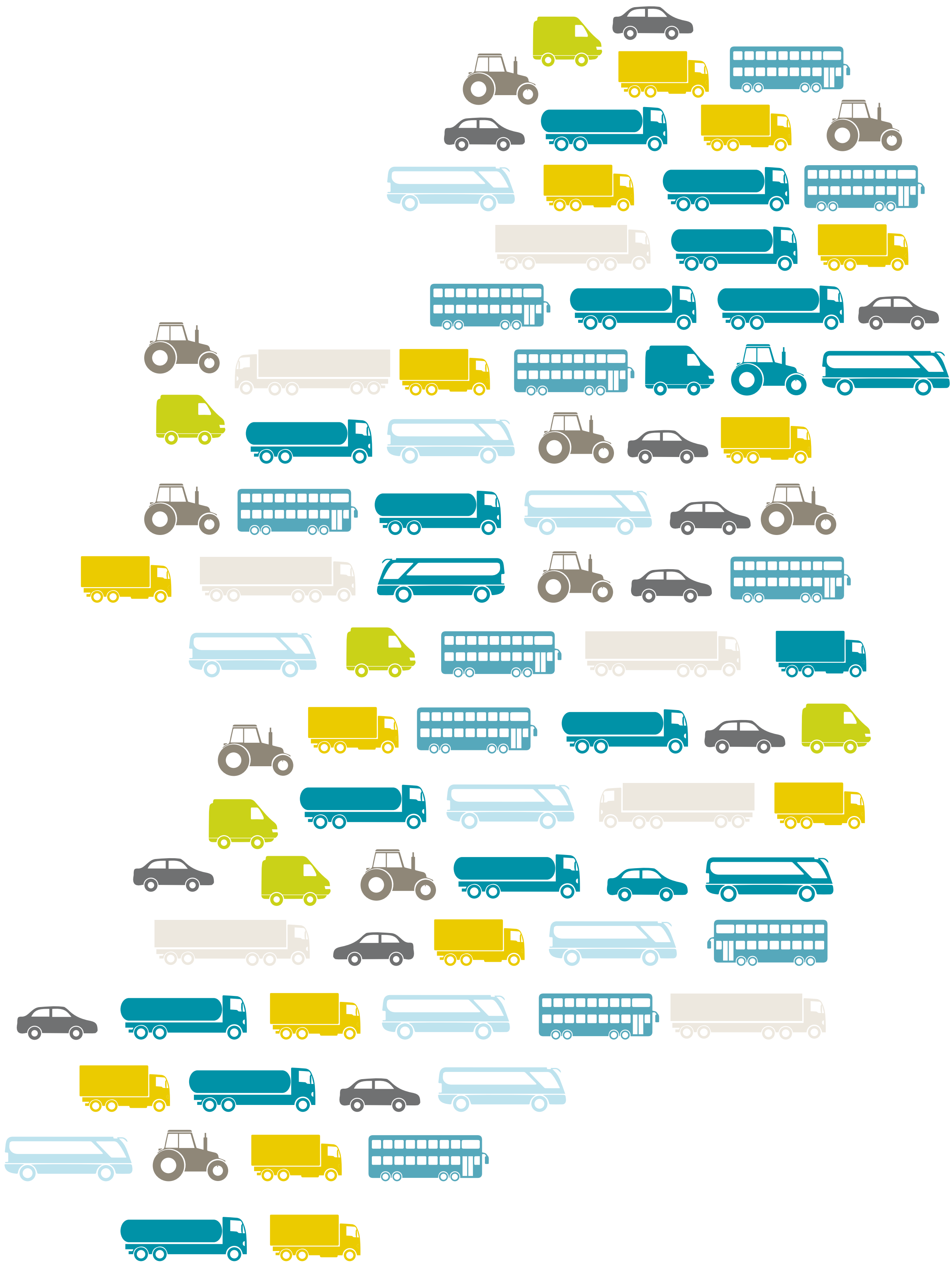
gaslink
Gas System Operator



Network Development Plan 2014

Contents

Data Freeze and Rounding – In order to complete the detailed analysis and modelling required to produce this document, the demand and supply scenarios were defined in March 2014, based on the most up to date information at the time.

In presenting the data obtained for publication in the Network Development Plan, energy values have been rounded to one decimal place, and aggregated growth/contraction rates are expressed as whole numbers to aid clarity. In certain cases, rounding may lead to slight variance in sum totals.

Disclaimer – Gaslink has followed accepted industry practice in the collection and analysis of data available. However, prior to taking business decisions, interested parties are advised to seek separate and independent opinion in relation to the matters covered by the present Network Development Plan and should not rely solely upon data and information contained therein. Information in this document does not purport to contain all the information that a prospective investor or participant in the Republic of Ireland's gas market may need.

1.

Foreword

In 2014 the Irish Government finalised the sale of the Energy Business of Bord Gáis Éireann[1] (BGE), including the Bord Gáis brand. The sale completed on 30th June 2014. Consequently, BGE has been renamed to Ervia, a multi-utility commercial semi state with responsibility for the national infrastructure associated with gas and water. This sale will also necessitate the restructuring of the BGE organisation.

As part of the restructuring the current TSO, Gaslink, will merge with Bord Gáis Networks and become a subsidiary of Ervia, known as Gas Networks Ireland (GNI). GNI will continue with the publication of the Network Development Plan (NDP) in 2015, as required under its network operator licence obligations.

The 2014 NDP covers the ten-year period up to 2022/23 and gives an overview on how the Irish gas network will operate during this period.

The purpose of this document is to set out our assessment of the future demand and supply position for the natural gas industry in the Republic of Ireland. The document also examines system operation and subsequent capital investment requirements.

We hope that you find it an informative and useful document. Your input is of great importance to us and we encourage you to provide feedback in order that we can continually add value to the information we provide on the status and future of natural gas in Republic of Ireland, we welcome feedback at info@gaslink.ie

We would like to acknowledge the contribution of the stakeholders in the process of preparing this document.

Aidan O'Sullivan
General Manager, Gaslink

[1] Bord Gáis Éireann, as System Owner, holds a licence relating to the ownership of the transportation system.

2.

Executive Summary

The Network Development Plan (NDP) provides a view of how the gas network will develop over a ten year period. It is based on existing supply and demand for gas, as well as moderate projections for growth in gas infrastructure and gas consumption. The ten year period facilitates the development and planning of the gas network, which can involve long lead times in the delivery of infrastructure projects.

The NDP is an annual document and is consistent with the European Ten Year Network Development Plan (TYNDP) published by European Network of Transmission System Operators for gas (ENTSOG) every two years.

The gas network continues to play a pivotal role in the Irish energy market and the Irish economy. Key to ensuring the flexibility required by electricity generation to cater for cycling of renewable energy will be a flexible gas network which can respond to the needs of customers. Increased flexibility is also required through the implementation of new European Network Codes and products such as Virtual Reverse Flow (VRF).

The gas network will play an essential role in facilitating the 40% renewable generation targets set by the Irish government for 2020.

In order to meet the required system flexibility, Bord Gáis Networks has been investigating a number of options to ensure a sustainable flexible gas network into the future. These studies will conclude over the next number of months which will outline the optimum solution to enhance operational flexibility at the Moffat[2] Entry Point.

In the interim, a short term network planning tool is being implemented, which will assist in response to the requirement for increasing flexibility and the challenges this presents to the operation of the network.

The twinning of the single 50 km section of Scotland remains a high priority. The project, identified as a project of common interest (PC1 5.2) would greatly enhance Ireland's security of supply and further integration with the European market, providing greater and more reliable access to European gas supplies, facilitating physical reverse flow at Moffat that would allow the European market access to existing and potential Irish gas supplies. Cross border cost allocation has been agreed between the regulatory authorities and the project will be submitted to European Union later this year for decision on grant funding from the Connecting Europe Facility.

The outlook regarding Republic of Ireland (ROI) gas demand is positive. Gas will continue to play a pivotal role in the Irish energy mix, despite the anticipated slight decline in annual gas demand by 2022/23. Peak day gas demand is expected to experience modest growth over the same period. This divergence is being driven exclusively by the power generation sector, as a result of increasing wind generation which is impacting on the running of gas fired plant in the Single Electricity Market (SEM); the effect is significant on an annual basis but negligible on winter peak days, as recent winters have demonstrated.

[2] The Moffat Entry Point is an offtake from the UK National Grid gas transmission system, located in south west Scotland.

This situation presents a considerable challenge to the Irish Energy market as a whole; despite the fall off in annual gas demand and the commercial challenges this presents, gas fired generation and upstream gas infrastructure will be essential in ensuring the secure supply of electricity during periods when it is most needed, i.e. cold weather events.

Bord Gáis Networks will continue to ensure that a resilient, robust and safe gas network is maintained to ensure security of supply to customers through appropriate efficient investment.

A key part to a sustainable and diverse gas network is innovation, Bord Gáis Networks has installed and commissioned the country's first fast fill compressed natural gas station at its Headquarters in Cork. This CNG station is refuelling the Bord Gáis Networks Natural Gas Vehicle fleet. Bord Gáis Networks are currently supporting a number of trials and will continue to develop the role of CNG in the transport sector.

Bord Gáis Networks are currently working with a number of parties regarding polices to facilitate the introduction of renewable gas to the network.

The Corrib gas field is anticipated to commence full commercial production in 2015, and will greatly enhance Ireland's security of supply, meeting approximately 75% and 40% of ROI forecasted annual and peak day gas demand in its first full year of production.

Further developments in the Irish gas market will see Great Island CCGT commencing commercial operation later this year, after the successful commissioning of the 45 km transmission pipeline in 2013, that will connect the plant to the existing gas network.

This pipeline has also provided for further development in the southeast region with a gas connection to the Industrial Development Agency (IDA) Belview site to the northeast of Waterford city in south Kilkenny, which is expected to be completed later this year.

The high level design stage of the National Smart Metering Programme is nearing conclusion and Bord Gáis Networks and other stakeholders are now preparing to commence the procurement phase of the programme.

Gaslink and Bord Gáis Network welcome new sources of gas supply, and as always, remain willing to discuss prospective projects with project promoters.

3.

