Tyrone)</td>
<td>23 Dec 2010</td>
<td>-9.0 °C</td>
<td>Boom Hall (County Londonderry)</td>
<td>27 Dec 1995</td>
</tr>
<tr>
<td><strong>Minimum</strong></td>
<td>Temperature</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-18.7 °C*</td>
<td>Castlederg (County Tyrone)</td>
<td>24 Dec 2010</td>
<td>-16.1 °C</td>
<td>Katesbridge (County Down)</td>
<td>28 Dec 2000</td>
</tr>
</tbody>
</table>


The peak daily demand on SNIP was recorded on 23\(^{rd}\) December (and the 8\(^{th}\) December) which coincided with the minimum temperature recorded of -18.7°C as noted above. Flows on SNIP also reached 6.6mscm on the 21\(^{st}\) and 22\(^{nd}\) December.

These four days were the winter peaks of gas demand in NI and are comparable to the previous winter’s peak experienced on the 7\(^{th}\) January 2010 of 6.7 mscm. As around 60 - 75% of NI gas demand on any day is used in electricity generation during winter months it should be noted that the winter peak days experienced in December also coincided with higher than usual dispatch of the two power stations in NI. The combination of cold weather and increased dispatch of these power stations under the SEM contributed to these December peak days.

The NI gas consumption for power demand on the 21\(^{st}\) December 2010 totalled 48,610 MWh. However, this was not the record peak NI gas consumption for power demand. This occurred on the 6\(^{th}\) October 2005 at a peak of 63,153 MWh.

Regarding demands at the distribution level, Phoenix Natural Gas recorded its highest ever daily system demand on 21\(^{st}\) December 2010. Demand on this day was 24.5 GWh and coincided with a 20.4 degree day at Aldergrove Airport. DM consumer demand accounted for 4.5 GWh (20.6%), whilst NDM consumers accounted for 17.3 GWh (79.4%). Firmus energy recorded its peak day demand of 5.477 GWh/d on 22\(^{nd}\) December.

### 3.4.3 Gas Market Response in Ireland, NI and GB

As regards security of supply requirements in the Irish market, domestic (Non Daily Metered) shippers in Ireland are required by means of the Code of Operations to reserve capacity to meet the 1 in 50 peak day demand (the highest demand that can be expected on the coldest day that occurs only once every 50 years). During the cold weather period NDM shippers were forced to call back this spare ‘1 in 50’ exit capacity that had been transferred to other shippers. These other shippers therefore had to reserve short-term daily capacity to replace capacity transfers. Ultimately, the market arrangements worked successfully during this period.
It should also be noted, the actual non power generation gas demand and BGN 1-in-50 non power forecast on the 2010/11 peak day in December 2010 closely agreed, with a slight variance of approximately 5%. Actual power generation gas demand on the peak day was approximately 19% less than the BGN forecast, which can be explained by unexpected outages at two gas fired stations, Whitegate and Tynagh CCGTs.

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

In terms of supplies from GB via the Moffat Entry Point, no difficulties were experienced as regards the sale and transfer of these supplies and as regards the operation of the Irish market. There was sufficient gas available at all times from GB to satisfy demand on the island. National Grid in GB was forced to issue a Gas Balancing Alerts for the 21st of December 2010.

The Gas Balancing Alerts did not indicate an emergency situation. The Alerts rather served as a notification to GB shippers both to bring additional gas supplies on to the GB transmission system and to large energy users to reduce gas demand where possible. The GB gas market responded to these Alerts accordingly and the availability of gas supplies in GB was never brought into question. This was achieved in part by some generators switching from gas-fired to coal-fired power stations, while other producers increased flows into Britain.

3.5 The Irish Gas Demand Forecast

3.5.1 Introduction

A single gas demand forecast was developed for the 2011 JGCS, which includes a combined forecast for both Ireland and Northern Ireland. The methodologies used to develop the relevant components of the demand forecast in this year’s JGCS are consistent with last year’s JGCS, and may be briefly summarised as follows:

- The gas demands for the different sectors of the Irish economy were modelled separately using a combination of historic gas demand information, provided by shippers and other stakeholders, future expectations of economic growth, new housing construction, electricity demand and fuel-prices.
- The future gas demand for NI was derived from information received from the distribution companies, power sector and storage developers, in the questionnaires that the Utility Regulator circulated as part of the 2011 JGCS information gathering process. The questionnaires provided an opportunity for the distribution and power sectors to refine the data that had previously been submitted to the Utility Regulator as part of the 2010/11 postalisation process. The postalised demand figures were reviewed and updated to reflect the distribution companies’ expected connection profiles for the period modelled. Similarly demand forecasts for the power generation sector were reviewed and updated to reflect their latest modelling assumptions.

3.5.2 Irish gas demand forecast methodology

Separate gas demand forecasts have been prepared for the power generation, I/C and residential sectors, since each sector has quite different gas demand drivers. These individual forecasts were then aggregated 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 “merit-order” stack-model to determine how power stations would be dispatched to meet the forecast hourly electricity demand, and to calculate the daily gas demand of the despatched stations;
- The historic weather adjusted I/C demand is assumed to grow (or contract) at 80% of ‘Real’ Gross Domestic Product (GDP)\(^{18}\), i.e. it is assumed to grow or contract in line with economic growth or recession, after adjustment for energy efficiency; and
- The historic weather adjusted residential gas demand is assumed to grow in line with increasing customer numbers, after including adjustments for energy efficiency.

\(^{18}\) See Section 3.5.4 below.
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 RAs and TSOs in each jurisdiction. Many of these inputs were sourced from external sources such as the ESRI and EirGrid.

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

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

### 3.5.3 Power sector demand

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

The latest EirGrid & SONI All-Ireland Generation Capacity Statement, 2011 – 2020 (AGCS) illustrates a further downward revision on the previous year’s Generation Adequacy Report (GAR) forecast as a result of the continued impact of the current economic recession. Peak electricity demand projections are presented in Figure 3-8. EirGrid anticipate that annual electricity demand will not return to 2008 levels until 2013.

Figure 3-8: EirGrid GAR 2010 and 2011 Median Demand Transmission Peak Forecast

The actual ROI electricity transmission peak demand, 5,090 MW, experienced during the severe weather period in December 2010 exceeded the All Island Generation Capacity Statement 2010 transmission peak demand forecast, 4,602 MW, by approximately 10.6%.

The electricity transmission peak demand forecasts published by EirGrid & SONI in the 2011-2020 All Island Generation Capacity Statement are based on a temperature standard known as Average Cold Spell (ACS), which represents an average type winter. Currently, EirGrid and SONI do not publish transmission peak demand forecasts for a severe type winter.

To date previous JGCS publications have adopted the electricity transmission peak demand forecasts published by EirGrid & SONI, for both average winter peak day and 1-in-50 peak day power generation gas demand forecasts.
This Statement adopts the EirGrid & SONI forecast for average year peak day power generation gas demand forecasts only.

The latest EirGrid & SONI AGCS median forecast growth rates were considered to be most appropriate for modelling purposes. Analysis was carried out using both an average and a peak electricity demand requirement. The average electrical demand is in line with the median forecast of the AGCS while the peak forecast allows for the median forecast growth rates to be applied to the actual all island 2010 peak demand figure of 6,955MW. The historic and forecast annual Total Electricity Requirement (TER) is shown in Figure 3-9 together with the corresponding growth rates.

The AGCS Median Case scenario assumes electricity demand will slowly recover to 2008 levels by 2013, with continued growth at c. 1.5% per annum post 2013. The annual Irish TER grew at an average rate of 2.1% p.a. between 2001 and 2009, despite the TER contracting by 4.7% in 2009 (based on EirGrid’s provisional 2009 TER).

The peak all island electrical demand is anticipated to grow from 6,955 MW in 2010/11 to 7,162MW by 2012/13. The growth rates applied are as per the AGCS median case scenario.

The level of future renewable generation construction has also been taken from the latest AGCS, based on the scenario which assumes 40% of electricity will be produced from renewable sources by 2020. This anticipates that the installed wind-powered generation in the Republic of Ireland will increase from 1538 MW in 2010 to c. 4,350 MW by the end of 2020.

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

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

Figure 3-9: Historical and Forecast Irish Annual TER & Electricity Growth Rates

It is assumed that the 500 MW East/West (E/W) electricity interconnector with GB will be fully operational by 2012/13 and will operate with a 450 MW annual average capacity. The assumptions in relation to both the construction of new power stations and the retirement of existing power stations are tabulated in Table 3-7, and may be briefly summarised as follows:

- It is assumed that Endesa will construct both a 420 MW CCGT at Great Island in 2013 and a 430 MW CCGT at Tarbert in 2016, and also retire the existing on-site oil-fired stations once the new gas-fired stations are fully commissioned;
The forecast also includes provision for three new 98 MW OCGTs to provide the necessary flexibility to back-up the additional renewable generation which is forecast to come on line.

In aggregate the JGCS 2011 forecast assumes that 1,144 MW of new gas-fired CCGT and OCGT capacity will be commissioned on the island over the forecast period. This additional generation will be required to meet the future growth in electricity demand, and to replace 1,564 MW of dual and oil-fired capacity (which is expected to retire over the period).

Table 3-7: Summary Assumptions for Build of New Power Stations & Retirement of Old Stations

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Location</th>
<th>Export Capacity (MW)</th>
<th>Start/Close Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEW STATIONS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Great Island</td>
<td>CCGT</td>
<td>Wexford</td>
<td>420</td>
<td>Oct-13</td>
</tr>
<tr>
<td>Tarbert</td>
<td>CCGT</td>
<td>Kerry</td>
<td>430</td>
<td>Oct-16</td>
</tr>
<tr>
<td>Other</td>
<td>OCGT</td>
<td>Westmeath</td>
<td>98</td>
<td>Oct-13</td>
</tr>
<tr>
<td>Other</td>
<td>OCGT</td>
<td>Kilkenny</td>
<td>98</td>
<td>Oct-13</td>
</tr>
<tr>
<td>Other</td>
<td>OCGT</td>
<td>Tipperary</td>
<td>98</td>
<td>Oct-14</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>1,144</td>
<td></td>
</tr>
<tr>
<td>RETIREMENTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ballylumford</td>
<td>Gas</td>
<td>Antrim</td>
<td>510</td>
<td>Dec-15</td>
</tr>
<tr>
<td>Great Island</td>
<td>Oil</td>
<td>Wexford</td>
<td>216</td>
<td>Sep-13</td>
</tr>
<tr>
<td>Marina</td>
<td>Gas</td>
<td>Cork</td>
<td>85</td>
<td>Sep-14</td>
</tr>
<tr>
<td>North Wall 4</td>
<td>Gas</td>
<td>Dublin</td>
<td>163</td>
<td>Sep-10</td>
</tr>
<tr>
<td>Tarbert</td>
<td>Oil</td>
<td>Kerry</td>
<td>590</td>
<td>Dec-15</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>1,564</td>
<td></td>
</tr>
</tbody>
</table>

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

The process in which power stations are stacked in order of increasing SRMC is illustrated in Figure 3-10, 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 JGCS 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 gas fired OCGTs; and
- Followed by oil-fired, i.e. Low Sulphur Fuel Oil (LSFO) power stations;

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

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

Fig. 3-11 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. Peak day demand is based on actual 2010 peak demand combined with EirGrid and SONI electricity demand growth forecasts.

It can also be seen from Fig. 3-11, 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 therefore likely to be offset by reduced gas demand from the older and less efficient gas-fired stations (which will likely be forced further up the generation merit-order and despatched less frequently).

Figure 3-10: All Island Generation price duration curve (2010-2011)

![Graph showing generation price duration curve]

Figure 3-11: Generator Despatch on Peak-day by Fuel-type

![Graph showing generator despatch by fuel type]

The 2011 JGCS forecast annual gas demand of the ROI power sector is presented in Table 3-8 in both energy and volume terms, together with the corresponding forecasts from the 2010 and 2009 JGCS and the 2008 GCS. The historical and forecast annual gas demand of the sector is shown in Fig. 3-12.
Table 3-8: Forecast Annual Gas Demand of Power Sector in Ireland (ROI)

<table>
<thead>
<tr>
<th>Unit</th>
<th>10/11</th>
<th>11/12</th>
<th>12/13</th>
<th>13/14</th>
<th>14/15</th>
<th>15/16</th>
<th>16/17</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JGCS11</td>
<td>39.0</td>
<td>35.4</td>
<td>34.1</td>
<td>35.7</td>
<td>36.5</td>
<td>37.5</td>
<td>40.2</td>
<td>41.8</td>
<td>42.8</td>
<td>43.3</td>
</tr>
<tr>
<td>VOLUME</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JGCS10</td>
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<td>3,274</td>
<td>3,200</td>
<td>3,155</td>
<td>3,389</td>
<td>3,379</td>
<td>3,541</td>
<td>3,573</td>
<td>3,842</td>
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</tr>
<tr>
<td>JGCS09</td>
<td>3,784</td>
<td>4,037</td>
<td>3,861</td>
<td>3,803</td>
<td>3,691</td>
<td>3,624</td>
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<td>GCS08</td>
<td>3,654</td>
<td>3,845</td>
<td>3,826</td>
<td>3,808</td>
<td>3,830</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3-12: Annual Historical and Forecast Gas Demand for the Power Sector

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

As a result of these factors the power sector gas demand is forecast to contract between 2010/11 and 2012/13, however recovery is expected from 2013/14 due to;

- increasing electricity demand;
- commissioning of new more efficient gas fired generation securing a higher merit order ranking;
- increasing carbon prices results in gas fired generation becoming more competitive in the thermal generation mix;
- potential lower electricity imports as a result of anticipated increased BETTA prices in the UK in 2015 and 2016 due to coal plant closures following the implementation of the Large Combustion Plant Directive (LCPD).

Peak day gas demand for the power sector is presented in Table 3-9. 2011/12 peak power sector gas demand is forecast to exceed the 2010/11 peak by 9%. The increase is due to the assumption that strategic gas power stations which were unavailable during the 2010/11 peak demand will be available for future peak demand scenarios. The peak demand is expected to contract in 2012/13 due to the commissioning of the East-West Interconnector but will continue to grow from 2013/14 as presented in Figure 3-13.
3.5.4 Irish Industrial/Commercial gas demand

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

It has been assumed for modelling purposes that the overall I/C annual gas demand will broadly grow (or contract) at 80% of the overall economic growth rate, as measured using ‘Real’ GDP. Real GDP is calculated using constant prices whereas nominal GDP is calculated using current prices.

The underlying GDP projections are shown in Fig. 3-14. However, some of this growth will be offset by increasing energy efficiency measures assumed for the I/C sector as presented in Appendix 5.
The starting point for the GDP forecast was the ESRI Quarterly Economic Commentary (QEC) for Winter 2010, which assumed that the Irish GDP would grow by 0.25% in 2010, 1.5% in 2011 and 2.25% in 2012.

A pragmatic approach was adopted to counter the absence of any updated GDP forecast beyond 2012, following consultation with the ERSI. The forecast assumes strong economic recovery in 2013, when GDP is anticipated to increase to a peak of 5.6 in 2013 and maintain average growth c.5.2% each year up to 2016, and revert to its long-term growth potential of c. 3.0% p.a. from 2016. A high growth forecast was assumed in order to examine the potential demand scenario that would pose the greater impact on the transmission system. The resultant I/C demand forecasts are summarised in Table 3-10, together with the corresponding forecasts published in previous the JGCS and GCS (see also Fig. 3-15).

Table 3-10: Forecast annual gas demand of the Irish I/C sector

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>10/11</th>
<th>11/12</th>
<th>12/13</th>
<th>13/14</th>
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<th>17/18</th>
<th>18/19</th>
<th>19/20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>TWh/y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JGCS11</td>
<td>TWh/y</td>
<td>10.3</td>
<td>10.4</td>
<td>10.8</td>
<td>11.2</td>
<td>11.6</td>
<td>11.8</td>
<td>12.0</td>
<td>12.1</td>
<td>12.3</td>
<td>12.5</td>
</tr>
<tr>
<td>VOLUME</td>
<td>mscm/y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JGCS11</td>
<td>mscm/y</td>
<td>934</td>
<td>947</td>
<td>980</td>
<td>1,041</td>
<td>1,080</td>
<td>1,099</td>
<td>1,106</td>
<td>1,116</td>
<td>1,126</td>
<td>1,139</td>
</tr>
<tr>
<td>JGCS10</td>
<td>mscm/y</td>
<td>929</td>
<td>956</td>
<td>1,014</td>
<td>1,053</td>
<td>1,093</td>
<td>1,094</td>
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<td>1,094</td>
<td>1,096</td>
<td></td>
</tr>
<tr>
<td>JGCS09</td>
<td>mscm/y</td>
<td>972</td>
<td>982</td>
<td>992</td>
<td>997</td>
<td>1,005</td>
<td>1,014</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GCS08</td>
<td>mscm/y</td>
<td>1,066</td>
<td>1,080</td>
<td>1,090</td>
<td>1,099</td>
<td>1,113</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Taking gas demand during winter 2010/11 into account, the annual I/C gas demand is shown as decreasing in 2010/11 due to the economic recession, before beginning to recover in 2011/12. Relatively strong growth is assumed to occur from 2012/13 to 2015/16 based on a higher GDP growth rate. Slower growth is expected from 2015/16 onwards due to an increase in energy efficiency measures and lower economic growth levels.

Most of the I/C energy efficiency savings outlined in the National Energy Efficiency Action Plan (NEEAP) for Ireland are assumed to take place post 2016. The JGCS 2011 assumes annual energy efficiency savings of 33 GWh/y up to 2015/16, and 133GWh/yr from 2015/16 onwards (equivalent to 0.3% and 1.3% respectively of annual I/C gas demand in 2009/10). The analysis assumed that 50% of the energy savings targets outlined in the NEEAP document will be achieved. The assumptions in relation to the I/C energy efficiency savings are explained in more detail in Appendix 5.

The latest JGCS forecast of I/C demand, though lower in the early years than that presented in the previous 2010 JGCS, is more optimistic from 2015/16. This is explained by the fact that the 2010 JGCS anticipated a more rapid rate of economic recovery during the 2012 to 2015 period (c. 5.5%) than is being assumed in the current forecast (c. 5.2%) and the assumption of lower energy efficiency savings.

### 3.5.5 Irish Residential gas demand

The growth in residential gas demand will be impacted by both the number of new residential customers and also the Irish Government’s planned energy efficiency initiatives. The forecast of new residential gas connections is based on ‘New Build’ Housing numbers provided by the ESRI, the Department of the Environment new housing figures, and BGN’s connection figures for 2009 and 2010. There is also an allowance for the number of existing dwellings which are expected to convert to gas for their central heating and ancillary needs over the forecast period.

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19 Statistical analysis undertaken determined that on average 28% of new dwellings will connect to the gas network. It is assumed that 20% of these will be apartments and 80% will be made up of residential houses from 2010/11.
Table 3-11: ‘New Build’ & Existing Housing Connection numbers

<table>
<thead>
<tr>
<th></th>
<th>10/11</th>
<th>11/12</th>
<th>12/13</th>
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<th>14/15</th>
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<th>17/18</th>
<th>18/19</th>
<th>19/20</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Builds</td>
<td>12,651</td>
<td>12,750</td>
<td>14,500</td>
<td>22,500</td>
<td>28,750</td>
<td>30,000</td>
<td>30,000</td>
<td>30,000</td>
<td>30,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Assumed New</td>
<td>2,430</td>
<td>2,948</td>
<td>3,598</td>
<td>6,566</td>
<td>8,884</td>
<td>9,021</td>
<td>8,834</td>
<td>8,647</td>
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<tr>
<td>Existing Houses*</td>
<td>4,054</td>
<td>4,054</td>
<td>4,054</td>
<td>4,054</td>
<td>4,054</td>
<td>4,054</td>
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<tr>
<td>Total New</td>
<td>6,484</td>
<td>7,002</td>
<td>7,652</td>
<td>10,620</td>
<td>12,938</td>
<td>13,262</td>
<td>13,075</td>
<td>12,888</td>
<td>12,701</td>
<td>12,514</td>
</tr>
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</table>

* New housing data based upon ESRI data.

The forecast assumes that the number of residential connections will fall off substantially in 2011, given the current state of the economy and the construction sector in particular. ‘New Build’ residential connections are therefore taken as being 2,948 in 2011/12 before climbing again to 7,710 p.a. by the end of the period.

The incremental demand from each new connection is also expected to reduce over the period due to enhanced building regulations, which are designed to reduce the typical energy consumption of a new home by c. 40% of 2005/06 levels and is assumed to increase to 60% and take effect in 2011/12.

The proposed standards for more efficient boilers, Home Energy Saving Scheme etc are designed to improve the energy efficiency for the existing housing stock. It is estimated these measures could lead to an annual reduction of -0.9% p.a. to the existing residential gas demand. The energy efficiency assumptions made in the JGCS forecast are based on achieving 50% of the NEEAP targets and are described in more detail in Appendix 5.

Due to continued uncertainty surrounding the rollout and implementation of the energy efficiency initiatives for existing housing it is assumed that the efficiency factor of new residential builds will increase from 40% of 2005/06 levels in 2009/10 to 60% in 2011/12. The results indicate that total demand for the island may be circa 0.9GWh/d lower by 2019/20. See Section 3.5.7 for further information on the peak day demand analysis.

The JGCS residential annual demand forecast is summarised in Table 3.12 and illustrated in Fig. 3.16 together with the corresponding JGCS and GCS forecasts from previous years.

Table 3-12: Forecast Annual Gas Demand of the Irish Residential Sector

<table>
<thead>
<tr>
<th></th>
<th>Unit</th>
<th>10/11</th>
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<th>17/18</th>
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<tr>
<td>JGCS 11</td>
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<td>8.0</td>
<td>7.9</td>
<td>7.9</td>
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<tr>
<td>VOLUME</td>
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<td>754</td>
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* These targets are based on requirements of the 2002 and 2010 Building Regulations respectively as noted in the NEEAP. The Gas Year 2012/13 has been used as it is presumed that the energy efficiency gains from the 2010 Building Regulation requirement would not be immediately evident.
The latest JGCS forecast is largely in agreement with that published in the 2010 JGCS, being c. 1.2% higher by 2015/16 than present demand figures. The slight reduction in demand from 2010/11 to 2012/13 can be largely explained by the lower forecast for new residential connections (arising from the ongoing economic recession and the associated slump in new housing construction), and increased savings from energy efficiency measures. The volumetric increase shown in 2014/15 is due to a reduction in the average GCV for 2014/15 and 2015/16 due to the introduction of Corrib gas onto the system. Demand growth is anticipated to remain relatively flat from 2012/13, as increasing energy efficiency is anticipated to offset any demand growth from new connections.

### 3.5.6 Total Irish annual gas demand

The forecast total Irish annual gas demand is summarised in Table 3.13 and illustrated in Fig. 3.17, together with the corresponding forecast published in previous versions of the JGCS. The total Irish annual gas demand is forecast to have decreased by approximately 8% in 2012/13 but is expected to increase at an average rate of 2.6% p.a. over the remaining period.

The latest forecast figures for Ireland used in the JGCS 2011 is largely in line with those presented in the 2010 JGCS until 2014/15 when the JGCS 2011 forecasts a slightly stronger rate of growth. The increase from 2014/15 is being primarily driven by power generation gas demand, with some growth in the I/C sector. Lower electricity imports are assumed from 2014/15 in this year’s statement, as a result of the impact of the LCPD on BETTA prices in GB. In addition to this, this year’s statement assumed only 50% of energy efficiency targets will be achieved in the I/C and residential sectors, giving rise to slightly higher demand, particularly in the I/C sector.

<table>
<thead>
<tr>
<th>Table 3-13: Forecast Total Irish Annual Gas Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit</strong></td>
</tr>
<tr>
<td><strong>ENERGY</strong></td>
</tr>
<tr>
<td>JGCS11 TWh/y</td>
</tr>
<tr>
<td><strong>VOLUME</strong></td>
</tr>
<tr>
<td>JGCS11 mscm/y</td>
</tr>
<tr>
<td>JGCS10 mscm/y</td>
</tr>
<tr>
<td>JGCS09 mscm/y</td>
</tr>
<tr>
<td>GCS08 mscm/y</td>
</tr>
</tbody>
</table>

Joint Gas Capacity Statement 2011
Page 40 of 89
3.5.7 Irish Peak-day gas demand
In addition to the forecast of total Irish annual demand, it is also necessary to produce a forecast of Irish peak-day demand in order to access the adequacy of the Irish transmission system. Two peak days are modelled as part of this process, a 1-in-50 winter peak day representing a severe winter peak day demand and an average year peak day representing an average winter peak day demand.

The Irish peak-day demand forecasts are summarised by sector in Appendix 1, together with the corresponding sources of supply.

3.6 The NI Gas Demand Forecast

3.6.1 NI gas demand forecasting methodology
As discussed previously, information was supplied by the Northern Ireland distribution companies, power stations and storage developers in response to the JGCS questionnaires that were circulated in early 2011. This gave respondents the opportunity to review the future capacity requirements and commodity throughput that had been submitted as part of the 2010/11 postalisation process.

The forecast NI annual demand is summarised is Table 3.14. The forecasts have been taken from information provided to the Utility Regulator by power generation and distribution system shippers in Northern Ireland.

Table 3.14: Forecast NI annual gas demand
Power Generation

Forecast figures were provided by the two gas fired power stations, Ballylumford and Coolkeeragh. The total power generation figures provided in Table 3-14 are the aggregated demand for the two sites. Figures provided were from the generators own demand modelling forecasts based on a number of assumptions: including the power stations’ expected growth rates in electricity demand, the impact of planned generator units and the expected dispatch order under SEM. Forward commodity prices and the influence of other fuel sources were also included in the modelling inputs.

Gas demand within the power generation sector is forecast to remain relatively stable during the period 10/11 until 2015/16. Following this NI is forecast to experience a decrease in gas demand from 2015/16 onwards mainly as a result of the potential closure of units at the Ballylumford Power Station.

Distribution

Forecast figures were provided by the two gas distribution companies, Phoenix Natural Gas Ltd and Firmus Energy Ltd. The total distribution figures provided in Table 3-14 are the aggregated demand forecasts for both distribution companies. Again figures provided for the purposes of the JGCS were based on the distribution companies own modelling forecasts which incorporated the expected growth rates within the domestic and I/C sectors over the 10 years modelled.

Demand in the Northern Ireland distribution market is forecast to grow at an annual rate of 2.8% p.a. over the period modelled. The year-on-year increase reflects the distribution companies’ expected growth rates within the domestic and I/C sectors. Forecast growth rates have also been revised to take into account prevailing economic conditions as well as the effect of energy efficiency measures across the sector.

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

Figure 3-18: Historic and Forecast NI Annual Gas Demand
4 Gas Supplies

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

In the short to medium term, the majority of the island’s demand will continue to be met from GB imports through the Moffat Entry Point. This supply outlook is likely to change significantly from 2013/14 and again from 2015/16 to 2018/19 with a number of new supply projects forecast to be online. These are at various stages of development and include:

- The Corrib gas field off the West Coast is currently being developed by the Corrib Gas Partners (i.e. Shell (Operator), Statoil and Vermillion) and is expected to commence commercial production in the Gas Year 2013/14;
- Islandmagee Storage Ltd. and the North East Storage project partners (BGE and Storengy) are looking into the commercial feasibility of developing salt-cavity gas storage in the Larne area in NI which may come on line 2015/16; and;
- Eirgas Ltd., a subsidiary of Providence Resources PLC, have identified plans to develop a gas storage facility in the Kish Bank Basin, offshore Dublin, which is due commence operation in 2018/19.

These projects have been included to produce the three supply scenarios that have been modelled in the 2011 JGCS and are further detailed below. The Regulatory Authorities have sought not to take a view on the commercial viability of proposed projects. The inclusion of data for certain projects in the JGCS modelling is based on information provided by producers/storage operators and is not intended to refer to the likelihood of these infrastructure projects being progressed.

The specific supply scenarios used in the modelling are outlined in Section 5.2.

4.2 Sources of supply

4.2.1 Indigenous production

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

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

Corrib Gas
The potential main source of future indigenous production is the Corrib gas field, which is currently being developed by the Corrib Gas Partners. Work on construction of the Bellanaboy terminal in Co. Mayo, which will process the gas from the Corrib field is 95% complete. The 83km offshore pipeline was completed in 2009. Laying the umbilical communication line to the offshore gas fields is planned for 2012. The project’s final stage, involves the construction of a circa 8.3 km pipeline between land-fall at Glengad and the gas processing terminal at Bellanaboy. It is expected that construction of the onshore pipeline will take at least 22 months from commencement. First gas from the Corrib field is therefore not expected until Gas Year 2013.
It is anticipated that commercial production of Corrib gas will make a significant contribution to the Irish security of supply situation. Corrib gas is expected to meet 29.6% of the forecast 1 in 50 peak-day demand, and 50.8% of the all island annual demand in 2013/14. Corrib is expected to on average provide 50.5% of all island gas demand over the period 2013/14 to 2015/16.