Introduction

Great Island Power Station

Key Messages:

- 2013/14 gas demand is anticipated to be 9.5% below 2012/13 demands following a 0.7% decrease the previous year;
- Moffat Entry Point accounts for 95% of BGÉ system annual gas demand and 90% of system peak day gas demand in 2013/14; and
- EWIC Electrical Interconnector operated at full capacity during winter 2013/14, resulting in double the electrical imports on EWIC compared to the same period in 2012/13

The role of Gaslink, as the transmission and distribution system licence holder in Ireland, is to promote an open and competitive market. It is an independent subsidiary of Bord Gáis Éireann (BGÉ) in its organisation and decision making processes. Gaslink identifies all work necessary for the operation, maintenance and development of the transportation system, and instructs Bord Gáis Networks accordingly.

The NDP covers the 10 year period from 2013/14 to 2022/23. It is published by Gaslink, with the assistance of Bord Gáis Networks.

The NDP satisfies the requirements of both Condition 11 of Gaslink's Transmission System Operator licence and Article 22 of Directive 2009/73/EC of the European Parliament to produce a long term development plan.

The publication of the Network Development Plan also satisfies the requirements of Article 19 of the Gas (Interim) (Regulations) Act 2002, as amended by the European Communities (Security of Natural Gas Supply) Regulations 2007 (S.I. No. 697 of 2007). This requires the CER to publish a report outlining supply and demand in Ireland over the next seven years. Gaslink holds two licences from the Commission for Energy Regulation (CER) for the operation of the ROI transmission and distribution systems, which cover the following areas:

- Connection to the transmission and distribution systems;
- Transmission and distribution system standards;
- Operating security standards;
- Provision of metering and data services; and
- Provision of services pursuant to the Code of Operation (the "Code").

3.1 Investment Infrastructure

There is a continuous programme of works to ensure that the network compiles with relevant legislation, technical standards and codes. Equally, capacity limitations identified on the network and capital investment programmes are implemented to ensure continuity of supply to all customers.

The following are some of the significant programmes completed since the publication of the 2013 NDP, in addition to maintaining a rolling planned maintenance programme.

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Pressure regulating stations capacity investment:

- Cork Gas AGI, Co. Cork;
- Cadbury's AGI, Co. Dublin;
- Fairview AGI, Co. Dublin;
- Kilbarry AGI, Co. Waterford;

Pipeline investment:

- Santry to Eastwall transmission pipeline refurbishment, Co. Dublin;
- Waterford transmission pipeline refurbishment, Co. Waterford;
- Baunlusk to Great Island transmission pipeline, Co. Wexford; and
- Extension of the gas network to Tuam Co. Galway and Cootehill Co. Cavan.

Boiler Upgrades:

- Alexander Reid AGI, Co. Meath;
- Ardree AGI, Co. Kildare;
- Ballyconra AGI, Co. Kilkenny;
- Ballynaclose AGI, Co. Meath;
- Barnakyle AGI, Co. Limerick;
- Hollybrook AGI, Co. Wicklow;
- Kilshane AGI, Co. Dublin;
- Naas AGI, Co. Kildare; and

The following are rolling capital investment programmes to be completed over price control period:

- Aerial Marker Post Replacement; and
- Meter Replacement (Domestic and Industrial Commercial).

3.2 Historic Demand & Supply

3.2.1 NDP 2013 Forecast Demand and Actual 2013/14 Demand

The forecast annual demand published in last year's NDP for the current gas year, 2013/14, proved reasonably accurate, with a variance of less than 5% between it and the actual 2013/14 gas demand.

Higher levels of wind generation and a greater utilisation of EWIC for electricity imports, than what had been assumed in the forecast, were the primary factors in power generation gas demand being less than forecast. Milder weather conditions than what had been assumed was the primary reason for I/C and residential gas demand being less than forecast. Weather correcting actual demand results in a variance of less than 3% for both I/C and residential gas demands.

3.2.2 ROI Annual Primary Energy Requirement

The Sustainable Energy Authority of Ireland (SEAI) report that Ireland's Total Primary Energy Requirement (TPER) for 2012[3] fell by 7% compared to 2011.

Oil continued to dominate the 2012 TPER accounting for 46% of total energy demands, as shown in Figure 3.1. Gas accounted for 31% of 2012 energy demands, reflecting its role in electricity generation, process and heating use. Renewable generation maintained its share of TPER at 6%.

[3] SEAI Energy Balance figures for 2013 not available at time of writing

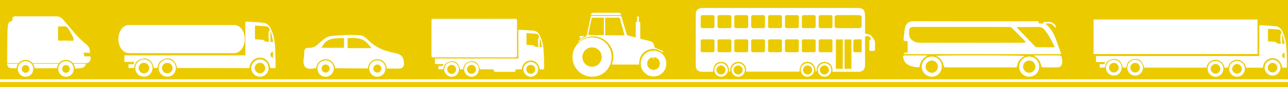
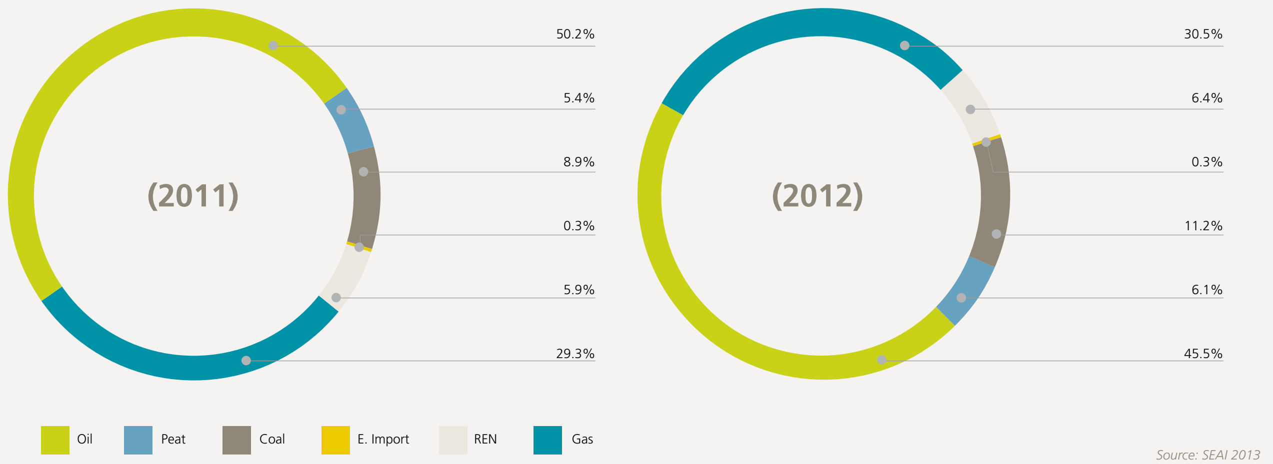


Figure 3.1: ROI TPER Analysis by Fuel (2011-2012)



Source: SEAI 2013

3.2.3 Historic Annual Gas Demand

This section refers to both BGE System Demand and ROI demand. BGE System Demand refers to the total demand transported through the BGE system, i.e. the combined demands for ROI, NI and IOM. ROI demand refers to ROI only and includes Inch storage injections where relevant[4].

Annual ROI gas demands for 2013/14 are anticipated to be 9.5% below 2012/13 demands following a 0.7% decrease the previous year, as shown in Figure 3.2. In the power generation sector, annual gas demand for 2013/14 is anticipated to be 10.1% below 2012/13 levels, following a 5.7% decrease the previous year. The I/C sector annual gas demand for 2013/14 is anticipated to be 4.6% below 2012/13 levels following 3.4% growth the previous year. Residential demand is anticipated to contract by 15.9% for 2013/14, following a growth of 12.1% in 2012/13.

The reduction in power sector gas demands can be attributed to:

- The continuing dominant position for coal fired generation on the Single Electricity Market (SEM)
- 2013/14 was the first year of commercial operation on the electrical East West Interconnector (EWIC) to full capacity. This resulted in a significant increase in net electricity imports from Great Britain to the SEM. Electricity imports on the EWIC in the 2013/14 year to date[5] were almost double those for the same period in 2012/13
- Wind powered generation on the SEM experienced growth of 16% from 2012 to 2013. Wind powered generation in the first 5 months of 2014 experienced 12.6% growth over the same period in 2013

The reduction in I/C and residential gas demands can be attributed to milder weather conditions in 2013/14.

[4] Inch storage injections are not included in the peak day forecast. Inch is assumed to be a source of supply on such days, when gas is withdrawn from storage.
[5] 1st October 2013 – 30th June 2014 at time of writing

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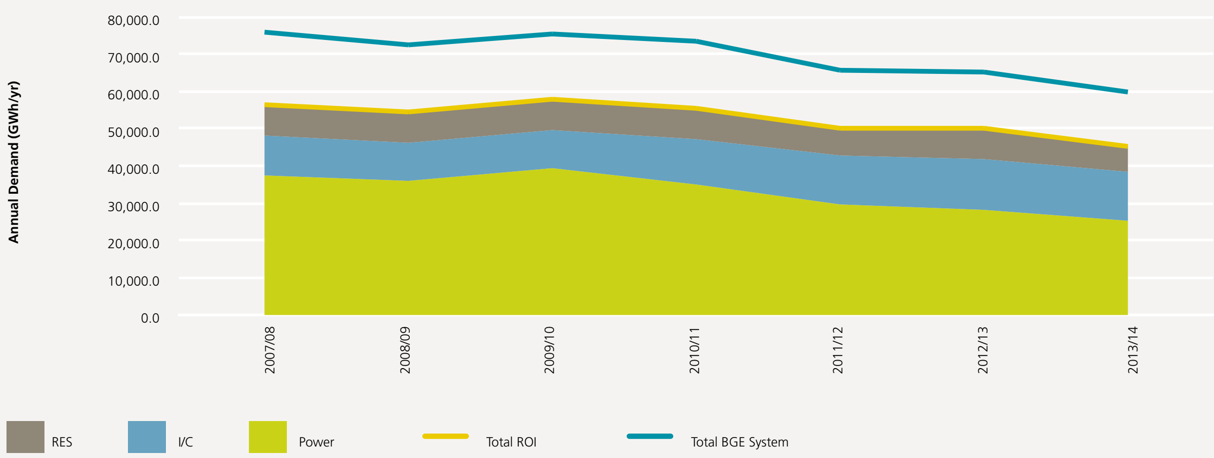
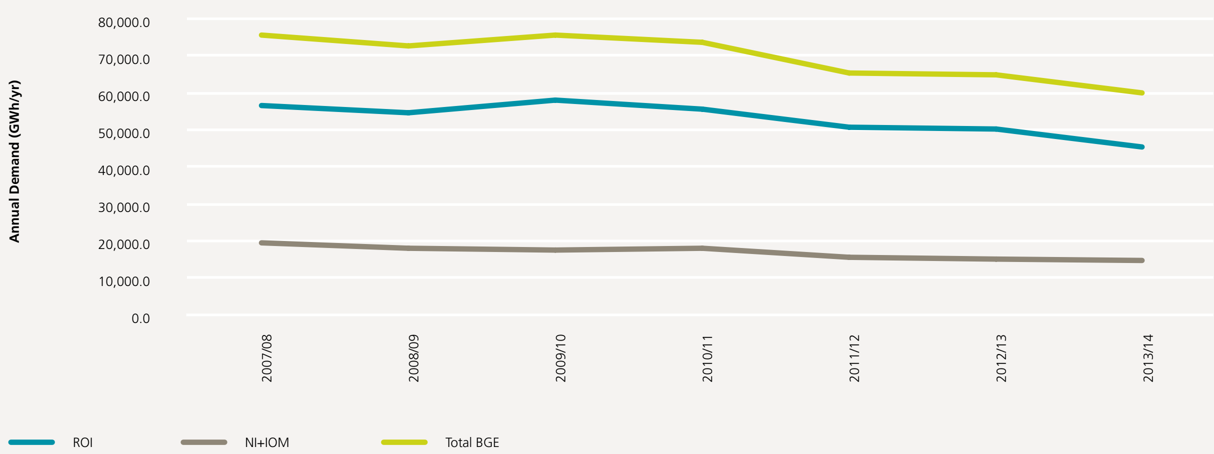
(continued)

Figure 3.2: Historic Annual Gas Demand



Total annual system gas demands for 2013/14 are estimated to be 8.2% below the previous year's gas demands. This reduction is comprised of a 9.5% decrease in ROI gas demand and a 3.6% decrease in Northern Ireland (NI) and Isle of Man (IOM) gas demands. The historic gas demand is presented in Figure 3.3.

Figure 3.3: Historic BGÉ System Gas Demand



3.2.4 Historic Peak Day Gas Demand

In 2013/14 peak day gas demand was 12% lower than the 2012/13 peak day gas demand, and was equivalent to the 2005/06 peak day demand. The reduction in the gas demand was driven primarily by a 14.9% reduction in the power generation sector combined with a 7.1% decrease in I/C gas demand, and a 9.7% decrease in residential gas demand when compared to the 2012/13 peak day. Figure 3.4 presents the historic trend in peak day gas demands.

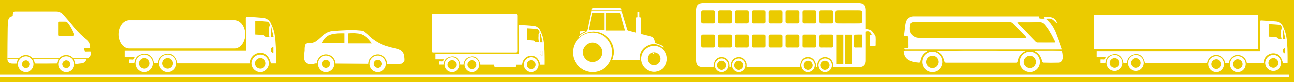
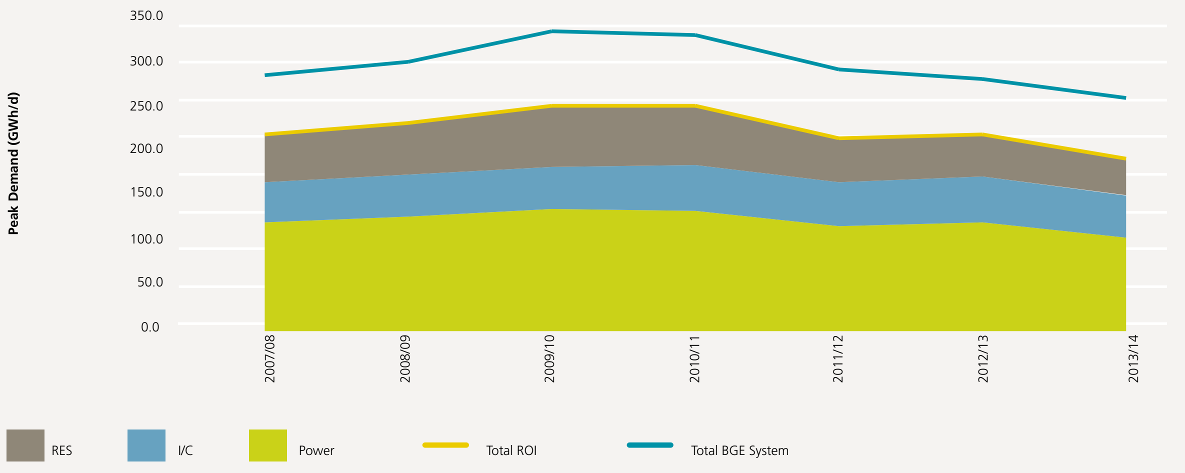


Figure 3.4: Historic ROI Peak Day Gas Demand



The BGÉ system[6] 2013/14 peak day gas demand was 7.5% below 2012/13 levels. The decrease was driven primarily by a 12.3% reduction in ROI peak day gas demands. The NI and IOM peak day gas demand was 8.8 % greater than 2012/13 levels.

3.2.5 Ireland's Weather

Based on a Degree Day (DD) comparison, the most recent winter was approximately 16% warmer than the previous year, 2012/13.

The coldest day in winter 2013/14, occurred in mid February, with an average temperature of 1.5°c, or a 14.0 DD; the equivalent day in 2012/13 occurred in late January with an average temperature of -1.5°c, or a 17.0 DD.

3.2.6 Wind Powered Generation[7]

The installed all-island wind generation capacity increased by 13.8% in 2013 from the previous year. In addition, monthly wind capacity factors published by EirGrid showed more favourable wind conditions in 2013 over 2012. As a result, an increase of 16% in total wind powered generation was recorded in 2013. Wind powered generation in the first 5 months[8] of 2014 experienced 12.6% growth against the same period in 2013. At the peak day for wind generation in winter 2013/14, daily wind powered generation accounted for 38.3% of the all-island daily electricity demand.

3.2.7 Electricity Interconnectors

There are two electrical interconnectors serving the island of Ireland – the East West Interconnector (EWIC) in ROI and the Moyle Interconnector in Northern Ireland. The net import capacity on the electrical interconnectors has increased as a result of the EWIC electrical interconnector commencing full capacity operation mid 2013. This has resulted in lower levels of thermal electricity generation than would have occurred in previous years.

The EWIC has been operating at full capacity since mid 2013, with the exception of some short maintenance outages. Prevailing market conditions on SEM and its UK equivalent, BETTA have resulted in a predominantly GB-IE flow on the EWIC since it commenced operation in late 2012, i.e. import of electricity from Great Britain. Figure 3.5 shows the historic flow profile[9] on the EWIC, with GB-IE imports shown as positive. Year to date[10] electricity imports on the EWIC for 2013/14 were almost double those for the same period in 2012/13.

[6] BGÉ System includes for gas supplies to ROI, Northern Ireland and Isle of Man.
[7] Calculations carried out by BGÉ employed wind generation data from EirGrid http://www.eirgrid.com/operations/systemperformancedata/
[8] Based on 2014 year-to-date EirGrid published wind generation data available at time of writing
[9] Data from EirGrid http://www.eirgrid.com/eastwest/eastwestflowgraph/
[10] 1st October 2013 – 30th June 2014 at time of writing

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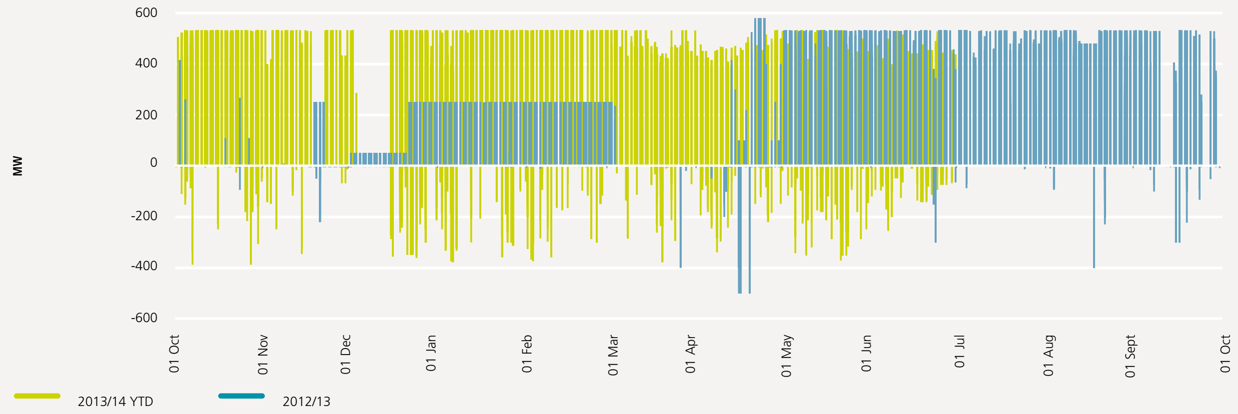
The resulting displacement of conventional thermal power generation is approximately equivalent to the typical energy production of a mid-merit CCGT plant. GB-IE import levels on the EWIC, and the associated thermal power displacement on the SEM, have reduced slightly since March 2014 as a result of an extension to the counter-trading facilities on the electricity interconnectors[11].

Figure 3.5: Historic Electricity Flow on the East West Interconnector

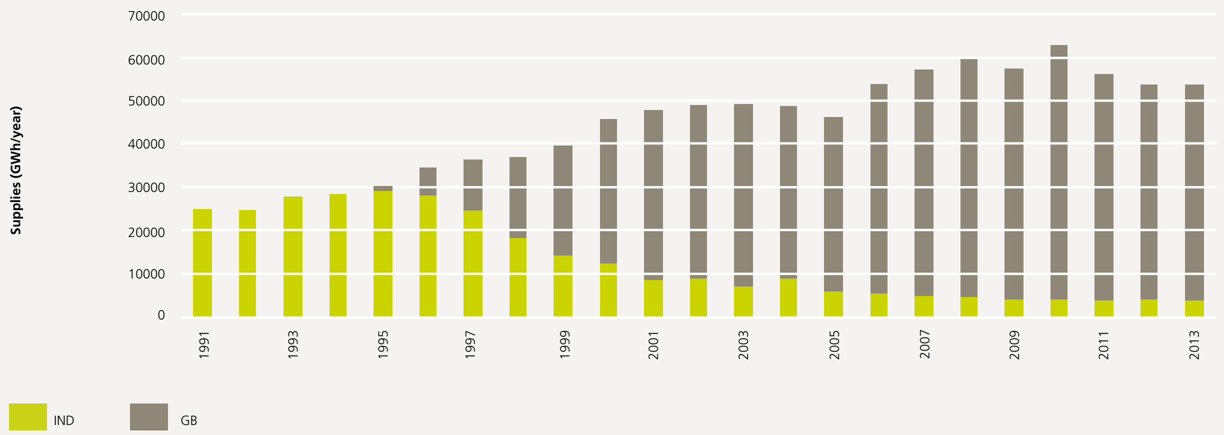


A fault occurred on the north cable of the 500MW Moyle Interconnector in June 2012, causing it to cease operation. The Moyle Interconnector continues to operate at 250 MW transfer capacity (half the full capacity of the interconnector). New cables are being procured and are expected to be commissioned in late 2017 from which point full capacity (500MW[12]) will be restored.