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

**Potential Gas Supply Sources**

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

Other potential prospects have been identified to the north west of the Corrib gas field, and include the West Dooish and Cashel prospects. The commercial viability of these Celtic Sea and North West coast prospects has yet to be established, however, and they have been omitted from the JGCS forecast for the time being.

Future development of unconventional gas resources may potentially contribute to the indigenous production of natural gas in Ireland. Investigations are presently ongoing to examine the potential development of shale gas resources in the North West region.

The position of all potential gas supply sources will continue to be kept under review in future JGCS publications.

**4.2.2 Gas Storage**

**Kinsale Storage Facility**

The Kinsale storage facility was developed by PSE Kinsale Energy Limited using the depleted Southwest Kinsale gas field. It currently has a working volume of c. 230 mscm (2,415.3 GWh) which is equivalent to about 3.2% of Ireland's annual consumption of gas. It has a maximum withdrawal rate of 2.6 mscm/d (27.3 GWh/d) and a maximum injection rate of 1.7 mscm/d (17.85 GWh/d). It mainly operates as a seasonal storage facility, but can also accommodate within-day gas withdrawals and injections.

The Kinsale storage and production facilities were sold by Marathon Oil Ireland Limited to Petronas in 2009 and Marathon was re-named as PSE Kinsale Energy Limited.

PSE Kinsale Energy Limited has noted that the economic viability of the existing storage facility is linked to that of its gas production operations. The company has informed the CER that, as gas production gradually declines, the existing storage operations will not be economic on a standalone basis. PSE Kinsale Energy has noted that it is likely that the storage operations would cease operation 2 to 3 years prior to the termination of gas production. It is expected that if the expansion to the storage business proceeds, the storage expansion may prolong gas production by a number of years.

For the purpose of modelling in this year's JGCS, following discussions with PSE Kinsale Energy, the RA's have analysed the potential low supply case in relation to the PSE Kinsale Energy Limited. All scenarios modelled in the JGCS 2011 assume the draw down of cushion gas from the wells in the years from 2013 to 2016 at which point operations cease. The supply scenarios used in the 2011 JGCS are detailed in Section 5.2.

PSE Kinsale Energy Limited have informed the CER that the Ballycotton gas storage project detailed in the 2010 JGCS has been put on hold due to engineering difficulties and current economic uncertainty. However, it is currently undertaking engineering studies with a view to expanding its existing Southwest Kinsale gas field storage facility, with a possible completion date of Q3 2013. PSE Kinsale Energy has indicated that the Southwest Kinsale storage expansion could potentially double the storage volume of the existing gas storage facility and increase
injection / withdrawal rates. A new well and injection compressor will be required with the decision to expand the facility being made in Q4 2011. It should be noted that this increased storage capacity at Kinsale has not been modelled in this year’s JGCS but will be taken into account by the RAs in the future.

**Larne Salt-cavity Storage**

Two 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 plan to develop a salt-cavity storage facility underneath Larne Lough, while the North East Storage project is seeking to develop an onshore salt-cavity storage facility near Larne.

Islandmagee Storage Limited is a joint venture between Infrastrata plc and Mutual Energy Limited. Islandmagee Storage Ltd forecast gas operations could commence in 2015. The project consists of a 500 mscm (5,523.6 GWh) working volume, a maximum withdrawal rate of 22.0 mscm/d (243.0 GWh/d) and a maximum injection rate of 12.0 mscm/d (132.6 GWh/d).

Islandmagee completed seismic testing in late 2007, and subsequently submitted a full planning application to the NI authorities in March 2010. The Islandmagee storage developers have indicated 2015/16 as a possible start date for commercial operation.

The North East Storage project, which is a consortium consisting of Bord Gais Energy and Storengy (a GdFSuez company), involves the development of a salt cavern underground gas storage facility to the southwest of Larne. Initial supplies from the facility are estimated as becoming available in 2017. An indicative figure of 300 mscm is being used for working gas capacity for this facility with projected maximum withdrawal rate of 15mscm/d and a maximum injection rate of 7mscm/d.

For the purposes of the 2011 JGCS, a “generic” salt-cavity in the Larne area has been modelled based on a 500 mscm (5,523.6 GWh) working volume, a maximum withdrawal rate of 22.0 mscm/d (243.0 GWh/d) and a maximum injection rate of 12.0 mscm/d (132.6 GWh/d). It should be noted that data associated with Islandmagee has been utilised for modelling purposes merely as it is the larger of the two storage projects at Larne and therefore constitutes the greater stress on the transmission systems in Ireland and Northern Ireland.

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

**Kish Banks Storage**

During early 2011 Eirgas Ltd, a subsidiary of Providence Resources PLC, completed the first phase of a conceptual development study for their salt cavern gas storage project in the Kish Bank Basin, offshore eastern Ireland. The initial phase of this study, carried out by AMEC plc, included a planning review, capacity modelling, infrastructural integration and gas sourcing review for the construction and operation of an offshore natural gas salt cavern storage facility. A number of conceptual scenarios have been developed in the study which have an associated range in capacity, off-take export rates and capital expenditure.

The facility has been examined on the basis of a total working volume of 590mscm (6,522.8 GWh) with a maximum withdrawal and injection rate of 28mscm/d (309.5 GWh/d). For modelling purposes it is assumed that the facility will connect to the gas network at the Gormanston AGI. It is estimated that the facility will be commissioned in December 2017. For the purposes of modelling the facility is assumed to begin supply operations at the start of 2018/19.

**4.2.3 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 connects into the GB National Transmission System (NTS) at the Moffat Entry Point. A second subsea interconnector (IC2) was completed in 2002 to meet the projected increase in demand, and is also used to supply gas to the IOM.
The IC1 system in Scotland is also used to supply gas to NI. The Scotland and Northern Ireland Pipeline (SNIP) subsea interconnector was completed in 1996 and connects into the IC1 system at Twynholm in Scotland. The SNIP currently supplies all of NI demand and is also used to supply gas to the town of Stranraer in Scotland which has a relatively small demand.

The first GB gas imports through the IC system in 1995 (IC1) were quite small, however they increased rapidly over time and accounted for c. 94.7% of total Irish annual demand in 2009/10 (IC1 & IC2). The historical breakdown of indigenous production and GB gas imports is given in Table 4.1 (for both Ireland and Northern Ireland).

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

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ENERGY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inch</td>
<td>GWh/y</td>
<td>6,637</td>
<td>9,705</td>
<td>6,397</td>
<td>5,451</td>
<td>4,976</td>
<td>4,772</td>
<td>4,259</td>
</tr>
<tr>
<td>Moffat*</td>
<td>GWh/y</td>
<td>53,221</td>
<td>51,982</td>
<td>56,890</td>
<td>64,023</td>
<td>69,236</td>
<td>72,645</td>
<td>70,446</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>GWh/y</td>
<td>59,858</td>
<td>61,687</td>
<td>63,287</td>
<td>69,474</td>
<td>74,212</td>
<td>77,417</td>
<td>74,705</td>
</tr>
<tr>
<td><strong>VOLUME</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inch</td>
<td>mscm/y</td>
<td>637</td>
<td>932</td>
<td>614</td>
<td>523</td>
<td>478</td>
<td>455</td>
<td>404</td>
</tr>
<tr>
<td>Moffat*</td>
<td>mscm/y</td>
<td>4,790</td>
<td>4,678</td>
<td>5,120</td>
<td>5,762</td>
<td>6,231</td>
<td>6,589</td>
<td>6,365</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>mscm/y</td>
<td>5,427</td>
<td>5,610</td>
<td>5,734</td>
<td>6,285</td>
<td>6,709</td>
<td>7,046</td>
<td>6,769</td>
</tr>
</tbody>
</table>

1Includes Irish, NI and IOM gas demand plus any Inch Exit to refill Kinsale Storage
2Volumes are derived from energy values by assuming a GCV of 40 MJ/m³ & 37.5 MJ/m³ for 2002/03 to 2006/07, 39.7 MJ/m³ & 37.8 MJ/m³ for 2007/08, 39.8 MJ/m³ & 37.9 MJ/m³ for 2008/09 &09/10, for Moffat and Inch respectively

Figure 4-2: Historical All-island Sources of Supply
5 Network Analysis

5.1 Introduction
As detailed in Chapter 4 of the JGCS, the timing of certain proposed supply projects remains uncertain. In particular, there is the potential for flows from Inch to cease in the medium term. Based on discussions with PSE Kinsale Energy, this year’s Joint Gas Capacity Statement therefore includes the potential outcome of the existing Inch storage operations ceasing in 2012/13 with Inch supply comprising of production and cushion gas from 2013/14 until 2015/16 when operations are taken as ceasing.

It is recognised that the continuation of Inch supply post 2015/16 is dependent on further developments in the Celtic Sea and as noted previously, the RA’s are mindful that there is the potential for gas storage at Inch to be significantly enhanced.

The Corrib field is the only new supply source expected to flow in the medium term, with first commercial gas supplies expected in 2013. It is expected that Corrib will meet approximately 33% of the Island’s peak day gas demand in the early years. However, flows are projected to decline relatively quickly and it is expected to meet approximately 13% of the Island’s peak day gas demand in 2019/20.

The RA’s are also mindful that the proposed Shannon LNG facility would have a significant effect on flows on the island and indeed has the potential to significantly contribute towards security of gas supply on the Island. Following discussions with Shannon LNG, flows from the facility have not been modelled in the 2011 JGCS. It should be noted that the effect of supplies from Shannon LNG has previously been modelled in detail in previous Joint Gas Capacity Statements. Flows from Shannon LNG will continue to be kept under review for future Statements.

Both Larne storage developers are progressing their respective projects and anticipate commercial operation in the next 4 to 5 years. Eirgas Ltd, a subsidiary of Providence Resources PLC, are also investigating the possibility of developing a gas storage facility in the Kish Bank Basin, off the coast of Dublin, and have indicated the possibility of commercial operation from 2018/19.

As per previous Statements, given that these storage projects are at various stages of feasibility studies and/or planning, flows and commencement dates provided by the respective developers are not interpreted as confirmed/definitive but are taken as indicative for the purpose of the network modelling.

This Chapter also addresses the assumptions and conditions that affect the capacity of the Moffat Entry Point, and the ability of the South West Scotland On-shore System (SWSOS) system to transport the required supplies from Moffat to the IC subsea system.

5.2 JGCS 2011 Supply Scenarios
The 2011 JGCS diverges from the analysis undertaken in previous years in terms of the principal supply sources under consideration. The scenarios in this year’s Statement are more limited in terms of the flows taken as being available from the Inch Entry Point. For the three supply scenarios in the 2011 JGCS, following discussions with PSE Kinsale Energy, the final injections to the existing Inch storage facility are assumed to take place in the summer 2012, i.e. May to September 2012, and withdrawal of this injection gas is assumed during the 2012/13 winter, i.e. October 2012 to March 2013. Inch supply post March 2013 is assumed to be a combination of cushion gas and production gas, until final cessation of supply in 2016.

The three scenarios include flows from Corrib as commencing in 2013/14 (and a 1 year delay to the project to 2014/15 is examined). The balance of supply is taken as being met by GB imports at the Moffat Entry Point. Consequently, for the early and later years of the forecast period, Moffat will be required to supply significant volumes of gas to the Island.

In addition to a base case scenario, two additional supply scenarios were also included to analyse the impact of the proposed Larne and Kish Bank storage projects. The three supply scenarios included in the analysis are summarised in Table 5 - 1.
Table 5-1: Summary of Supply Scenarios

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Inch</td>
<td>Ceases in September 2016</td>
<td>Ceases in September 2016</td>
<td>Ceases in September 2016</td>
</tr>
<tr>
<td>Corrib</td>
<td>Start October 2013²</td>
<td>Start October 2013⁴</td>
<td>Start October 2013³</td>
</tr>
<tr>
<td>Larne Storage</td>
<td>Unavailable</td>
<td>Start October 2015⁴</td>
<td>Unavailable</td>
</tr>
<tr>
<td>Kish Bank Storage</td>
<td>Unavailable</td>
<td>Unavailable</td>
<td>Start October 2018⁴</td>
</tr>
</tbody>
</table>

¹ Modelling of flows Inch from involves the facility operating as a storage reservoir until 2012/13 after which the cushion gas is produced and the facilities decommissioned in 2015/2016
² Base case modelling also includes a sensitivity for a 1 year delay to Corrib (Oct’ 2014)
³ Larne injections are assumed to commence in 2015/16
⁴ Kish Bank injections are assumed to commence in 2018/19

The CER and the Utility Regulator have engaged with developers in Ireland and Northern Ireland on the status of various gas supply projects. Where sufficient information is available, potential supply sources have been modelled with the permission of the relevant developers. The Regulatory Authorities have sought not to take a view on the commercial viability of proposed projects. The inclusion of data for such projects in the JGCS modelling is based on information provided by producers/storage operators and is not intended to refer to the likelihood of these infrastructure projects being progressed.

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

Table 5-2: Summary of Supply Source Dispatch Order for each Scenario

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inch &amp; Corrib Production</td>
<td>Inch &amp; Corrib Production</td>
<td>Inch &amp; Corrib Production</td>
</tr>
<tr>
<td>2</td>
<td>Inch Existing Storage</td>
<td>Inch Existing Storage</td>
<td>Inch Existing Storage</td>
</tr>
<tr>
<td>3</td>
<td>Moffat</td>
<td>Larne Storage</td>
<td>Kish Bank Storage</td>
</tr>
<tr>
<td>4</td>
<td>n/a</td>
<td>Moffat</td>
<td>Moffat</td>
</tr>
</tbody>
</table>

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 dispatched will be determined by shipper nominations and the commercial arrangements between shippers, transporters and producers/suppliers at the various Entry Points.

5.3 Transmission network capacity modelling

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

In order to assess the system on days of different demand pattern three demand type days were analysed for each supply scenario over a 10 year period from 2010/11 – 2019/20 inclusive:

- 1-in-50 year winter peak day
• Average year winter peak day
• Average year summer minimum

These demand days, which are generated from BGN’s gas demand forecast, have been chosen as they represent the maximum and minimum flow conditions on the transmission system. In addition to this, these demand type days represent the best case scenario regarding maximum possible withdrawal rates on peak days and maximum possible injection rates on summer minimum days, assuming the various proposed storage facilities included in the analysis operate on a seasonal basis, i.e. injecting gas during the summer months and withdrawing gas during the winter months. Modelling was carried out using “PipelineStudio®”, simulation software which was configured to analyse the transient 24 hour demand cycle over a minimum period of three days to obtain consistent steady results (see Appendix 2 for more details of the network analysis modelling).