3.2.8 Historic Gas Supply

The Moffat Entry Point is anticipated to meet 95% of annual BGÉ system demands and 93% of ROI demands for 2013/14, with Inch[13] satisfying the remaining gas demands. During 2012/13 the Moffat Entry Point accounted for 94% of system demands and 92% of ROI demands. The change in the percentage of BGE System and ROI demand met through Moffat is attributed to the reduction in gas demand combined with only a slight reduction in the gas supply through the Inch Entry Point. Figure 3.6 shows historic ROI gas supplies.

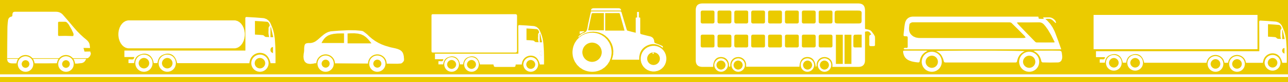
Figure 3.6: Historic Annual Indigenous Gas Production and Great Britain (GB) Imports



[11] Following a request by the CER and UREGNI, EirGrid examined and extended the counter-trading facility on the interconnectors to assist in the management of Dispatch Balancing Costs. *http://www.eirgrid.com/media/InformationNoteExtensionofTSOcounter-tradingfacilitiesforDBCmanagement.pdf*

[12] Update on expected return to full capacity was provided to Gaslink in June 2014, subsequent to the NDP data freeze. Consequently the demand forecast presented in this document assumes Moyle operating at 50% capacity for the forecast period.

[13] The point of entry to the BGÉ system from the Kinsale gas storage and production field off the south coast of Ireland.



In 2013/14 90% of peak day BGÉ System gas demands were met through the Moffat Entry Point, with the remaining 10% supplied through the Inch Entry Point. The Moffat Entry Point also met 90% of peak system gas demands in 2012/13.

The Moffat Entry Point met 86% of ROI peak day gas demands in 2012/13, an decrease from 88% in 2012/13. Figure 3.7 shows the sources of BGÉ system peak day gas supplies. Figure 3.8 shows the sources of ROI system peak day gas supplies.

Figure 3.7: BGÉ System Peak Day Gas Supplies

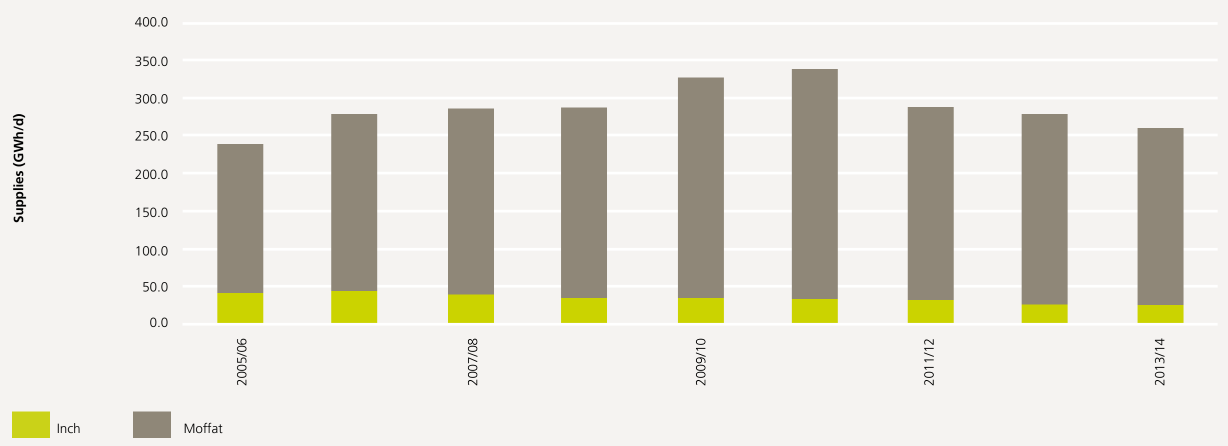
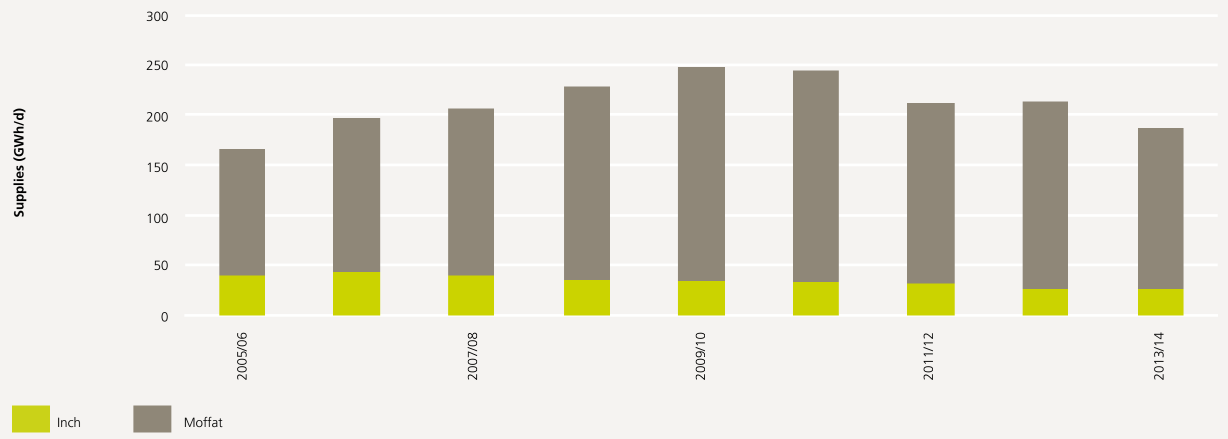


Figure 3.8: ROI System Peak Day Gas Supplies



4.

Gas Demand & Supply Forecast

Corrib Gas Platform Flaring
Source: Shell E&P Ireland Ltd

Key Messages:

- Annual ROI gas demand is anticipated to decrease by 2% by 2022/23;
- Peak day ROI gas demand is anticipated to increase by 6% over the same period;
- The divergence in the annual and peak gas demand forecast is primarily as a result of the impact of wind generation on the operation of gas fired plants in the SEM
- Moffat Entry Point continues to supply over 94% of the annual BGÉ system gas demands to 2014/15; and
- Corrib gas field is anticipated to commence full commercial operation in 2015, and meet 58% and 25% of annual and peak day BGÉ system demands in 2015/16.

4.1 Gas Demands

This chapter presents an overview of the gas demand forecasting process, and the outlook for gas demand and corresponding gas supply for the period 2014/15 to 2022/23. The NDP forecasts future gas demands by examining the development of individual power, I/C and residential sector gas demands.

Gas demand refers to both BGE System Demand and ROI demand. BGE System Demand refers to the total demand transported through the BGE system, i.e. the combined demands for ROI, NI and IOM. ROI demand refers to ROI only and includes storage injections where relevant[14].

4.1.1 Last Year's Forecast versus actual 2013/14 demand

The forecast annual demand published in last year's NDP for the current gas year, 2013/14, proved to be reasonably accurate, with a variance of less than 5% between it and the actual 2013/14 gas demand.

Higher levels of wind generation and a greater utilisation of EWIC for electricity imports, than what had been assumed in the forecast, were the primary factors in power generation gas demand being less than forecast. Milder weather conditions than what had been assumed was the primary reason for I/C and residential gas demand being less than forecast. Weather correcting actual demand results in a variance of less than 3% for both I/C and residential gas demands.

4.1.2 Demand Forecasting, Network Development and Tariff Setting

The demand forecast modelling approach used in producing the NDP generates a ten year forecast for the power generation, I/C and residential sectors, based on a series of assumptions[15] that impact demand for each of these sectors. The primary demand assumptions by sector are summarised in table 4.1.

[14] Inch storage injections are not included in the peak day forecast. Inch is assumed to be a source of supply on such days, when gas is withdrawn from storage.
[15] A number of external data sources are referenced when generating future gas demands along with additional sector specific assumptions. Details of these assumptions are in Appendix 2.

4.

Gas Demand & Supply Forecast

(continued)

Table 4.1: Key Demand Forecasting Assumptions

Power Generation	I/C	Residential
• Electricity demand • Available Generation Capacity • Energy/Fuel prices	• Gross Domestic Product • New connections • Energy Efficiency	• New connections • Disconnections • Energy Efficiency

A number of forecasts are produced for each year, relating to the type of demand day, namely;

- The 1-in-50 winter peak day, i.e. a severe winter peak day that is statistically likely to occur once every fifty years
- An average winter peak, i.e. a winter peak day that would occur in a typical winter (most years)
- A summer minimum day, i.e. the lowest demand day of the year

The demand forecast is a primary input for the analysis that is undertaken to assess the adequacy of the transmission network and associated assets. The network analysis identifies the areas of the network that will require future development/ investment, and as such, all aspects of it must be highly reliable and robust, particularly the peak day demand forecast.

Two separate 1-in-50 peak day events occurred in winter 2009/10 and winter 2010/11. The 1-in-50 peak demand forecasts that were produced for each of the two winters proved to be highly accurate, with forecasted demands and actual demands varying by less that 3% on both occasions, clearly demonstrating that the demand forecasting methodology/process is reliable and robust.

Table 4.2: 1-in-50 Peak Day Forecasting Assumptions

Year	Actual (GWh/d)	Forecast (GWh/d)	Variance (%)
2009/10	253	246	2.8
2010/11	251	249	0.8

The average year peak day forecast is also considered for additional analysis that may be undertaken to assess the adequacy of the network to meet peak flows during a typical winter. The summer minimum day forecast is also used to determine issues such as the Moffat low flow issue detailed in section 9.4.

In addition to the daily forecasts an annual gas demand forecast is produced. This forecast is not used for network planning purposes; its primary purpose is to identify the level of coupling between peak day gas demand and annual gas demand (see section 4.1.3.1), and the factors that impact this coupling.

The demand forecasting methodology employed for the NDP is also used for generating forecasts for commercial planning purposes. Both the peak day and annual demand forecasts are inputs to the annual tariff setting process. The annual demand forecast forms the basis for the commodity element of the Tariff, which has a relatively low weighting with respect to the overall tariff, i.e. 10%.

The average year peak day forecast is one of the inputs used for generating the (commercial) capacity bookings forecast, which accounts for 90% of the overall Tariff. The peak day forecast is adjusted to take account of commercial behaviour, and as such, the resultant capacity bookings forecast may vary significantly from the original average year peak day forecast, particularly for the power generation sector.

It's important to note, while the there has been some variation between the capacity forecast used to set the Tariff and actual out-turn (capacity bookings), the original peak day forecast remains accurate.

4.1.3 The Demand Outlook

The latest forecasts illustrated in Figures 4.1 and 4.2 indicate a significant divergence between the ROI annual gas demand and ROI peak day gas demand. Annual gas demand is anticipated to decrease whereas peak day gas demand is expected to increase.

Figure 4.1: ROI Peak Day and Annual Gas Demand Forecast

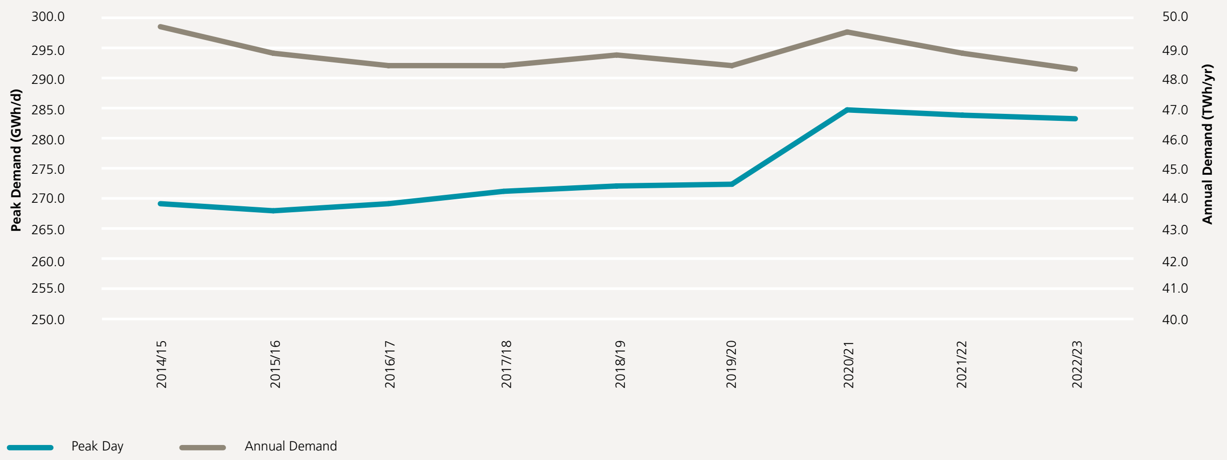
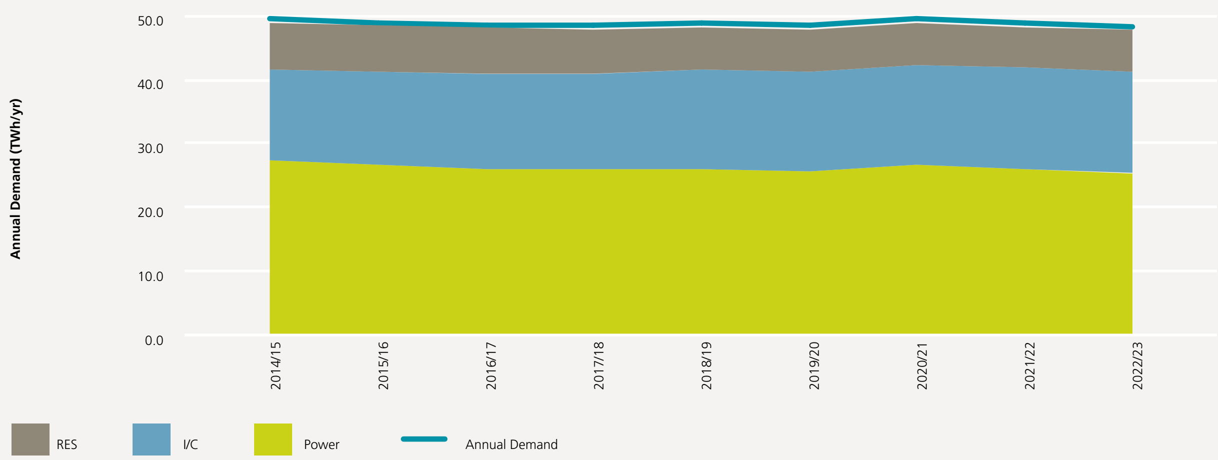


Figure 4.2: Annual ROI Gas Demand Forecast



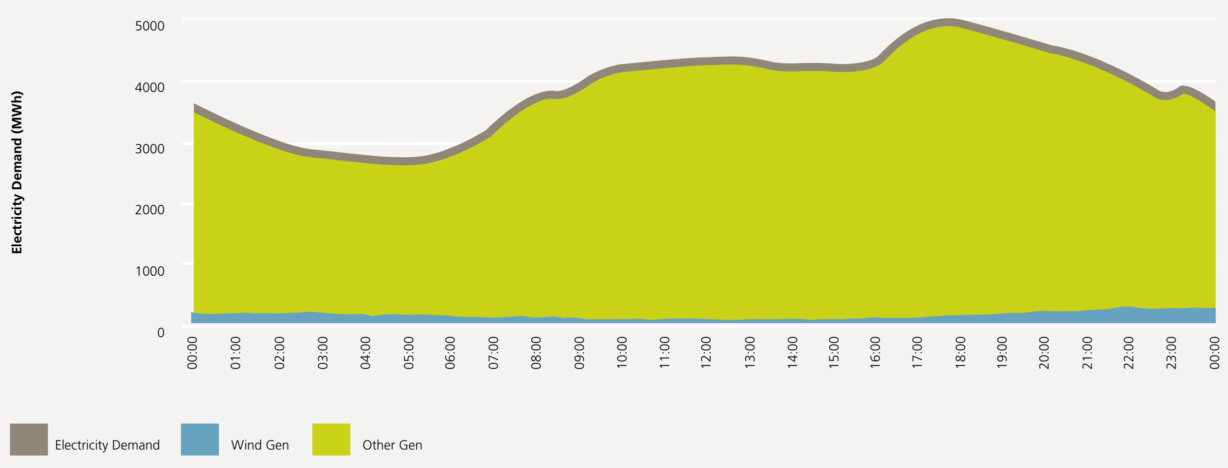
This divergence is been driven exclusively by the power generation sector; annual and peak day gas demand for the I/C and residential sectors are anticipated to experience modest growth and contraction respectively.

The divergence in power generation's annual and peak day gas demand is as a result of wind generation's impact on the operation of gas fired plant in the SEM and consequently power generation gas demand. Annual power generation gas demand is expected to continue decreasing in line with increasing wind generation, which is displacing gas fired generation in the SEM.

However, wind generation is assumed to have little impact on the winter peak day. Recent winters have proven that there is limited wind generation available during cold weather peak demand periods. Consequently, there's a high dependency on thermal generation, particularly gas fired generation, to meet high the levels of electricity demand that occur during such cold weather periods. On this basis, peak day gas demand is anticipated to grow in line with increasing electricity demand forecast and gas fired plant's increasing penetration in the merit order.

Figure 4.3 illustrates the level of dependency the SEM would have on conventional (other) generation during severe weather events, despite a high level of wind generation capacity. The grey line illustrates the quarter hourly electricity demand that occurred on the 21st December 2010, during a period of severe weather and peak energy demands. The blue and green areas represent wind generation and other generation that would be required to meet the electricity demand. The blue area, wind generation, is based on the wind capacity factors observed on the 21st December '10, averaging 3.3%, combined with the forecasted wind generation capacity for 2023, 3,986 MWh. The green area, Other Generation, refers to thermal generation and electricity imports (assuming EWIC is importing) that would be required to provide the balance of supply.

Figure 4.3: Peak Day Electricity Demand and Generation 2010



This graph demonstrates that in the event of weather conditions similar to those in 2010 reoccurring in the future, the SEM would be highly dependent on 'Other Generation', particularly gas fired generation, to meet electricity demand, despite nearly 4,000 MWh of wind generation capacity being installed on the system.

This situation presents a considerable challenge to the Irish energy market as a whole. Despite the continuing fall-off in annual gas demand, and the commercial challenges this presents, gas fired generation and the upstream gas infrastructure will be essential in ensuring the secure supply of electricity during the periods when it is most needed, i.e. cold weather events.

4.1.3.1 Annual

Annual gas demand is anticipated to decrease by 2% by 2022/23. The annual gas demand outlook for each of the sectors can be summarised as follows;

- Power generation gas demand is anticipated to contract by 7% primarily due to increasing wind generation.
- I/C gas demand is anticipated to grow by 11% in line with new connection numbers and forecast economic (GDP) growth
- Residential gas demand is expected to contract by 13% primarily as a result of increasing energy efficiency

4.1.3.2 Peak Day

Peak day gas demand is anticipated to increase by 6% by 2022/23. The peak gas demand outlook for each of the sectors can be summarised as follows;

- Power generation gas demand is expected to increase by 11% primarily due to the increase in electricity demand forecasts and the assumed fall off in peat fired generation[16], which gas fired generation is anticipated to replace, thus increasing its penetration in the merit order.
- I/C gas demand is anticipated to grow by 13% in line with new connection numbers and forecast economic (GDP) growth
- Residential gas demand is expected to contract by 13% primarily as a result of increasing energy efficiency

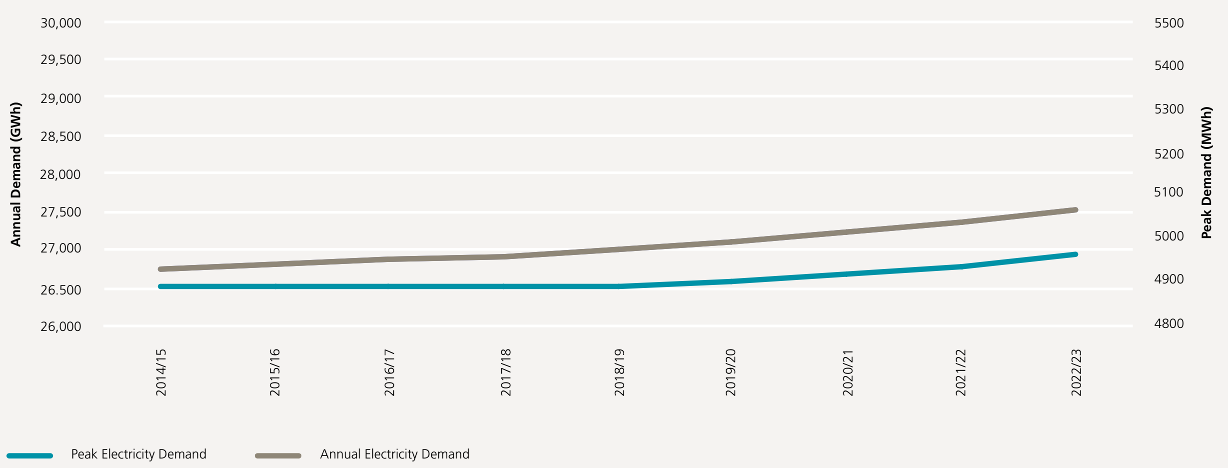
4.1.4 Demand Forecast Assumptions

This section details the main assumptions that impact the gas demand for each of the sectors.