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

- Maintaining the specified minimum and maximum operating pressures at key points on the transmission systems, including:
  - Minimum of 55 barg at the Dublin City gates;
  - Minimum of 45 barg at Ballyveelish (for Waterford area)
  - Minimum of 40 barg north of Midleton compressor station;
  - Minimum of 30 barg at Coolkeeragh (Derry – Londonderry);
  - Minimum of 35 barg on the South North Pipeline (SNP);
  - Minimum of 56 barg at the inlet to Twynholm; and
  - Not to exceed the Maximum Operating Pressure (MOP) of the onshore transmission systems, currently 70 barg in Ireland and 75 barg in NI;
- Ensuring gas velocities do not exceed their design range of 10 – 12 m/s; and
- Operating the compressor stations within their performance envelopes.

5.4 Transmission System Configuration

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

The potential system configurations at the Gormanston AGI, referred to as ‘CAG Open’ and ‘CAG Closed’, are detailed in Appendix 3.

BGN have noted that the necessary operational requirements to facilitate flows between the two jurisdictions (CAG Open Configuration) would involve system modifications, particularly at the Gormanston AGI. The inclusion of additional metering, flow control and pressure control equipment would, in particular, be required. Modifications may also be required at Twynholm, Carrickfergus Ballanabanagh and Brighouse Bay.
5.5 Entry Point Assumptions

The main Entry Point assumptions in terms of gas pressures, Gross Calorific Value (GCV) and flow profiles are summarised in Table 5-3, which shows both the contractual minimum pressure and the pressure assumed for network analysis.

Table 5-3: Summary of Main Entry Point Assumptions

<table>
<thead>
<tr>
<th>PRESSURE</th>
<th>Unit</th>
<th>Moffat</th>
<th>Inch</th>
<th>Corrib</th>
<th>Larne</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractual</td>
<td>barg</td>
<td>42.5</td>
<td>30.0</td>
<td>Up to 85</td>
<td>N/A</td>
</tr>
<tr>
<td>Assumed</td>
<td>barg</td>
<td>47.0/55.0</td>
<td>30.0</td>
<td>Up to 85</td>
<td>Up to MOP¹</td>
</tr>
<tr>
<td>OTHER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GCV</td>
<td>MJ/m³</td>
<td>39.77</td>
<td>37.80</td>
<td>37.90</td>
<td>39.77</td>
</tr>
<tr>
<td>Flow profile²</td>
<td>Flat</td>
<td>Flat</td>
<td>Flat</td>
<td>Flat</td>
<td></td>
</tr>
<tr>
<td>Max Supply³</td>
<td>mscmd</td>
<td>32.0</td>
<td>3.34</td>
<td>10.0</td>
<td>22.0</td>
</tr>
</tbody>
</table>

¹MOP=Maximum Operating Pressure (MOP) of the Pipeline
²Flat flow profile assumes that the hourly delivery of the Entry Point = 1/24th of the daily delivery
³The maximum capacity for each supply source over the forecast period. Maximum supplies may not coincide.

Currently, under the Inch Connected Systems Agreement (CSA), PSE Kinsale Energy is required to provide a minimum pressure of 30 barg at Inch.

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

The SNIP and SNP currently have an MOP of 75 barg, but it is assumed that the SNIP and SNP MOPs could be upgraded to 85 barg coincident with the availability of Larne Storage. While there are currently no contractual arrangements in place with either of the proposed Larne gas storage projects, it is assumed that they will be able to deliver gas at 85 barg.

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

Both the Larne and Kish Bank Storage facilities are assumed to operate as seasonal gas storage facilities i.e. withdraw gas from storage during the winter period and inject gas into storage during the summer period.

5.5.1 Moffat Pressures & Flow Profile

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

To date a 1-in-50 peak day peak day source pressure of 47.0 barg has been assumed for network modelling purposes. This assumption was validated by actual pressures on the peak days that occurred in early January 2010, when hourly pressures at Moffat ranged between 50.0 and 56.7 barg, averaging at 54.4 barg for the day.
However, during December 2010 and January 2011, average daily pressures at Moffat approached the ANOP pressure of 47.0 barg on a number of occasions.

Gaslink are currently engaging with National Grid regarding the contractual and ANOP pressures at Moffat. Taking these discussions into account, it may be prudent to consider scenarios in future network modelling that adopt a pressure of less than 47 barg or adopt the contractual minimum pressure at Moffat of 42.5 barg.

Also, the assumption regarding the flat flow profiles assumed at Moffat may need to be revised in future network modelling to reflect the actual flow profiles that occurred on the record peak days during the severe weather periods in 2010.

5.6 Twynholm & Scotland Northern Ireland Pipeline

PTL currently has a contractual entitlement to 8.08 mscmd (89.3 GWh/d) of capacity and a minimum pressure of 56 barg at Twynholm. The design capacity of Twynholm is 8.64 mscmd. Network models restrict flows through Twynholm in accordance with these limits. Network modelling assumes Twynholm operates under flow control and therefore, the gas entering SNIP would follow a flat flow profile. SNIP is taken to have a design of pressure of 75 barg, but assumed SNIP MOP could be upgraded to 85 barg coincident with the availability of Larne storage.

A number of sensitivity runs were carried out in order to establish whether the network can accommodate the larger withdrawal and injection rates proposed at Larne in the latter years under review. For these model runs network analysis assumes Twynholm AGI is upgraded to provide the capability to operate in reverse mode and any capacity restrictions at the AGI would be removed. However, these results are subject to further investigations of the South West Scotland On-shore System (SWSOS), under such a configuration.

5.7 Entry Point Technical Capacities

5.7.1 Inch Entry Point

The technical capacity of the Inch entry point is determined by the capacity of the Midleton compressor station and the gas demand of the Cork area (upstream of Midleton compressor station).

Midleton compressor station currently has a capacity of 63 GWh/d (6.0 mscmd), based on two compressors running and one compressor being operated in standby mode.

5.7.2 Minimum flows through Midleton Compressor Station

The level of Celtic Sea production gas has been declining in recent years and may fall below the minimum design-flow criteria of Midleton compressor units in certain scenarios. PSE Kinsale Energy and Gaslink may need to investigate potential solutions to address the low flows with respect to the minimum design-flow criteria.

Similarly, in the event of existing Celtic Sea assets ceasing operation in the future, PSE Kinsale Energy and Gaslink would need to investigate any potential issues which may arise with low gas flows during the decommissioning phase, when the cushion gas would be withdrawn from the storage facility.

It is also envisaged that in such a scenario the Inch connection agreement would be reviewed and amended as necessary.

5.7.3 Moffat Entry Point

The technical capacity of the Moffat Entry Point is essentially determined by the physical capacity of the SWSOS, which includes Beattock and Brighouse Bay compressor stations, the onshore Scotland BGE transmission network and the sub-sea interconnectors. The capacity of a compressor station is defined as a function of the gas inlet conditions and the ability of the compressor component parts to meet specific output conditions. The parameters of this function include:

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

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

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

- An inlet pressure of 47 barg at the compressor station, based on the National Grid ANOP of 47.0 barg for the Moffat Entry point;
- A discharge pressure of 85 barg to ensure that the contractual minimum pressure of 56 barg is maintained at Twynholm;
- A gas inlet temperature of 15 °C, and a gas molecular weight of 18.3; and
- Three compressor units operating in “series-mode” configuration, with the fourth unit operating in stand-by mode.

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

- The above capacity is significantly higher than the original design capacity of the station, namely 287 GWh/d (26.0 mscmd). Ongoing analysis of the subsystems is being progressed to verify that they are capable of meeting these flows (i.e. station pipe-work, meters, filters and after-coolers etc); and
- The capacity of the station is sensitive to the assumed station inlet pressure. If the minimum contractual pressure under the Pressure Maintenance Agreement of 42.5 barg is assumed, then the theoretical maximum capacity of the station in series mode reduces to 302 GWh/d (27.4 mscmd). The capacity is also sensitive to the gas temperature assumptions (see above).

5.7.3.2 Beattock compressor station - mode of operation
Currently Beattock compressor station can only operate in parallel mode. There are a number of operational considerations that arise if the station is operating in series mode at higher flows. Engineering works are currently progressing to address these issues at Beattock, which should allow for further operation in series mode.

However, it is unlikely that this work will be completed in advance of winter 2011/12, due to the complexity of the engineering works being currently progressed, and it is likely the station will continue to operate in parallel mode until mid 2012.
5.7.3.3 Brighouse Bay compressor station capacity

The main driver of the Brighouse Bay capacity is the available pressure at the station inlet. If it is assumed that Beattock is flowing 32 mscmd and discharging at 85 barg then the available pressure at the Brighouse Bay inlet will be approximately 60 barg.

The maximum theoretical capacity of Brighouse Bay has been assessed at 298 GWh/d (27 mscmd) based on a station inlet pressure of 60 barg and a discharge pressure of 120 barg (to give a compression ratio of 2.0). This figure is significantly higher than the original design capacity of the station, namely 201 GWh/d (18.2 mscmd).

Ongoing analysis of the subsystems is being progressed to verify that they are capable of meeting these flows (i.e. station pipe-work, meters, filters and after-coolers etc)

Note the maximum theoretical capacity, 298 GWh/d (27 mscmd) is stand alone capacity based on these pressure assumptions and does not take supply to Northern Ireland into consideration. Assuming the capacity of Beattock is 32 mscmd, and allowing the contractual 8.08 mscmd for Northern Ireland at Twynholm, leaves c. 23.9 mscmd of capacity available at Brighouse Bay Compressor Station.

5.8 Network Modelling Results

5.8.1 Summary of Overall Modelling Results

Based on the 1-in-50 winter peak day forecasts carried out by BGN, the results of the 2011 JGCS indicate that measures would need to be taken to ensure that flows can meet all-island demand for 2015/16 if flows from Inch decline and cease in 2015/16 and if there is any further delay to the Corrib project. The modelling results carried out by BGN also show that measures would be needed for 2019/20 in the event of Corrib proceeding in 2013/14 taking into account Corrib’s flow profile. Furthermore, BGN have noted that in the event that primary assumptions, such as ANOP pressure of 47.0 barg at Beattock and a flat flow profile at Moffat were not to hold true as part of their forecasts, the required limits at Beattock could be shown as being breached by 2013/14. These potential constraints are present in all of the supply scenarios modelled in the JGCS.

It should also be noted that, while the capacity of the SWSOS is not expected to be breached on the 1-in-50 year peak days for the forthcoming winters, BGN’s modelling indicates that the capacity limit is expected to be almost reached. The following table summarises the level of SWSOS capacity utilised if the Corrib project is delayed until 2015/16 onwards and if flows from Inch do not continue past 2015/16.

Table 5-4: SWSOS Capacity utilisation on 1-in-50 year peak days

<table>
<thead>
<tr>
<th>Year</th>
<th>Projected 1-in-50 Peak Day Moffat Supplya</th>
<th>SWSOS capacityb</th>
<th>SWSOS capacity utilisedc</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GWh/d</td>
<td>GWh/d</td>
<td>%</td>
</tr>
<tr>
<td>2010/11</td>
<td>303.9</td>
<td>353.0</td>
<td>86%</td>
</tr>
<tr>
<td>2011/12</td>
<td>332.4</td>
<td>353.0</td>
<td>94%</td>
</tr>
<tr>
<td>2012/13</td>
<td>315.3</td>
<td>353.0</td>
<td>89%</td>
</tr>
<tr>
<td>2013/14</td>
<td>337.4</td>
<td>353.0</td>
<td>96%</td>
</tr>
<tr>
<td>2014/15</td>
<td>344.5</td>
<td>353.0</td>
<td>98%</td>
</tr>
<tr>
<td>2015/16</td>
<td>369.0</td>
<td>353.0</td>
<td>104%</td>
</tr>
</tbody>
</table>

1 Actual peak flow in Winter 2010. If Inch was unavailable 96% of capacity would have been utilised.
2 Based on All Island peak day demand less Inch supply.
3 This is subject to flat flow profile.
4 The SWSOS capacity is currently determined by the theoretical maximum capacity of Beattock compressor station, 353 GWh/d
5 2012/13 – Flows through Moffat reduce in 2012/13, due to a fall off in power generation gas demand, resulting from the East/West interconnector commencing operation.
6 2013/14 – Flows through Moffat increase in 2013/14 primarily due to the reduction in Inch supply, and a 2% increase in the Island’s gas demand.
BGN have noted that based on current market arrangements, operating the system with very little spare capacity as noted in Table 5-4 may provide little or no operational flexibility and a significant challenge in the event of an unexpected supply or demand event, e.g. higher demand than forecast due to colder weather, lower pressures at Moffat or a supply outage.

As outlined in the section 5.7, SWSOS capacity is subject to the capacity of Beattock compressor station. The capacity of Beattock compressor station, 353 GWh/d (32.0 mscmd) is based on the ANOP pressure of 47.0 barg. If pressures closer to the contractual pressure are assumed for the winter peak day, BGN have noted that, in their view, this would accelerate the need to twin the 50 km pipeline between Cluden and Brighouse Bay in order to address this potential constraint (see below).

In addition to the above, the assumption of a flat flow profile is currently being reviewed by BGN as a result of the actual flow profiles observed at Moffat during the peak demand periods experienced in 2010. The actual flow profiles observed at Moffat represent a stepped/swing type flow profile rather than a flat flow profile.

The swing/stepped flow profiles which actually occur result in SWSOS pipeline pressures fluctuating in line with hourly flow variations. During periods of high flows, pressures in the SWSOS will fall. This could lead to minimum pressure requirements at Brighouse Bay and Twynholm being violated.

The network modelling undertaken for this Statement did not incorporate the most recent flow profiles that reflect current market arrangements at the Moffat Entry Point, i.e. renominations and non-uniform flow rates. Based on the existing supply scenarios, BGN’s modelling has demonstrated that the inclusion of up to date flow profiles, i.e. adopting a swing/stepped profile, for the 1-in-50 winter peak day modelling would show a breach of capacity at Beattock by 2013/14.

BGN have indicated that by twinning the 50 km Cluden to Brighouse Bay 85 barg pipeline the pressure losses in the SWSOS between Beattock and Brighouse Bay would be reduced and the required discharge pressure at Beattock by 2013/14.

Other key observations from the results of the JGCS 2011 are as follows;

- If high flows through the SWSOS are coincidental with peak hourly demands in NI, it is possible minimum pressure violations in the NI transmission system may occur.
- CAG Open Configuration (see Appendix 3) may be feasible on certain demand type days and years under all the supply scenarios, but is very sensitive to demand, supply and pressure conditions. Compression facilities on the SNP north of Gormanston would greatly enhance the flow capacity between the two jurisdictions (see 5.8.2 below).
- Significant levels of gas withdrawal and injection can be accommodated for the proposed storage facilities at Larne and at the Kish Bank Basin, however it is not possible to accommodate the proposed maximum withdrawal and injection rates based on existing minimum system pressure Requirements.