4.1.4.1 Power Generation

The latest EirGrid / SONI electricity demand forecasts[17], illustrated in Figure 4.4, indicate all-island electricity demand is anticipated to experience slight growth ranging from 0.1% to 0.6% per annum.

Figure 4.4: ROI Forecast Electricity Demand



The following summarises the main assumptions regarding the changes in the SEM generation portfolio, as per the EirGrid / SONI All-Island Generation Capacity Statement 2014-2023:

- Wind generation is anticipated to increase to 3,986 MW and 1,780 MW in ROI and NI respectively, by 2022/23
- Gas fired generation capacity is expected to increase by approximately 630 MW[18] in the ROI and decrease by 510 MW[19] in NI
- LSFO generation is expected to decrease by approximately 800 MW with the closure of Tarbet (from 2021) and Great Island (from 2015) oil fired plants.

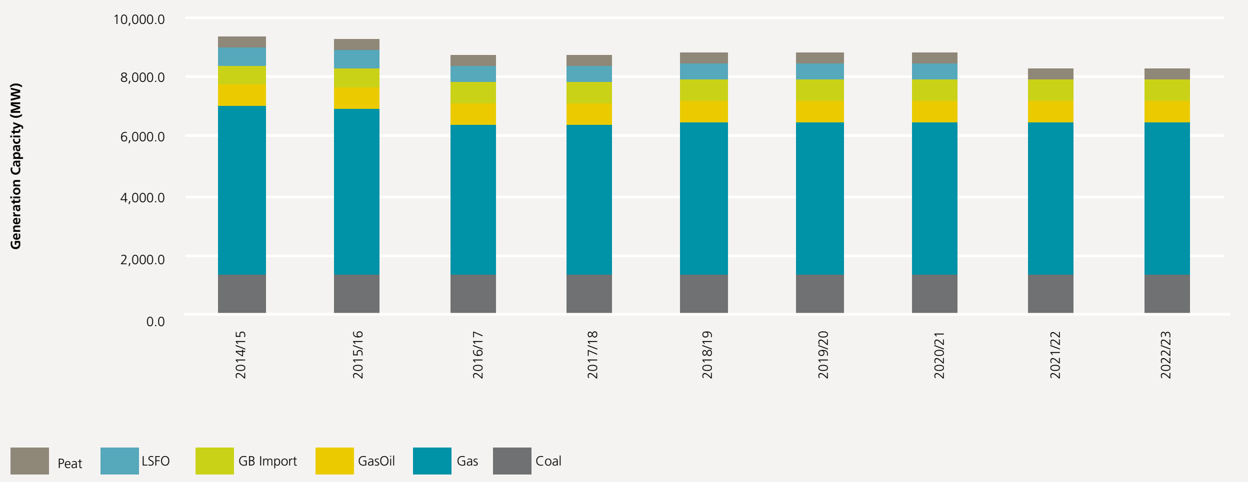
[16] It is assumed that peat fired generation will decrease in line with the expiration of the PSOs the peat generators currently receive.
[17] EirGrid Low Electricity Demand Forecast per All-Island Generation Capacity Statement 2014-2023 was used in this NDP demand forecast. Had the EirGrid Median Electricity Demand Forecast been used, the resulting gas demand forecasts would be higher for both annual and peak demand.
[18] Great Island CCGT (2014), 430 MW, plus two OCGTs (2018), 196 MW
[19] Three units at Ballylumford are anticipated to cease operation after 2015

The outlook to 2023 regarding the merit order in the SEM, as per the output of the Bord Gáis Networks Power Generation gas demand forecasting model, is as follows:

- Renewables are assumed to be priority despatch and will meet 40% of generation by 2023.
- Coal fired plant is anticipated to continue providing base-load generation over the forecast period
- Peat fired generation is anticipated to fall-off in-line with the expiration of the PSOs that the peat fired stations currently receive
- The electricity interconnectors, EWIC and Moyle[20], are anticipated to be net importers of electricity and would be expected to be importing at full available capacity on peak days
- Gas fired plant is anticipated to primarily meet the balance of electricity demand

Figure 4.5 illustrates the anticipated level of generation by fuel for thermal plant in the SEM, as per the EirGrid / SONI All-Island Generation Capacity Statement 2014-2023.

Figure 4.5: Single Electricity Market (SEM) Thermal Generation Mix



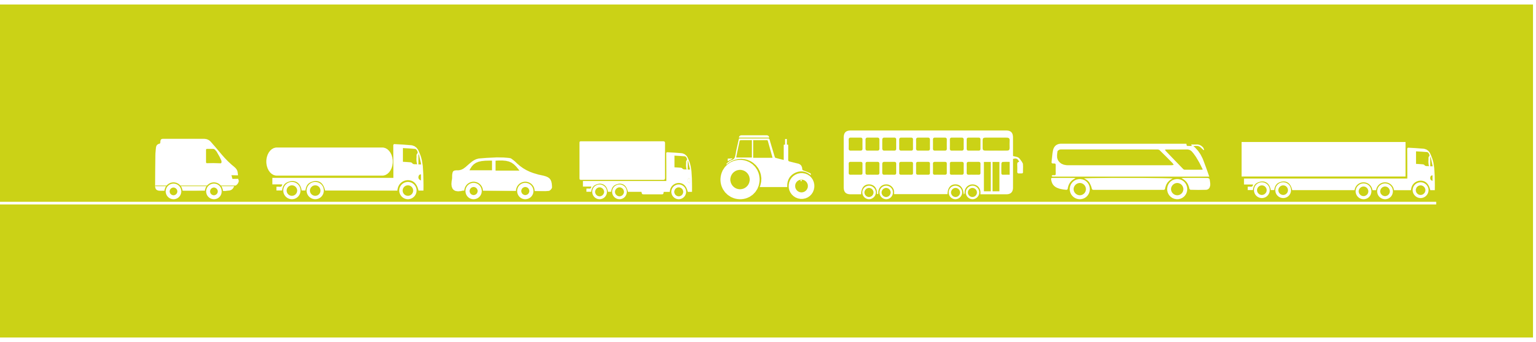
4.1.4.1.1 EWIC & Gas Demand

A sensitivity analysis included in this year's NDP to determine the impact that a variation in EWIC flows would have on 1-in-50 peak day gas demand, i.e. no electricity imports and electricity exports; the base case assumes that EWIC will be importing at full capacity on a 1-in-50 peak day.

The analysis indicates that the 1-in-50 peak day gas demand would increase by approximately 20 GWhd when there are no EWIC electricity imports and approximately 33 GWhd when EWIC is exporting.

Analysis also indicates that in the event of no EWIC imports, or EWIC exports, the capacity limit of the Moffat Entry Point would be reached by 2019/20 on the winter peak.

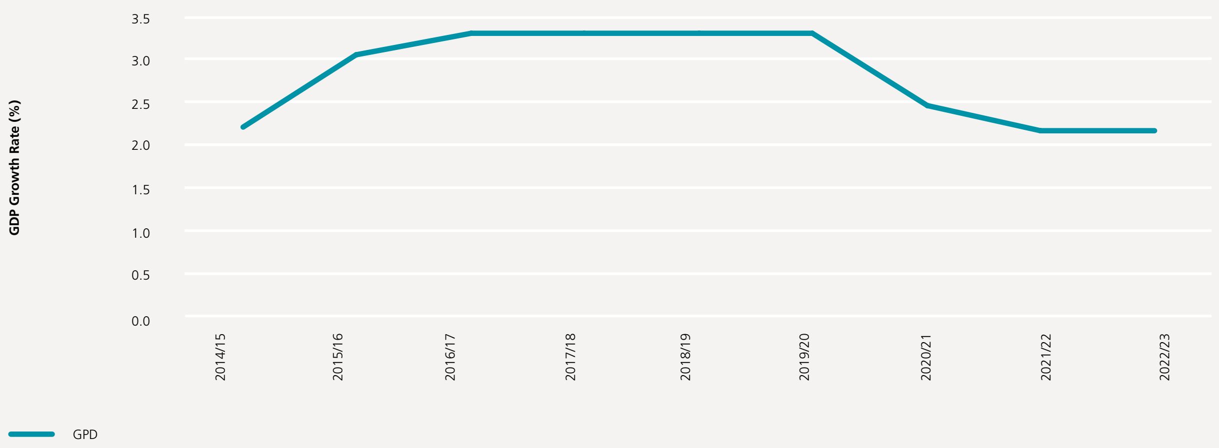
[20] At the time of the NDP data freeze, Moyle was assumed to operate at 50% of its maximum capacity for the entire forecast period, in line with the best available information at that time. Gaslink were recently advised that Moyle may return to full operation from 2017 which will be considered in future development plans.



4.1.4.2 Industrial and Commercial

Industrial and commercial gas demand is assumed to continue to increase in line with anticipated connection numbers and forecast Gross Domestic Product (GDP) as appropriate. Figure 4.6 presents the GDP growth rate assumptions over the forecast period. GDP forecasts take account of the latest Economic and Social Research Institute (ESRI) Quarterly Economic Commentary, Central Bank Bulletin and the Organisation for Economic Cooperation and Development (OECD) Economic Outlook combined with further long range economic forecasts[21]. Strong growth is also expected in the export led sector increasing I/C gas demand in later years.