5.8.2 All-Island Transmission Network Operation

The volume of gas that can be transported between the two jurisdictions via the SNP is subject to prevailing pressures at the northern and southern end of the pipeline. The prevailing pressure is a function of both local supply and local demand conditions.

Assuming the necessary operational and commercial requirements are in place and both the SNIP and SNP pipelines are up-rated to 85 barg, network analysis undertaken by BGN determined CAG Open Configuration may be feasible for certain years in all supply scenarios;

- Transporting surplus ROI gas supply to NI via the SNP. This can be achieved on certain summer min days, when Corrib supply exceeds ROI demand, and on winter peak days when supplies from Kish Bank Storage exceed ROI demand.
- Transporting surplus NI gas supply to ROI via the SNP and/or SNIP, Twynholm and the ICs.
Routing Moffat gas for the ROI through Twynholm, SNIP and SNP

It should be noted that the necessary operational requirements to facilitate flows between the two jurisdictions (CAG Open Configuration) would involve system modifications, particularly at the Gormanston AGI. The inclusion of additional metering, flow control and pressure control equipment would, in particular, be required. Modifications may also be required at Twynholm, Carrickfergus Ballanabanagh and Brighouse Bay.

Detailed engineering studies will be required to determine the optimal solution and the costs associated with completing these works. Further studies will also be required to determine if any other locations on the network require modifications to fulfill the operational requirements for a single all Island network under a CAG regime.

5.8.2.1 SNP Flow
Corrib supply exceeds ROI demand on the summer minimum days for the first three years of Corrib production. Modelling indicates that on occasion it may be possible to supply the excess Corrib gas to NI via the SNP, subject to the pressure at Twynholm. The excess Corrib gas is forecast to be less than 1 mscmd annually for the 1st two years of Corrib production, i.e. 2013/14 and 2014/15.

The modelling undertaken for the Kish Bank scenario indicates up to 5.0 mscmd of storage from the Kish Bank gas can be transported to NI via the SNP, depending on demand conditions.

Network modelling indicates up to 3.9 mscmd of Larne gas can be transported to the ROI via the SNP, depending on demand conditions.

All such flow scenarios are dependent on appropriate supply pressures being made available, suitable network conditions and the appropriate system modifications being in place.

5.8.2.2 SNIP/Twynholm reverse flow
The volume of NI gas that can be transported to ROI via the SNIP, Twynholm and the ICs is subject to operating conditions at Beattock, capacity limits at Twynholm and minimum pressure requirements at Brighouse Bay. BGN's modelling indicates up to 9.5 mscmd of Larne gas could potentially be transported to ROI via the SNP, Twynholm and the ICs. Section 5.8.4.3 discusses the SNIP reverse flows in more detail.

It should be emphasised, operating the SWSOS and IC system at lower pressures, in order to facilitate the SNIP reverse flow, results in lower levels of interconnector linepack consequently reducing the security of supply of the system. Further detailed studies would be required in order to determine the viability of such a configuration.

Also, it is worth noting that there can be a large daily variation in gas inlet pressures from Moffat and consequently daily variation of gas pressures in the Beattock to Brighouse Bay pipeline. This can impact on the volume of reverse flows through the SNIP.

5.8.2.3 ROI flows from Moffat via the SNIP
The following observations were noted in the modelling results when routing Moffat gas for the ROI through Twynholm, SNIP and the SNP;

- No scope for CAG Open Configuration on 1-in-50 winter peak days in the Base scenario. Higher flows in Scotland result in lower pressures at Twynholm. Consequently pressures in the SNP at Gormanston are lower than the ROI. Operating in a CAG Open Configuration would result in pressures reducing in the ROI on-shore system, potentially breaching minimum pressure limits.
- There is limited scope for CAG Open Configuration on average winter peak days for years 2013/14 to 2015/16 in the Base scenario. However, operating in a CAG Open configuration requires that pressures in the ROI ring-main are lowered so that minimum pressures are encountered. Operating the system at minimum pressure limits may prove to be a challenging mode of operation.

The addition of compression facilities on the SNP, north of Gormanston, would greatly enhance flow capacity between the two jurisdictions for all scenarios outlined below.
5.8.2.4 Minimum flows through the SWSOS and ICs

The demand and supply balances indicate that there may be occasions when there are low levels of gas required from the Moffat Entry point, particularly in the years when Corrib peak production coincides with summer minimum demand days.

These low flows may fall below the minimum design-flow criteria of Beattock and Brighouse Bay compressor stations in Scotland, and Gormanston and Loughshinny AGIs in Ireland.

Gaslink and BGN are currently undertaking analysis to determine the frequency and extent of the low flows and will subsequently investigate potential solutions to accommodate the potential low flows that may arise.

5.8.3 Base Case Supply Scenario

The following graph illustrates the significant levels of GB imports supplied via the Moffat entry point for the years preceding Corrib and the years proceeding peak Corrib production.

Figure 5-1: 1-in-50 Peak-day demand and Base supply

5.8.3.1 Flows at Moffat Before Corrib Commencement

Based on 1-in-50 winter peak day forecasts carried out by BGN, c. 94% and 89% of Beattock capacity may be utilised in winter 2011/12 and winter 2012/13 respectively. The fall-off from 94% to 89% can be explained by lower gas demand in 2012/13, due to the expected availability of the East/West electricity interconnector, resulting in higher electricity imports and consequently lower power generation gas demand.

If Corrib is delayed by 1 year to 2014/15, BGN’s network modelling indicates that 96% of Beattock capacity may be utilised. The results also indicate that further delays to the Corrib project past 2014/15 combined with flows from Inch ceasing in 2015/16 would result in Beattock capacity limits being almost reached in 2014/15 and limits being breached in 2015/16.

BGN have emphasised that, though the Moffat flows are within capacity limits of Beattock compressor station for the years outlined above, this is subject to certain assumed conditions; a constant inlet pressure and a flat flow profile. Departures from these conditions may lead to possible violations of the required limits and consequently the potential need to address such potential constraints by 2013/14.

5.8.3.2 After Corrib peak production

Corrib is expected to meet approximately 33% of the Island’s peak day gas demand in the early years. However, the Corrib flow profile is forecast to decline relatively quickly, when it is expected to meet approximately 13% of the Island’s peak day gas demand in 2019/20.

In the final years of the forecasting period, the island would revert to importing significant volume of GB gas via the Moffat entry point. Based on 1-in-50 winter peak day forecasts and assuming Corrib production from 2013/14,
BGN’s network modelling indicates that c. 91% and 97% of Beattock capacity would be utilised in winter 2017/18 and winter 2018/19 respectively.

Capacity limits at Beattock are also forecast to be breached in 2019/20 based on the Corrib flow profile. A one year delay to Corrib will postpone this constraint by 1 year (albeit adding to a potential constraint in 2013/14).

5.8.4 Larne Supply Scenario

The following table summarises the volume of gas that can be withdrawn from Larne storage on both 1-in-50 peak days and average winter peak days:

<table>
<thead>
<tr>
<th>Year</th>
<th>1-in-50 Winter Peak Day</th>
<th>Average Winter Peak Day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mscmd</td>
<td>mscmd</td>
</tr>
<tr>
<td>2015/16</td>
<td>5.99</td>
<td>5.99</td>
</tr>
<tr>
<td>2016/17</td>
<td>10.00</td>
<td>10.00</td>
</tr>
<tr>
<td>2017/18</td>
<td>19.16</td>
<td>18.59</td>
</tr>
<tr>
<td>2018/19</td>
<td>19.25</td>
<td>18.66</td>
</tr>
<tr>
<td>2019/20</td>
<td>19.34</td>
<td>18.73</td>
</tr>
</tbody>
</table>

The above results are subject to the capacity limits at Tywnholm and the ability to reverse flow Larne gas via the SNIP and ICs to ROI.

The volume of gas that can be supplied from Larne storage is determined by the following:

- NI demand; and
- The volume of gas that can be transported to the ROI via the SNP; and
- The volume of gas that can be transported to the ROI via reverse flow through the SNIP, Tywnhom and the ICs.

It has been assumed that the SNIP MOP would be upgraded to 85 barg coincident with the availability of Larne storage.

5.8.4.1 NI Demand

NI forecast demands are lower than previous years;

- The proposed Kilroot CCGT is not assumed in new power station builds for this year’s JGCS.
- NI power generation gas demand forecasts for existing power generation have been revised downwards on forecasts provided for previous Statements

5.8.4.2 Flows via the SNP

The volume of gas that can be to be transported to the ROI via the SNP is dependent on the capacity of the SNP. The capacity of the SNP is determined by;

- The pressure available at Larne; and
- The pressure in the north Dublin area (Gormanston)

The pressure available at Larne is assumed to be up to 85 barg. Modelling indicates pressures vary between between 77 barg and 85 barg in line with the demand diurnal profile, i.e. lower pressures during periods of high demand and higher pressures during periods of low demand.

There is a minimum pressure requirement of 55 barg at Dublin City gates (Abbotstown and Brownsbarn). The pressures at Gormanston recorded in the network modelling ranged from c. 62 barg to 69 barg.

The pressure at Gormanston is determined by the discharge pressure from the ICs. This pressure is set to ensure minimum pressure requirements are not breached on the ROI system.

In summary, the higher the pressure at the source (Larne) and the lower the pressure requirement at the end of the pipeline (Gormanston), the greater the capacity of the pipeline.
Modelling indicates flows through the SNP, range from c. 2.8 mscmd to 3.9 mscmd, with higher flows possible on average winter peak days, than 1-in-50 peak days.

5.8.4.3 Flows via the SNIP, Twynholm and ICs
The volume of gas that can be transported to ROI via the SNIP, Tywnhol and the IC is subject to:

- Twynholm capacity; and
- Operating conditions at Beattock compressor station; and
- Minimum pressure requirement at the inlet of Brighouse Bay compressor station of 52 barg.

The design capacity of Tywnholm is 8.64 mscmd, however current capacity is limited by the contractual capacity of 8.08 mscmd.

Also, Twynholm is designed to flow gas east to west, i.e. from the SWSOS into the SNIP. On this basis, modifications may be required at Twynholm to facilitate reverse flows, from west to east, i.e. the SNIP into the SWSOS.

Modelling indicates by removing the capacity restrictions at Twynholm and maintaining a minimum of 52 barg at Brighouse Bay, flows may increase by 0.5 mscmd to 1 mscmd, depending on flows through the SWSOS. Twynholm AGI is assumed to have been bypassed in this instance. The minimum pressure requirement at Brighouse Bay, 52.0 barg, is based on the stations minimum design pressure.

Higher flows through the SWSOS imply higher pressure losses on the system, resulting in lower pressures at Brighouse Bay. Consequently, higher reverse flows through the SNIP and Twynholm can be attained on average winter peak days, when flows from Moffat are lower than flows on 1-in-50 winter peak days.

It should be emphasised, operating the SWSOS and IC system at lower pressures, in order to facilitate the SNIP reverse flow, results in lower levels of interconnector linepack consequently reducing the security of supply of the system. Further detailed studies would be required, to determine the optimal solution for such a configuration.

BGN have noted that twinning the existing pipeline between Cluden and Brighouse Bay may also allow for increased reverse flows from Larne storage.

5.8.4.4 Summer minimum day
The summer minimum day is included in the network analysis to determine the maximum level of storage injections that can be achieved.

The volume of gas that can be injected into Larne storage is determined by the following;

- The volume of GB imports via SNIP; and
- The volume of GB imports via the ICs and SNP; less
- NI demand

Network modelling indicates, up to 10.2 mscmd of gas can be injected into Larne storage on the summer min day. This represents a best case scenario for storage injections.

5.8.5 Kish Bank Supply Scenario
Network modelling undertaken by BGN assumes an Eirgas storage facility at the Kish Bank Basin connects to the ROI transmission system downstream of Gormanston AGI. This may be reviewed subject to future consultation with the storage developers.

5.8.5.1 Winter Peak Days - Withdrawals
The volume of gas that can be supplied from Kish Bank Storage is determined by the following;

- ROI demand;
- The volume of surplus gas that can be transported to NI via the SNP;
- Corrib supply; and
- Ensuring minimum system pressure limits are not breached.
While there is sufficient 1-in-50 peak day demand on the Island to absorb Kish Bank Storage and Corrib supply, BGN’s analysis indicates it is not possible to accommodate the combined maximum flows from both supply sources, without breaching minimum system pressure requirements.

As the Island’s two supply sources, Corrib and Kish Bank Storage, are assumed to flow gas on a flat profile basis, the pressures at each of the two supply points will fluctuate in line with the demand profile, i.e. pressures at the supply points will be higher during periods of low demand and pressures at the supply points will be lower during periods of high demand.

Analysis indicates the pressures at the supply points observed during periods of high demand are not sufficient to maintain minimum pressure requirements in certain parts of the network.

In the absence of reinforcement to the areas of the transmission network, where minimum pressure requirements are breached, it may be necessary to restrict supply.

5.8.5.2 Summer Min Days – Injections

The volume of gas that can be injected into Kish Bank Storage is determined by the following:

- Brighouse Bay nominal capacity (27 mscmd); and
- Corrib supply; less
- ROI and IOM demand

As a result of the high flows in the SWSOS, pressures at Twynholm are insufficient to facilitate the flow of gas from Moffat for ROI through the SNIP and SNP (i.e. in a CAG Open Configuration). Consequently the ROI and IOM gas requirement at Moffat, must flow through the IC system, and therefore is limited by the capacity of Brighouse Bay compressor station, 27 mscmd.

Analysis indicates it would not be possible to inject the maximum proposed rates to Kish Bank Storage, 28 mscmd. Figure 5.3 illustrates the maximum capacity of combined Corrib and Moffat, Kish Bank Storage injection requirement, ROI and IOM gas demand.

Figure 5-3: Summer min day demands, Kish Bank Storage injection and supply capacity

Injections up to 23.9 mscmd are feasible in 2017/18. However, this is forecast to decline in later years, as Corrib production reduces.
Reinforcement to the SWSOS system would be required to accommodate the flows required for the Island’s demand and proposed Kish Bank Storage injection rate.

5.8.6 Peak-day and Local Reinforcement Requirements

BGN’s network analysis indicates that the main transmission systems to Cork, Dublin, Waterford, the North East and Limerick, have sufficient capacity to meet the forecast peak day demands.