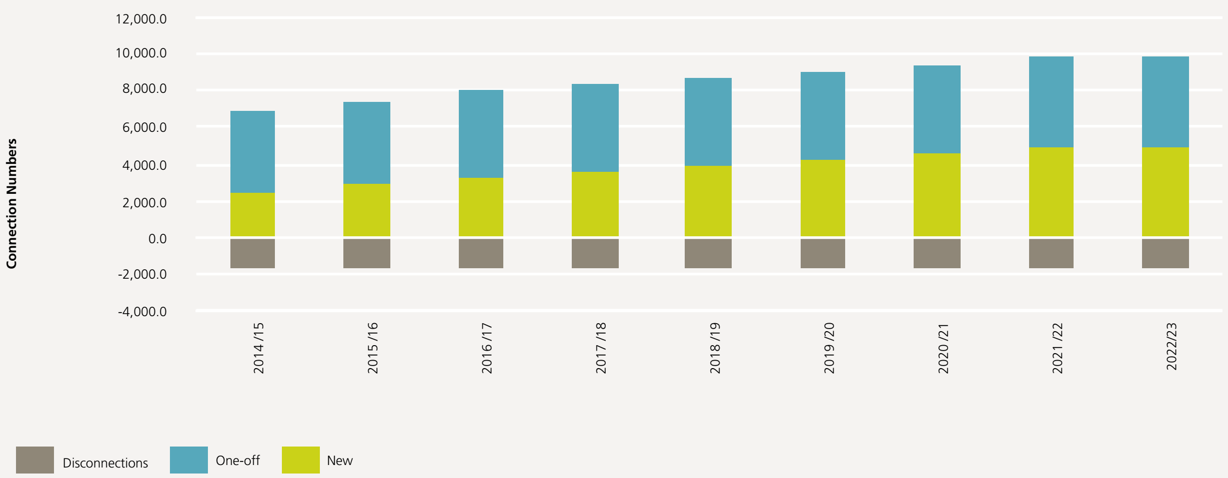
Figure 4.6: GDP Assumptions



4.1.4.3 Residential

The forecast of new residential customer numbers is shown in Figure 4.7. It is assumed that residential numbers will grow slowly over the initial period, increasing to over 8,200 additional connections by 2022/23.

Figure 4.7: Residential Connection Numbers



[21] External sources were used as a benchmark for validating the GDP assumptions

4.

Gas Demand & Supply Forecast

(continued)

4.1.4.4 Energy Efficiency

Energy efficiency savings impacting on I/C and residential gas demands are derived from the National Energy Efficiency Action Plan 2 (NEEAP), published in February 2013. The combined gas demand for the I/C and residential sectors is anticipated to reduce by approximately 1.5%[22] annually (up to 2020) as a result of increasing energy efficiency.

Assumptions relating to energy efficiency savings are further outlined in Appendix 3.

4.1.4.5 Transport

The demand forecast's generated for this year's NDP include a new demand sector, Transport. The transport forecast relates to the anticipated development of Compressed Natural Gas (CNG) within the transport industry through the promotion of Natural Gas Vehicles (NGVs).

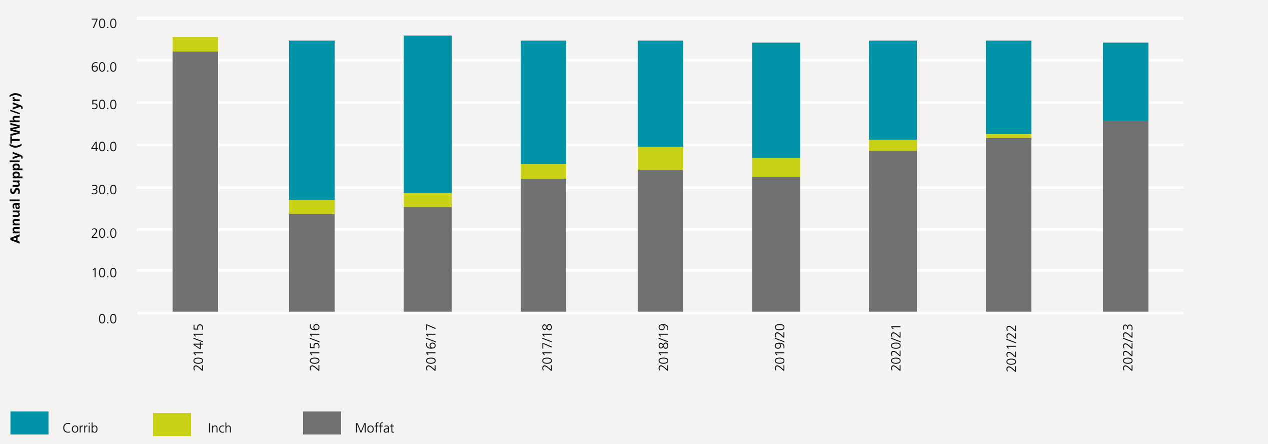
Bord Gáis Networks are currently targeting at least 5% of the commercial transport and 10% of the bus market in Ireland will be operating on CNG or Biogas by 2024. Please refer to section 10.5 for further detail on Bord Gáis Networks' plans regarding CNG and NGVs.

4.2 Gas Supply

Figure 4.8 presents the forecast BGÉ system[23] annual gas supply for the period to 2022/23. The Moffat Entry Point continues to supply over 94% of the annual BGÉ system gas demands to 2014/15.

The Corrib gas field is expected to meet 58% of annual BGÉ system demands in its first full year of commercial production, 2015/16, with the Inch and Moffat Entry Points providing the remaining 5% and 37% respectively. The remainder of the forecast sees Corrib gas supplies decline to approximately 50% of initial peak production levels. The anticipated reduction in Corrib and Inch gas supplies should re-establish the Moffat Entry Point as the dominant supply point from 2017/18, supplying 71% of annual BGÉ system demands by 2022/23.

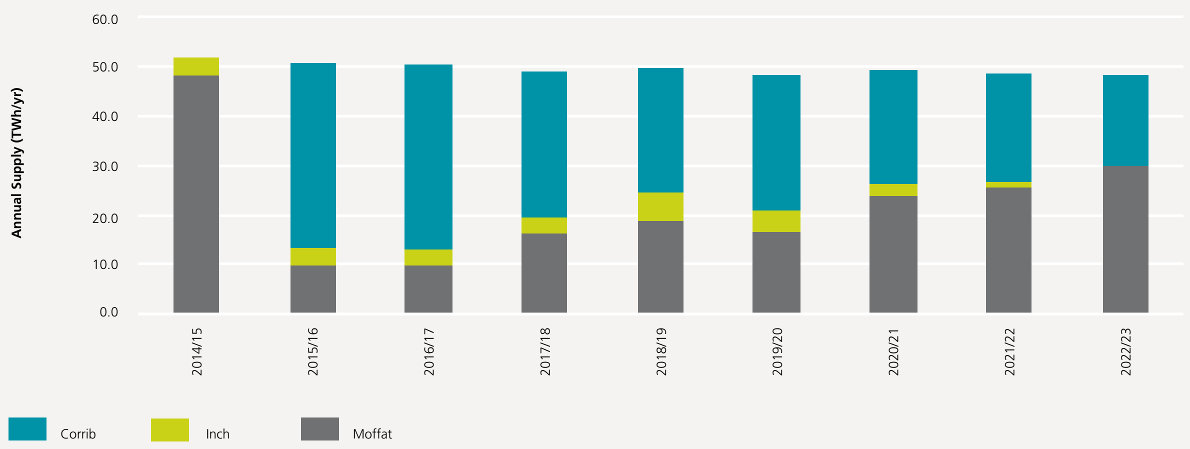
Figure 4.8: Annual BGÉ System Gas Supply Forecast



[22] Based on current gas demand for the I/C and residential sectors.
[23] BGÉ system supply is equivalent to the total gas supplied at the Moffat, Inch and Bellanaboy Entry Points, including all supplies for ROI, NI and IOM.

Figure 4.9 presents the forecast ROI system[24] annual gas supply for the period to 2022/23. Considering ROI system gas demand, the Moffat Entry Point will supply over 93% of the annual demand to 2014/15. The Corrib gas field is expected to meet 74% of annual ROI demands in its first full year of commercial production, 2015/16, with the Inch and Moffat Entry Points providing the remaining 7% and 19% respectively. Following the forecast decline in Corrib gas supply through the following years, the Moffat Entry Point should re-emerge as the dominant ROI system supply point from 2020/21, supplying 62% of annual ROI system demands by 2022/23.

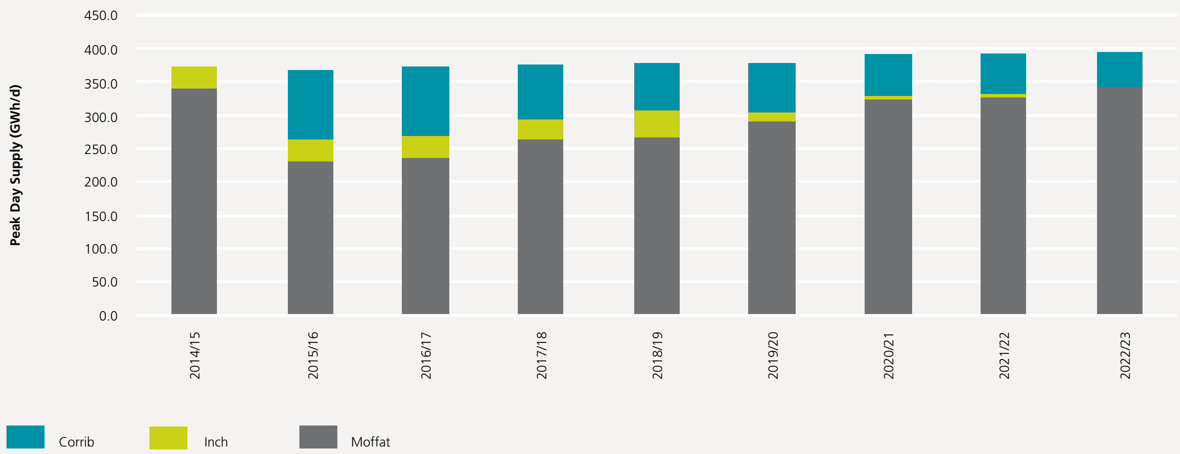
Figure 4.9: Annual ROI System Gas Supply Forecast



The 1-in-50 peak day BGÉ system peak day gas supply profile is presented in Figure 4.10. The Moffat Entry Point continues to provide approximately 95% of BGE system gas demands and nearly 90% of ROI gas demand to 2015/16. The Corrib gas field is anticipated to supply nearly 40% of ROI peak day gas demand in 2015/16 and Inch is expected to provide 12%. The Moffat Entry Point is expected to meet nearly 50% and 63% of ROI demand and BGÉ system demands respectively in 2015/16. Moffat is anticipated to revert to its current position by 2022/23, when it's forecasted to meet 82% and 87% of ROI and BGÉ system demands respectively. The current gas supply outlook highlights the critical role of the Moffat Entry Point throughout the forecast period.