It should be noted:

- Reinforcement to the Waterford area is not required subject to the construction of the transmission pipeline to the proposed CCGT at Great Island proceeding;
- The reinforcement requirement to the Limerick area network referenced in last year’s JGCS is being addressed by refurbishment work, which is currently being progressed.

However, the growth levels assumed in the models for the local transmission systems are uniform with national growth levels. If localised growth was to exceed the assumed national growth levels, there may be a requirement for reinforcement at the relevant location on the local transmission network.
6 Summary & Conclusions

The 2011 Joint Gas Capacity Statement (JGCS) presents an assessment of the ability of the all-island transmission network to meet forecast gas demand and potential supply scenarios over the next ten years (2010/11 to 2019/20).

The 2011 JGCS diverges from the analysis undertaken in previous years in terms of the principal supply sources under consideration. The scenarios in this year's Statement are more limited in terms of the flows taken as being available from Inch Entry Point during the forecast period.

6.1 Sources of Gas

In the medium term, the island’s demand will continue to be met from GB imports via the Moffat Entry Point and from gas storage at Inch. The timing and availability of indigenous gas supply remains a significant source of uncertainty, particularly with respect to peak day scenarios.

In relation to Inch supplies, PSE Kinsale Energy Limited has noted that the economic viability of the existing storage facility is linked to that of its gas production operations. The company has informed the CER that, as gas production gradually declines, the existing storage operations will not be economic on a standalone basis. In this year’s JGCS, the RAs, in conjunction with the TSOs, have analysed potential flows from Inch based on data provided by PSE Kinsale Energy. This involves the existing storage operations ceasing in 2012/13 and the drawdown of cushion gas from the wells in the years from 2013 to 2016 at which point operations cease.

PSE Kinsale Energy Limited has informed the CER that they are currently determining the commercial feasibility of increasing storage capacity in the Celtic Sea by increasing the storage capacity of the existing Southwest Kinsale gas field.

In relation to the introduction of Corrib gas, the project’s final stage, involves the construction of a circa 8.3 km pipeline between land-fall at Glengad and the gas processing terminal at Bellanaboy. First gas from the Corrib field is not expected until Gas Year 2013.

The Regulatory Authorities also note the likely increasing importance of gas storage as a supply source over the coming years. Analysis is ongoing in relation to the technical and commercial feasibility of salt-cavity gas storage in the Larne area as part of the project of Islandmagee Storage Ltd and the North East Storage project jointly led by BGE and Storengy. Eirgas Ltd., a subsidiary of Providence Resources PLC, have also identified plans to develop a gas storage facility in the Kish Bank Basin, offshore Dublin, which is due to commence operation in 2018/19.

Three supply scenarios were developed in light of information provided on proposed timings and forecast flows from these current and prospective gas producers/storage operators. The impact of these supply scenarios and of forecast demand on the transmission system over the next ten years was modelled by BGN using specialist network analysis software. The aim of the scenario analysis is to examine whether the system is adequate to cope with a reasonable expectation of demand. It should be taken into account that, while this JGCS has examined potential gas flows from various Entry Points, actual flows will be determined by shipper nominations.

The Regulatory Authorities have sought not to take a view on the commercial viability of existing or proposed projects. The inclusion of data for these projects in the JGCS modelling is based on information provided by producers/storage operators and is not intended to refer to the likelihood of these infrastructure projects being progressed.
6.2 Modelling Results

6.2.1 Potential Capacity Constraint on the Southwest Scotland Onshore System

As noted in Section 5.8.1, analysis undertaken by BGN for this year’s JGCS shows that capacity limits at Beattock may potentially be breached in 2015/16 for each of the three supply scenarios analysed.\(^2\) The results of the 1-in-50 winter peak day modelling also indicate that 94% of Beattock capacity may be utilized by 2011/12 and 96% by 2013/14.\(^2\) Furthermore, BGN have noted that in the event that primary assumptions, such as ANOP pressure of 47.0 barg at Beattock and a flat flow profile at Moffat, were not to hold true as part of their forecasts\(^2\), the required limits at Beattock could be shown as being breached by 2013/14.\(^2\)

The Regulatory Authorities have closely considered the information provided by BGN on this matter. The issue of a potential capacity constraint in onshore Scotland is largely based upon significant assumptions regarding flows from Inch declining and ceasing in the medium term combined with uncertainty surrounding the Corrib commencement date.

The Regulatory Authorities are of the view that reinforcing the onshore Scotland network, if it is to go ahead, should be undertaken only in light of an appropriate assessment of the risk to gas supply and note that alternative commercial or physical means should be also considered to overcome short-term capacity constraints.

Taking this into account and noting that a final decision on infrastructure investment for 2013/14 would not be required until the end of 2011, the Regulatory Authorities will consult on potential mitigation measures in the coming months with a view to implementing the most economic and flexible solution(s) as soon as reasonably practicable.

The consultation will involve an examination of the most cost-effective ways in which the existing system may be utilised in order to overcome any potential shortfalls in onshore Scottish capacity in the short to medium term. The consultation will allow for an informed decision on the implementation of appropriate supply and/or demand side measures to remove or mitigate the risks identified.

It should also be noted that, in addition to this future consultation, under EU Regulation 994/2010\(^2\), a full assessment of the risks affecting security of gas supply is to be carried out by the Competent Authority in each Member State by the 3rd of December 2011. This assessment will utilise the results of the JGCS and enable the production of appropriate preventative action and emergency plans. The CER was appointed as the Competent Authority for Ireland by the Department of Communication Energy and Natural Resources in December 2010. The CER will engage with the Utility Regulator and DETI on these issues as part of the regional cooperation requirements of Regulation 994/2010.

In the interim period, the RAs request that BGN continue to examine localised modifications at Beattock to improve compressor performance

6.2.2 All Island System Configuration

A system configuration where the physical separation of the two jurisdictions’ transmission networks is removed is feasible under all supply scenarios, but is very sensitive to demand, supply and pressure conditions and is therefore not possible on certain peak-days in certain years. Compression facilities on the SNP north of Gormanston would greatly enhance the flow capacity between the two jurisdictions.

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21 That is 104% of South West Scotland Onshore Capacity utilised in 2015/16. See Table 5-3.
22 The peak demand is expected to contract in 2012/13 due to the commissioning of the East-West interconnector.
23 See Section 5.8.1.
24 These results are also based upon overall I/C annual gas demand broadly growing or contracting at 80% of the overall economic growth rate, as measured using ‘Real’ GDP. A high growth forecast was assumed in light of information from the ESRI in order to examine the potential demand scenario that would pose the greater impact on the system.
BGN has informed the Regulatory Authorities that system modifications, particularly at the Gormanston AGI, would be required in order to put in place the necessary operational requirements to facilitate flows between the two jurisdictions under this ‘CAG Open’ configuration. The inclusion of additional metering, flow control and pressure control equipment would, in particular, be required. Modifications may also be required at Twynholm, Carrickfergus Ballanabanagh and Brighouse Bay.

Detailed engineering studies will be required to determine the optimal solution and the costs associated with completing these works. Further studies will also be required to determine if any other locations on the network require modifications to fulfill the operational requirements for a single All Island network under a CAG regime.

As part of the development of the CAG project, analysis is also being undertaken by the TSOs on the capability of the transmission networks, subject to some modifications, to deliver services on an all island basis under certain scenarios. This network analysis is ongoing in parallel with the JGCS at the request of the RAs.

6.2.3 Larne & Kish Bank Supply Scenarios

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

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

It should also be noted that significant levels of gas withdrawal and injection can be accommodated for the proposed storage facilities at Larne and Kish Bank, however it is not possible to accommodate the proposed maximum withdrawal and injection rates based on existing pressures.

6.2.3.1 Larne Supply Scenario

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

- Allowing an amount of the surplus gas to enter into Ireland via the SNP under a CAG Open Configuration. Modelling indicates flows through the SNP, range from c. 2.8 mscmd to 3.9 mscmd, with higher flows possible on average winter peak days, than 1-in-50 peak days.

and/or

- Reverse flow through SNIP to Twynholm and routed to Ireland via Brighouse Bay and the IC subsea system using existing infrastructure. The maximum reverse flow capability through SNIP is, however, dependent upon operating conditions at Beattock, capacity limits at Twynhom and minimum pressure requirements at Brighouse Bay. Modelling indicates up to 9.5 mscmd of Larne gas could potentially be transported to ROI via the SNIP, Twynholm and the ICs. It should be emphasised, operating the SWSOS and IC system at lower pressures in order to facilitate the SNIP reverse flow, results in lower levels of Interconnector linepack consequently reducing the security of supply of the system. Further detailed studies would be required, to determine the viability of such a configuration.
6.2.3.2 Kish Bank Supply Scenario

Network modelling assumes Eirgas storage facility at the Kish Bank in offshore Dublin would connect to the ROI transmission system downstream of Loughshinny AGI. While there is sufficient 1-in-50 peak day demand on the Island to absorb Kish Bank and Corrib supply, analysis indicates it is not possible to accommodate the combined maximum flows from both supply sources, without breaching minimum system pressure requirements.

6.2.4 Effect of Winter 2010/11 Peak Demand

The winter of 2010/11, like that of 2009/10, resulted in exceptionally high gas demand on the gas systems in Ireland and Northern Ireland. The month of December 2010 was the coldest December on record, corresponding with the coldest record day at Dublin airport on the 24th of December, since records commenced in 1942.

The all time record for peak flows onto the island’s transmission system (including onshore Scotland, onshore Ireland and Northern Ireland) of 337.6 GWh/d (30.4 mscm/d) that occurred on the 8th of December 2010. This peak flow is the sum of the ROI demand, Northern Ireland (NI) demand, the Isle of Man (IOM) demand and system balancing gas requirement, which were 249.6 GWh/d (22.4 mscm/d), 74.6 GWh/d (6.7 mscm/d), 4.8 GWh/d (0.4 mscm/d) and 8.6 GWh/d (0.8 mscm/d) respectively.

This date was also a record event for peak flows through the Moffat Entry Point, 304 GWh/d (27.2 mscmd). The Island’s demand on the 8th of December 2010, 329 GWh/d, approached but did not break the record peak demand, 332.9 GWh/d, which occurred on the 7th January 2010, however, there was a requirement for system balancing gas on the 8th December, approximately 8.6 GWh/d, increasing the island’s gas flows to a record level.

Gas flows through the subsea IC System exceeded the design capacity of IC1 on 42 days over the 2010/11 winter period, demonstrating the importance of the increased capacity provided by IC2. On the 8th of December 2010 flows of 229.3 GWh/d (20.6 mscm/d) were recorded which exceed the design capacity of the IC1, stated as 188.2 GWh/d (17.0 mscm/d). Taking into account the design capacity of IC2 (22.33 mscm/d), the IC system successfully provided for these peak flows into the Irish system. Without IC2 it may have been necessary to curtail gas supplies to the power sector in Ireland during record electricity peak demand.

Though no major incidents were encountered on the transmission and distribution systems to meet during the high demand period in December 2010, BGN have indicated, operation of the onshore Scotland system proved very challenging on the 8th of December, as a result of the record flows through the Moffat Entry Point combined with the flow profiling (renominations) on the day. However, favourable pressure conditions at Moffat on the 8th of December, ensured all flow requirements were met.

The electricity system in Ireland experienced record levels of demand during the severe weather periods in 2010, with its highest ever system demand peak of 5,090 MW occurring on the 21st of December. This period of high electricity demand coincided with extremely low levels of wind generation and resulting in the record levels of power generation gas demand. The 2010/11 peak power generation gas demand occurred on the 8th December with a total demand of 133.0 GWh/d (12.0 mscm/d). However, it is likely the power generation peak day gas demand would have occurred on the 21st of December if the Tynagh and Whitegate gas burning power stations had been available on this day. Modelling undertaken by BGN indicates, power generation gas demand could have been in the order of 144 GWh.

The low levels of wind-powered electricity generation experienced during this period highlight the importance of gas-fired generation in meeting required electricity demand during cold weather periods. The RAs have noted that there remains a substantial requirement for conventional thermal generation to back-up wind generation, especially on calm days.
6.3 Gas Demand

6.3.1 Gas Demand on the Island

Peak day demand on the island is not expected to grow considerably in the next two years, declining by c. 4% in 2012/13 due to the commissioning of the East-West Interconnector but is projected to increase significantly from 2013/14 to the end of the forecast period.

The all island system peak of 337.6 GWh/d (30.4 mscm/d) occurred on the 8th of December 2010. This peak demand surpassed the previous highest level of 332.9 GWh/d (30.2 mscm/d) which occurred in the same year on the 7th of January.

6.3.2 Gas Demand in Ireland

As regards Irish gas demand, the JGCS shows that, in contrast with 2008/09, Irish annual gas demand grew by 6.8% in 2009/10 largely on account of increased power sector gas demand which was driven by favourable gas prices, generally low levels of low wind powered generation and the extended periods of exceptional cold weather. As per the 2010 JGCS, the outlook for future gas demand is less certain compared to previous years due to the economic recession. Annual demand is forecast to have decreased by approximately 8% by 2012/13 but is expected to have returned to 2007/08 levels by 2014/15. 26

Irish peak day gas demand grew by 9% in 2009/10 and remained around this level in 2010/11 due to a second cold winter period in December 2010. Peak day gas demand is not expected to increase considerably from this level until the latter half of the forecast period. Overall, natural gas continues to be an important fuel for power generation, and remains the fuel of choice for new thermal power station projects.

6.3.3 Gas Demand in Northern Ireland

Annual gas demand in 2009/10 in Northern Ireland has fallen by 4.8% largely due to a reduction in gas supplied to the power sector. However the distribution sector has grown by 11.2% over the year.

The overall forecast for gas demand in Northern Ireland is to grow relatively slowly over the next ten years (less than 1% on average). This is due to a relatively stable demand for gas consumption in power stations combined with growth within the distribution sector which is forecast to grow at an average of 2.8% each year.

6.3.4 Gas Demand by Sector

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. In aggregate the JGCS 2011 forecast assumes that 1,164 MW of new gas-fired CCGT and OCGT capacity will be commissioned on the island over the forecast period. This additional generation will be required to meet the future growth in electricity demand, and to replace 1,564 MW of dual and oil-fired capacity (which is expected to retire over the period).

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

26 In relation to forecast industrial/commercial demand, a pragmatic approach was adopted to counter the absence of any updated GDP forecast beyond 2012, following consultation with the ERSI. A high growth forecast was assumed in order to examine the potential demand scenario that would pose the greater impact on the system.
with GB and rising gas prices. As a result of these factors the power sector gas demand is forecast to contract between 2010/11 and 2012/13, however recovery is expected from 2013/14 due to increasing electricity demand, new gas fired generation increasing carbon prices and potentially lower electricity imports.

The annual I/C gas demand in Ireland is forecast to continue to fall in 2010/11 due to the economic recession, before beginning to recover again in 2011/12. Relatively strong growth is anticipated to occur from 2012/13 to 2015/16 with moderate growth from 2015/16 onwards expected due to an increase in energy efficiency measures.

Residential demand in Ireland is forecast to slightly reduce between 2010/11 to 2014/15 on account of the lower forecast for new residential connections (arising from the ongoing economic recession and the associated slump in new housing construction), and increased savings from energy efficiency measures. It is projected to be c. 1.1% higher by 2015/16 than present demand figures.

6.4 Longer Term Issues

6.4.1 Flows from GB

GB imports through Moffat will remain an integral aspect of the island’s transmission systems. As has been shown in this Statement, the importance of maintaining adequate flows and pressures at Moffat is accentuated by the potential for supplies from Inch to cease in the medium term and by the potential for flows from Corrib to be further delayed.

While the introduction of new sources of supply in the long term such as from potential storage facilities at Larne and in the Kish Bank basin would involve a reduced dependence on gas through Moffat, it remains likely that a proportion of gas would be sourced from Moffat, in particular when supplies from the Corrib gas field decline from their initial peak.

Overall, the commercial and operational arrangements of the all-island gas market will continue to be heavily influenced by developments in GB.

6.4.2 Reverse Flows at Moffat

As has been noted above, the integration of the two systems under CAG, the possibility of increased flows from potential storage facilities, as well as greater flows from the West, may have a significant impact on the movement of gas on the island and on the Scottish onshore system. In later years there is the potential for reverse flows through the SNP, SNIP and IC1 and 2 in order to improve the ability of the system to move gas from the Larne storage facility to the south.

In January of 2010 Gaslink submitted a Code Modification (A043) which proposes to change the Code of Operations in Ireland in order to facilitate virtual reverse flow at Moffat. This Code Modification proposal affects a number of areas including the Moffat Agency Arrangements, the development of corresponding virtual reverse flow facility upstream of Moffat, Regulatory Arrangements, Transporter Arrangements and Shipper Arrangements.

Following on from the proposed Code Modification, progress has been made in 2011 in respect of implementing a virtual reverse flow service at the Moffat Interconnection Point. The CER has engaged with OFGEM and UR as well as the relevant TSOs (Gaslink and National Grid) in the form of monthly Joint Regulatory meetings in order the progress this project. In July 2011, the CER decided in consultation with both Ofgem and UR, to progress the development of TSO-TSO arrangements to facilitate virtual reverse flow at Moffat in order to achieve the implementation of the service by 1st October 2011.\textsuperscript{27}

\textsuperscript{27} CER/11/113 CER Decision Paper – Institutional Arrangements for Virtual Reverse Flow at Moffat – published 4th July 2011
6.5 Conclusion and Recommendations of the Regulatory Authorities

- In the medium term, the island’s demand will continue to be met from GB imports via the Moffat Entry Point and from gas production and storage at Inch. The timing and availability of indigenous gas supply remains a significant source of uncertainty, particularly with respect to peak day scenarios.

- The network modelling carried out by BGN indicates that capacity limits at the Beattock Compressor Station in onshore Scotland may potentially be breached in 2015/16 if flows from Inch decline and cease in 2016 and if there is a further significant delay to the Corrib project. The capacity of the onshore Scotland network is not expected to be breached on the 1-in-50 year peak days for the forthcoming winters. However, based on current market arrangements, BGN’s results also show that there may be little flexibility in terms of system operation in the onshore Scotland network as early as 2013/14.

- The RAs consider it appropriate to consult on potential mitigation measures in the coming months with a view to implementing the most economic and flexible solution(s) as soon as reasonably practicable.

- In the interim period, the RAs request that BGN continue to examine localised modifications at Beattock in order to improve compressor performance.

- In the longer term, new sources of supply described in the JGCS may significantly change the direction and nature of flows on the island’s transmission network. It is evident that, should a number of these projects come into operation at the same time, without investment allowable minimum operating pressures might not be obtainable.

In summary, the requirement for future investment remains highly dependent upon the timing and combination of new and existing supply sources.

The Regulatory Authorities welcome the continued co-operation within the framework of the CAG project and would like to thank all parties involved in the preparation of the JGCS 2011.
Appendix 1: Peak Day Demand Forecasts

Irish Peak-day demand forecast

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

In line previous Statements the distribution peak-day demand is weather corrected to 1 in 50 weather conditions. The power sector peak day demands, however, is calculated by applying the 2011-2020 All Island Generation Capacity Statement median growth rate profile to the actual winter 2010 peak demand which was 5,090MW. The 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 peak demand growth is forecast in line with EirGrid’s prediction of annual peak demand growth as issued in the GAR with the initial demand for 2010/11 taken as the actual electricity peak demand of 5,090MW which occurred on 21st December 2010;
- 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 and 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. Given that gas powered generation stations account for approximately 56% of the total dispatchable generation capacity on the island, the forecasted peak day power sector gas demand is assumed to be less than the combined maximum potential gas generation plant gas demand. It is considered unlikely that all gas fired stations would operate at maximum potential load on a peak day in advance of all other dispatchable plant available. The contribution from renewable energy generation is considered to be minimal during the peak day.

NI Peak-day demand

The NI peak-day demand was derived from information provided by MEL and the Utility Regulator. The peak-day forecast is summarised by sector in Table A1-4.

IOM Peak-day forecast

The peak-day demand forecast for the IOM was based on information provided by the Manx Electricity Authority (MEA), who also operate the natural gas system on the IOM. IOM demand is included in relation to all respective all-island scenarios.

In the tables that follow, volume conversion calculations have been carried out using a weighted average of forecast peak day supplies for the particular supply scenario and take into account the relevant calorific value of the gas delivered at each Entry Point.
### Table A1-1: 1 in 50 Winter Peak day Demand & Base Supply Scenario

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Joint Gas Capacity Statement 2011  
Page 69 of 89
### Table A1-2: 1 in 50 Winter Peak day Demand & Larne Supply Scenario

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<td>33.5</td>
<td>34.6</td>
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<td>7.4</td>
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<td>7.8</td>
<td>7.9</td>
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</table>
Appendix 2: System Modelling Approach

A hydraulic model of the combined Irish and NI transmissions is constructed using Pipeline Studio® software. Pipeline Studio® pipeline simulator allows the user to configure and analyse scenarios using transient modelling. All scenarios simulate the 24 hour demand cycle of the all-island transmission system over a three day period to obtain steady consistent results.

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

The transmission network model includes:

- All of the relevant physical characteristics of the transmission Pipelines, including pipeline lengths, wall-thickness and internal diameter;
- All of the major flow-regulating stations, i.e. Twynholm, Carrickfergus, Gormanston (IC2 landfall), Loughshinny (IC1 landfall), Craughwell, and the Dublin City Gates – i.e. Abbotstown, Brownsbarn and Diswellstown:
  - Twynholm is modelled as a flow-control regulating station, with a minimum pressure drop across the regulators of 2.5 barg;
  - Carrickfergus is modelled with a differential-pressure control of 0.5 barg across the regulators;
  - Gormanston discharge from IC2 is be pressure-controlled (with 66% of the IC system flow assumed to come through IC2);
  - The Loughshinny discharge from IC1 is flow-controlled (with 33% of the IC system flow assumed to come through IC1); and
  - The discharge from the Dublin City Gates into their respective 40 barg systems is set to be pressure controlled.
- A generic-compressor model for each of three compressor stations at Beattock, Brighouse Bay and Midleton:
  - Beattock compressor station is assumed to be pressure controlled, to give a flat-discharge pressure of 85 barg in all scenarios;
  - The Brighouse Bay compressor station is modelled to achieve a flat flow profile; and
  - The Midleton compressor station is modelled to achieve a flat flow at the Inch Entry Point.

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

- The hourly gas demand of the Irish power stations is generated directly by the merit-order stack model;
- The hourly gas demand of the NI power stations was provided by PTI 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 potential need for future reinforcement.
Appendix 3: System Configuration

Phase 1 of the IC2 landfall station at Gormanston was constructed in 2002 and provides pressure regulation facilities from the IC2 sub-sea pipeline to the ROI transmission network. Subsequently, Phase 2 of Gormanston AGI was constructed in 2006 as part of the South-North Pipeline (SNP) project which can provide pressure regulation facilities to the NI network.

The current configuration at Gormanston, referred to as ‘CAG Closed’, is shown Figure A5-1:

- The closed block valve highlighted provides for the separation of the two systems;
- The flow of gas from IC2 into the ROI and NI transmission systems is controlled through separate regulators (i.e. the ROI and SNP regulators), with their own individual settings.

The combined effect of this configuration is that the two systems are separated, and have separate pressure control regimes. Under the existing arrangement gas would only flow from IC2 into the SNP in the event that an emergency in Northern Ireland is declared by PTL and PTL request BGE to flow gas through the Interconnectors and the SNP to Northern Ireland.

**Figure A5-1: CAG Closed Configuration at Gormanston**

Under a future operational environment, this existing (‘CAG Closed’) configuration may change to a ‘CAG Open Configuration’, where given certain supply and demand scenarios there may be excess gas supplies in either jurisdiction available for supply to the other jurisdiction.

With the CAG Closed configuration there is no control mechanism or metering available to control the flow of gas between the ROI and NI. The gas would simply flow between the two systems depending on the relative system pressures on the ROI and NI transmission systems, subject to MOP limits.
In order to facilitate the CAG Open Configuration, significant system modifications would be required, particularly at Gormanston AGI (see Figure A5-2). The inclusion of additional metering, flow control and pressure control equipment would, in particular, be required. Modifications may also be required at Twynholm, Carrickfergus, Ballanabanagh and Brighouse Bay.

Detailed engineering studies will be required to determine the optimal solution and the costs associated with completing these works. Further studies will also be required to determine if any other locations on the network require modifications to fulfil the operational requirements for a single All Island network under a CAG regime.

**Figure A5-2: Requirements at Gormanston to accommodate CAG Open Configuration**

For the relevant years under review in this Statement, it is assumed for modelling purposes that the necessary operational and commercial requirements are in place as part of the CAG project to operate the network under either the CAG Closed Configuration, or a CAG Open Configuration in the event that there are excess supplies in either jurisdiction. This assumption will continue to be reviewed in the preparation of future Statements.
Appendix 4: Network Schematics

Base Supply Scenario
1-in-50 Winter Peak Day
Year 2019/20

ROI demand = 28.1 mscmd
NI demand = 8.0 mscmd
IOM demand = 0.6 mscmd

ROI demand = 28.1 mscmd

Corrib 4.4 mscmd
(Max on entering Ringmain 70 barg)

Dublin City Gates
(Min 55 barg)
Actual min 65.0 barg

Coolkeeragh
(Min 30 barg)
Actual min 33.1 barg

IC discharge
set to 69 barg

IC1

IC2

8.0 mscmd
through Twynholm

NWP

SNP

Brighouse Bay
24.3 mscmd

Beattock
32.3 mscmd
Discharge
85.0 Barg

Ballyveelish - Waterford
Spur line (Min 45 barg)
Actual min 45.7 barg

Midleton
(Min 40 barg)
Actual min 42.4.0 barg

Cork

Joint Gas Capacity Statement 2011
Page 76 of 89
**Base Supply Scenario**

**Average Winter Peak Day**

**Year 2019/20**

ROI Demand = 24.8 mscmd
NI Demand = 7.4 mscmd
IOM Demand = 0.5 mscmd

- **Corrib 4.4 mscmd** (Max on entering Ringmain 70 barg)
- **NWP Base**
- **IC1**
- **IC2**
- **Brighouse Bay 19.9 mscmd**
- **IC discharge set to 69 barg**
- **Coolkeeragh**
  - (Min 30 barg)
  - Actual min 45.3 barg
- **Dublin City Gates**
  - (Min 55 barg)
  - Actual min 66.2 barg
- **Cork**
  - Actual min 52.3 barg
- **Midleton (Min 40Barg)**
- **Ballyveelish - Waterford Spur line (Min 45 barg)**
  - Actual min 53.9 barg
- **Beattock 28.3 mscmd**
  - Discharge @ 85.0 barg

---

Joint Gas Capacity Statement 2011
Page 77 of 89
Larne Supply Scenario
1-in-50 Winter Peak Day
Year 2019/20
ROI demands = 28.1 mscmd
NI demands = 8.0 mscmd
IOM demands = 0.6 mscmd
SNP (NI to ROI) = 2.8 mscmd
SNIP (Reverse flow) = 8.64 mscmd

Corrib 4.4 mscmd
(Max on entering Ringmain 70 barg)

Dublin City Gates
(Min 55 Barg)
Actual min 64.9 barg

Coolkeeragh
(Min 30 barg)
Actual min 72.8 barg

NWP

Larne 19.3 mscmd
Actual Pressures
77.1 – 85.0 barg

2.8 mscmd
SNP export
to ROI

8.6 mscmd
through
Twynholm in
reverse mode

21.6 mscmd
Beattock
Discharge
61.5 barg

Ballyveelish -
Waterford Spur line
(Min 45 barg)
Actual min 45.6 barg

Cork
Actual min 42.2 barg

Ballyveelish -
Waterford Spur line
(Min 45 barg)
Actual min 45.6 barg

Midleton
(Min 40 barg)
Actual min 42.2 barg

Cork

ROI Ringmain
Larne Supply Scenario

Average year Winter Peak Day

Year 2019/20

ROI demand = 24.8 mscmd
NI demand = 7.4 mscmd
IOM demand = 0.5 mscmd

SNP (NI to ROI) = 2.8 mscmd
SNIP (Reverse flow) = 8.5 mscmd

Corrib 4.4 mscmd
(Max on entering Ringmain 70 barg)

ROI Ringmain

Coolkeeragh
(Min 30 barg)
72.8 barg

Larne 18.7 mscmd
Actual Pressure
77.7 – 85.0 barg

Dublin City Gates
(Min 55 barg)
Actual min 66.2 barg

IC discharge
set to 69Barg

IC1

SNP

2.9 mscmd
SNP export
to ROI

8.5 mscmd
twist
through
SNIP (Reverse flow) = 8.5 mscmd

Brighouse Bay
18.1mscmd

NWP

IC2

Ballyveelish - Waterford Spur line
(Min 45 barg)
Actual min 53.9 barg

Midleton Compressor
Station (Min 40 barg)
Actual min 52.2 barg

Cork

Larne 18.7 mscmd
Actual Pressure
77.7 – 85.0 barg

Cork

Midleton Compressor
Station (Min 40 barg)
Actual min 52.2 barg

Larne Supply Scenario

Average year Winter Peak Day

Year 2019/20

ROI demand = 24.8 mscmd
NI demand = 7.4 mscmd
IOM demand = 0.5 mscmd

SNP (NI to ROI) = 2.8 mscmd
SNIP (Reverse flow) = 8.5 mscmd

Corrib 4.4 mscmd
(Max on entering Ringmain 70 barg)

ROI Ringmain

Coolkeeragh
(Min 30 barg)
72.8 barg

Larne 18.7 mscmd
Actual Pressure
77.7 – 85.0 barg

Dublin City Gates
(Min 55 barg)
Actual min 66.2 barg

IC discharge
set to 69Barg

IC1

SNP

2.9 mscmd
SNP export
to ROI

8.5 mscmd
twist
through
SNIP (Reverse flow) = 8.5 mscmd

Brighouse Bay
18.1mscmd

NWP

IC2

Ballyveelish - Waterford Spur line
(Min 45 barg)
Actual min 53.9 barg

Midleton Compressor
Station (Min 40 barg)
Actual min 52.2 barg

Cork

Larne 18.7 mscmd
Actual Pressure
77.7 – 85.0 barg

Cork

Midleton Compressor
Station (Min 40 barg)
Actual min 52.2 barg

Larne Supply Scenario

Average year Winter Peak Day

Year 2019/20

ROI demand = 24.8 mscmd
NI demand = 7.4 mscmd
IOM demand = 0.5 mscmd

SNP (NI to ROI) = 2.8 mscmd
SNIP (Reverse flow) = 8.5 mscmd

Corrib 4.4 mscmd
(Max on entering Ringmain 70 barg)

ROI Ringmain

Coolkeeragh
(Min 30 barg)
72.8 barg

Larne 18.7 mscmd
Actual Pressure
77.7 – 85.0 barg

Dublin City Gates
(Min 55 barg)
Actual min 66.2 barg

IC discharge
set to 69Barg

IC1

SNP

2.9 mscmd
SNP export
to ROI

8.5 mscmd
twist
through
SNIP (Reverse flow) = 8.5 mscmd

Brighouse Bay
18.1mscmd

NWP

IC2

Ballyveelish - Waterford Spur line
(Min 45 barg)
Actual min 53.9 barg

Midleton Compressor
Station (Min 40 barg)
Actual min 52.2 barg

Cork

Larne 18.7 mscmd
Actual Pressure
77.7 – 85.0 barg

Cork

Midleton Compressor
Station (Min 40 barg)
Actual min 52.2 barg

Larne Supply Scenario

Average year Winter Peak Day

Year 2019/20

ROI demand = 24.8 mscmd
NI demand = 7.4 mscmd
IOM demand = 0.5 mscmd

SNP (NI to ROI) = 2.8 mscmd
SNIP (Reverse flow) = 8.5 mscmd

Corrib 4.4 mscmd
(Max on entering Ringmain 70 barg)

ROI Ringmain

Coolkeeragh
(Min 30 barg)
72.8 barg

Larne 18.7 mscmd
Actual Pressure
77.7 – 85.0 barg

Dublin City Gates
(Min 55 barg)
Actual min 66.2 barg

IC discharge
set to 69Barg

IC1

SNP

2.9 mscmd
SNP export
to ROI

8.5 mscmd
twist
through
SNIP (Reverse flow) = 8.5 mscmd

Brighouse Bay
18.1mscmd

NWP

IC2

Ballyveelish - Waterford Spur line
(Min 45 barg)
Actual min 53.9 barg

Midleton Compressor
Station (Min 40 barg)
Actual min 52.2 barg

Cork

Larne 18.7 mscmd
Actual Pressure
77.7 – 85.0 barg

Cork

Midleton Compressor
Station (Min 40 barg)
Actual min 52.2 barg
Larne Supply Scenario
Summer Min Day
Year 2019/20
ROI demand = 9.3 mscmd
NI demand = 3.3 mscmd
IOM demand = 0.3 mscmd
Larne Injection = 10.3 mscmd
SNP (IC2 to NI) = 5 mscmd
SNIP = 8.64 mscmd

Corrib 4.4 mscmd
(Max on entering
Ringmain 70 barg)

Coolkeeragh
(Min 30 barg)
Actual min 59.7 barg

Dublin City Gates
(Min 55 barg)
Actual min 66.2 barg

Larne injection
10.3 mscmd
Actual Pressure
58.7 – 61.9 barg

IC1

IC discharge
set to 69 barg

IC2

5 mscmd
SNP export
to NI (from IC2)

8.6 mscmd
through
Twynholm

NWP

ROI Ringmain

Ballyveelish - Waterford
Spur line (Min 45 barg)
Actual min 66.7 barg

Cork

Midleton
(Min 40 barg)
Actual min 66.6 barg

Briottower

8.6 mscmd
through
Twynholm

Brighouse Bay
10.2 mscmd

Beattock 18.9 mscmd
Discharging at 85 barg

Larne Injection
10.3 mscmd

SNP (IC2 to NI) = 5 mscmd

SNIP = 8.64 mscmd

Cork

Midleton
(Min 40 barg)
Actual min 66.6 barg

Ballyveelish - Waterford
Spur line (Min 45 barg)
Actual min 66.7 barg

Larne Supply Scenario
Summer Min Day
Year 2019/20
ROI demand = 9.3 mscmd
NI demand = 3.3 mscmd
IOM demand = 0.3 mscmd
Larne Injection = 10.3 mscmd
SNP (IC2 to NI) = 5 mscmd
SNIP = 8.64 mscmd

Corrib 4.4 mscmd
(Max on entering
Ringmain 70 barg)
Kish Bank Supply Scenario
1-in-50 Winter Peak Day

Year 2019/20
ROI demand = 28.1
NI demand = 8.0
IOM demand = 0.6
SNP (ROI to NI) = 4.2 mscmd
SNIP = 3.72 mscmd

Corrib 4.42 mscmd
(Max on entering Ringmain 70 barg)

ROI Ringmain

Coolkeeragh
(Min 30 barg)
Actual Min 40.2Barg

Dublin City Gates
(Min 55 barg)
Actual min 58.6 barg

IC1

IC2

NWP

SNP

Brighouse Bay
0.63 mscmd

Providence
28.0mscmd

3.72mscmd through Twynholm

Beattock
4.35mscmd
Discharge
85 barg

Cork

Ballyveelish -Waterford Spur line (Min 45 barg)
Actual min 40.7 barg

Midleton (Min 40 barg)
Actual min 37.6 barg

Kish Bank Supply Scenario
1-in-50 Winter Peak Day

Year 2019/20
ROI demand = 28.1
NI demand = 8.0
IOM demand = 0.6
SNP (ROI to NI) = 4.2 mscmd
SNIP = 3.72 mscmd

Corrib 4.42 mscmd
(Max on entering Ringmain 70 barg)
Kish Bank Supply Scenario
Average Winter Peak Day

Year 2019/20
ROI demand = 24.9
NI demand = 7.4
IOM demand = 0.5
SNP (ROI to NI) = 5.0 mscmd
SNIP = 2.4 mscmd

Corrib 4.4 mscmd
(Max on entering Ringmain 70 barg)

Dublin City Gates
(Min 55 Barg)
Actual min 61.4 Barg

Coolkeeragh
(Min 30 barg)
Actual Min 29.5 barg

ROI Ringmain

IC1

Ballyveelish - Waterford Spur line (Min 45 Barg)
Actual min 49.5.8 Barg

Cork

Beattock
2.9 mscmd
Discharge @ 85 barg

Ballyhouse Bay
0.5 mscmd

Providence
25.4 mscmd

2.4 mscmd through Twynholm

5.0 mscmd
SNP export from ROI to NI

NWP

Joint Gas Capacity Statement 2011
Page 82 of 89
Kish Bank Supply Scenario

Summer Min Day

Year 2019/20
ROI demand = 9.3
NI demand = 3.3
IOM demand = 0.3
Providence Injections = 23.5 mscmd
SNP (ROI to NI) = 0 mscmd
SNIP = 3.3 mscmd

Corrib 4.4 mscmd
(Max on entering Ringmain 70 barg)

ROI Ringmain

Dublin City Gates
(Min 55 Barg)
Actual min 69.0 barg

Coolkeeragh
(Min 30 barg)
Actual min 50.2 barg

IC discharge set to 69 barg

No SNP flows

SNP

Providence Injections
23.5 mscmd

3.3 mscmd through Twynholm

IC1

IC2

Brighouse Bay
28.7 mscmd

Ballyveelish Waterford Spur line (Min 45 barg)
Actual min 66.8 barg

Cork
(Min 40 barg)
Actual min 66.5 barg

Beattock
32.0 mscmd
Discharge @ 85 barg
Appendix 5: Energy Efficiency Assumptions\(^{28}\)

National Energy Efficiency Action Plan (NEEAP)
The NEEAP for Ireland sets out the Government’s strategy for meeting the energy efficiency savings targets identified in the energy White Paper (2007) and the EU Energy Services Directive (ESD)\(^{29}\). These targets include:

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

The JGCS assumes that 50% of the NEEAP energy efficiency targets will be met for both the residential and IC sectors. This assumption is intended to reflect the increased difficulty in achieving the targeted savings within sectors where straightforward energy savings have already been achieved.

Table A3.1: NEEAP Energy efficiency savings targets

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<th>2020 PEE target (GWh)</th>
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<td>Low carbon homes</td>
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<td>SEI house of tomorrow</td>
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<td>Eco-design for energy appliances (lighting)</td>
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<td>1,200</td>
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<td>SEI energy agreements (IS 393)</td>
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<td>330</td>
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<td>Existing ESB DSM programmes</td>
<td>380</td>
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<td>Renewable Heat Deployment programme</td>
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<td>Total business and commercial savings</td>
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<td><strong>Other sectors</strong></td>
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<td>Transport</td>
<td>775</td>
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<td>Energy Supply sector</td>
<td>275</td>
<td>300</td>
<td>365</td>
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<td>Total measures identified above</td>
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<td>White Paper target (20% reduction by 2020)</td>
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<tr>
<td>Additional measures yet to be identified</td>
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<td>8,195</td>
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</tbody>
</table>

\(^{28}\) These energy efficiency assumptions have also been utilised in Gaslink’s Network Development Statement 2010/11-2019/20


\(^{30}\) Primary Energy Equivalent
Impact on residential gas demand

The proposed energy efficiency measures for the residential sector will clearly have a material impact on annual gas demand of the residential sector. The JGCS forecast for the residential sector includes the following assumptions:

- Incremental gas demand from new residential connections will continue to reduce due to tighter building regulations and will fall to 40% of 2005/06 levels by 2012/13; and

- Existing residential gas demand will also reduce due to the introduction of more efficient boiler standards (e.g. condensing boilers), smart metering and the combined impact of the Low Carbon Homes, Warmer Homes & Home Energy Saving schemes.

The average annual gas consumption of all new residential customers connected during the 2005/06 gas year was approximately 12.3 MWh/y. The JGCS forecast assumes the average gas consumption of each new customer connected by 2012/13, will reduce by 54% of 2005/06 levels to 5.7 MWh/y with a greater ratio of houses to apartments being connected.

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

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

- Total energy efficiency savings of 2,807 GWh in residential heat demand between 2010/11 and 2019/20 from the above measures (annual reduction of 281 GWh/y);

- Approximately 27% of this target reduction will be achieved in gas-fired residential homes, based on the gas share of residential heat in 2008, i.e. the gas share of total residential Total Final Consumption after excluding the electricity and renewable components; and

- This would lead to a reduction of 74.4 GWh/y in residential annual gas demand, which is equivalent to 0.9% of the residential gas demand in 2009/10.

If all of the above energy efficiency measures are implemented as anticipated and achieve the assumed energy savings, then it is estimated that annual residential gas demand will reduce by approximately -0.55% over the period. This reduction is less than anticipated in previous documents due to the reduced impact of energy efficiency savings and the decrease in new dwelling units connecting to the system.

Impact on I/C gas demand

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

- That the total I/C energy demand will reduce by 3,375 GWh by 2016 and a further 4,965 GWh by 2020 (50% of the NEEAP target), an annual reduction of 338 GWh/y up to 2016 and 1,174 GWh/y up to 2020;

- The gas share of these reductions is assumed to be 19.3% up to 2016 and 21.4% up to 2020, based on gas share of total I/C TFC in 2008 (of 23.0%) and adjustments to exclude initiatives which are specific to electricity (e.g. ESB demand reduction programmes); and

- This would lead to an annual reduction of 65.1 GWh/y in I/C annual gas demand up to 2014/15, and 266 GWh/y from 2015/16 onwards (which is equivalent to 0.3% and 1.3% of the 2009/10I/C annual demand respectively).
Appendix 6: Glossary

AGI: Above Ground Installation.

AGCS: All Island Generation Capacity Statement

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

BGÉ: Bord Gáis Éireann

BGN: Bord Gáis Networks

BGTL: Belfast Gas Transmission Limited

c.: Circa

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

CER: Commission for Energy Regulation

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

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

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

Cubic Metre (m³): The unit of volume; approximately equal to 35.34 cubic feet. One million standard cubic metres is referred to as mscm.

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


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

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

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

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

**ESD:** Energy Services Directive

**ESRI:** The Economic and Social Research Institute.

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

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

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

**GCS:** Gas Capacity Statement

**GCV:** Gross Calorific Value

**IC:** 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.

**IPP:** Independent Power Producer.

**JGCS:** Joint Gas Capacity Statement

**Kilowatt hour (kWh):** The unit of energy used by the gas industry. Approximately equal to 0.0341therms. One Megawatt hour (MWh) equals 1,000kWh, one Giga watt hour (GWh) equals 1,000,000kWh, and one Terawatt hour (TWh) equals 1012Wh.

**LCPD:** Large Combustion Plant Directive

**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.

**MJ:** Mega Joules

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

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

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

NI: Northern Ireland

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

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

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

P.A.: Per Annum

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

PTL: Premier Transmission Limited

PNG: Phoenix Natural Gas Limited

Res: Residential

ROI: Republic of Ireland

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

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

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

SNP: South-North Pipeline

SNIP: The Scotland to Northern Ireland Pipeline.

SRMC: Short Run Marginal Cost

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

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

Supply: The delivery or sale of natural gas, including liquefied natural gas, to customers, and includes Shipping.
**TER:** Total Electricity Requirement - EirGrid’s GAR converts total electricity sales at the customer level for a 52-week year to TER by bringing the figure to export level (applying loss factor of 8.3%) and adding an estimate of self-consumption.

**TX:** Transmission Connected

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