[24] ROI system supply is equivalent to the total BGÉ system supply, with the supply for NI and IOM netted off the Moffat Entry Point.

Figure 4.10: 1 in 50 Peak Day Gas Supply Forecast



4.2.1 Moffat

The Moffat Entry Point continues to function as the largest source of gas supply to the BGÉ transmission system and is forecast to maintain this position into the future. It has a current technical capacity of 31 mscm/d (342 GWh/d) and supplies gas to ROI, NI and IOM. It has reliably met the systems energy demand requirements and ensured security of supply for Ireland since the construction and commissioning of IC1 in 1993. This connection to the GB National Transmission System (NTS) provides access to global energy markets and facilitates Ireland's participation in an integrated European energy market.

4.2.2 Celtic Sea Gas Storage

The Kinsale storage facility is operated by PSE Kinsale Energy Limited (KEL) using the depleted Southwest Kinsale gas field. It currently has a working volume of c. 230 mscm (2,472 GWh), which is equivalent to approximately 5% of Ireland's annual gas consumption in 2013/14. It has a maximum withdrawal rate of 2.7 mscm/d (29.3 GWh/d) and a maximum injection rate of 2.55 mscm/d (27.6 GWh/d). It operates as a seasonal storage facility.

KEL has informed the CER that, as gas production gradually declines, the existing storage operations will not be economic on a standalone basis without further development. KEL indicated that existing storage operations may cease in 2017/18, thereafter a blowdown period will begin, during which injection operations will cease and the cushion gas will be produced in the years from 2018/19 to 2021/22. It is anticipated that in such a scenario gas will be supplied from the Inch Entry Point during both winter and summer periods.

KEL has also advised that storage activities may continue beyond these dates subject to market conditions. KEL is presently determining the commercial feasibility of the expansion of the Southwest Kinsale storage facility which would increase the working volume to 400 mscm and deliverability to 3.7 mscm/d. It has been noted that the economic viability of the existing storage facility and the proposed expansion is linked to that of its gas production operations.

4.2.3 Corrib Gas

Construction of the onshore phase of the Corrib gas pipeline, which includes a 4.9 km tunnel to carry the gas pipeline under Sruwaddacon Bay, was completed earlier this year. Construction of the onshore terminal is virtually complete and commissioning of the Corrib infrastructure is scheduled to commence in Autumn 2014.

First commercial gas supply from Corrib is expected to flow by mid 2015. Table 4.3 shows the forecast maximum daily supply from Corrib.

For planning purposes, the NDP forecast assumes that the facility may not be operational during the peak winter period of 2014/15, which may occur during the facilities commissioning period and hence assumes first commercial production from October 2015. As per previous development plans, the impact of one year sensitivity is also assessed, where the facility is assumed to commence full operation October 2016, should any delays arise.

Table 4.3: Corrib Forecast Maximum Daily Supply

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Daily Supply (mscm/d)	9.9	9.9	7.8	6.6	7.2	6.1	5.8	4.9	4.3
Daily Supply (GWh/d)	103.1	103.1	80.7	69.0	74.8	63.5	60.5	50.6	45.0

4.2.4 Shannon LNG

Shannon LNG have indicated the earliest possible start date of 2018 for commercial operation, assuming a resolution to a number of uncertainties and delays. Shannon LNG has received planning permission for both its proposed liquefied natural gas (LNG) terminal near Ballylongford in Co. Kerry, and for the associated transmission pipeline that will deliver the gas into the ROI transmission system. It is indicated that the terminal would be developed on a phased basis:

- The initial phase will involve the construction of an LNG storage tank(s), and re-gasification facilities with a maximum export capacity of up to 191.1 GWh/d (17.0 mscm/d); and
- Subsequent phases with an ultimate capacity of up to 314.7 GWh/d (28.3 mscm/d).

4.2.5 Other Supply Developments

Gaslink and Bord Gáis Networks welcome new sources of gas supply and are willing to fully engage with both prospective onshore and offshore sources. Bord Gáis Networks has an excellent track record in delivering infrastructure projects.

Energy from biomethane (renewable gas) has the potential to contribute significantly to Ireland's renewable energy targets. In particular renewable gas could greatly assist Ireland in meeting the EU targets for thermal energy from renewables (RES-H) and transport fuel from renewable RES-T). Bord Gáis Networks' work in this area is discussed further in section 10.6.

5.

The Gas Network Infrastructure

AGI on the SWSOS System

Key Messages:

- The 45km transmission pipeline to Great Island was commissioned in 2013.
- Bord Gáis Networks are currently exploring options to enhance the operating range at Beattock compressor station, in order to provide the flexibility required by the market.
- The high level design stage of the National Smart Metering Programme is nearing conclusion and Bord Gáis Networks and other stakeholders are now preparing to commence the procurement phase of the programme.

5.1 Overview of the BGÉ Gas Network

The BGÉ[25] transmission system includes onshore Scotland, interconnectors and the ROI system. The interconnector system comprises of two subsea Interconnectors between ROI and Scotland; compressor stations at Beattock and Brighouse Bay, and 110 km of onshore pipeline between Brighouse Bay and Moffat in Scotland. The Interconnector (IC) system connects to the GB NTS at Moffat in Scotland. It also supplies gas to the NI market at Twynholm and the IOM market via the second subsea Interconnector (IC2). The IC system is also used to provide a gas inventory service to ROI shippers.

The BGÉ ROI gas network is 13,434 km in length, consisting of 2,213 km of high pressure steel transmission pipelines and 11,221 km lower pressure polyethylene distribution pipelines, Above Ground Installations (AGIs), District Regulating Installations (DRIs) and compressor stations at entry points in ROI and Scotland. AGIs and DRIs are used to control and reduce pressures on the network.

The ROI system consists primarily of a ring-main system with spur lines serving various network configurations and a compressor station located in Midleton Co. Cork.

The gas infrastructure is differentiated by the following pressure regimes:

- High pressure transmission infrastructure which operates above 16 barg; and
- Distribution infrastructure which operates below 16 barg.

The distribution infrastructure is typically operated at 4 barg and less than 100 mbarg for inner city networks.

Figure 5.1 shows an overview of the BGÉ Transmission system.

[25] The BGÉ System includes infrastructure in ROI, NI & South West Scotland, this network development plan only assesses the ROI and South West Scotland infrastructure.

5.

The Gas Network Infrastructure

(continued)

Figure 5.1: Overview of the BGÉ System

5.2 Network Assets & Information

For Bord Gáis Networks to maintain a safe, secure and efficient network and to meet its primary responsibility to transport gas from entry to exit points, the integrity and safety of the infrastructure system must be assured. This section discusses some of the key infrastructure in place on the network.

5.2.1 Compressor Stations

Gas compressors are essential to the operation of a gas network. They are typically located at, or close to, an Entry (supply) Point on a gas transmission network and provide the pressure required to transport the gas downstream to the end-user/customer.

Bord Gáis Networks operates three compressor stations on its transmission network, two located in southwest Scotland, Beattock and Brighouse Bay, and one at Midleton in ROI. Beattock can compress the gas up to 85 barg at the Moffat Entry Point for transportation downstream to the Twynholm Exit Point and Brighouse Bay compressor station. Brighouse compresses the gas for transportation across the subsea Interconnectors, IC1 and IC2, to Ireland and the Isle of Man. Midleton compresses the gas from the Inch Entry Point for delivery into the 70 barg ROI transmission network.

The compressor stations consist of widely diverse and complex plants containing numerous elements ranging from high voltage electrical equipment, air processing, office blocks and high speed rotating machinery. The turbo-compressors and the ancillary turbine equipment (required to operate the turbines) at the core of the compressor stations are the key element of the compression process upon which the security of supply of the transmission network depends.

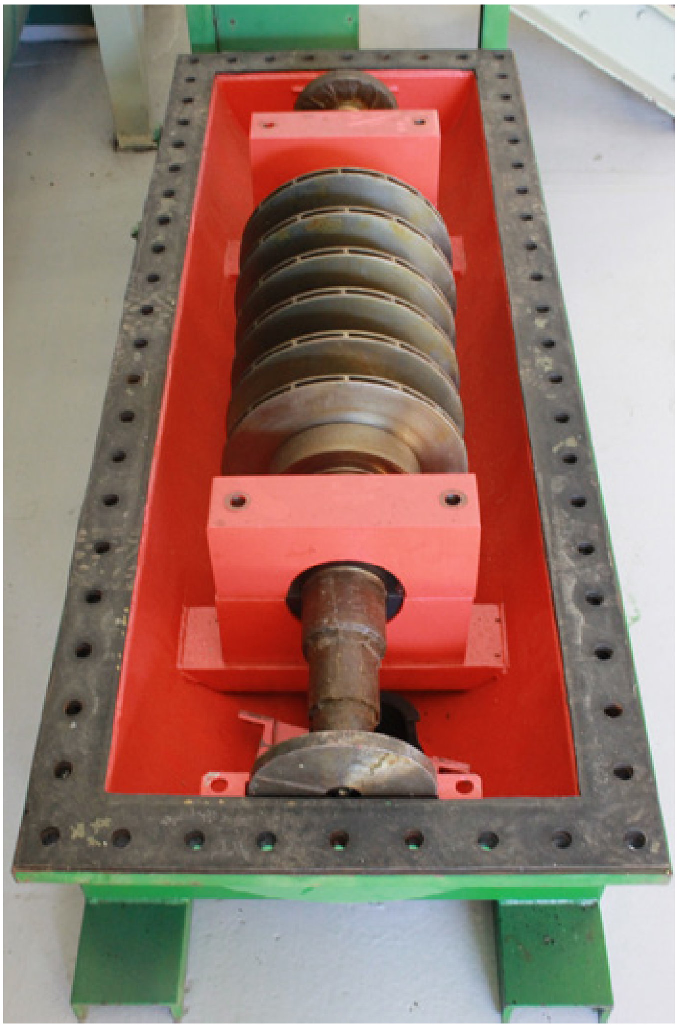
The compressor stations are required to operate 24/7, unmanned outside of working hours and controlled remotely from Grid control in Cork.

Although the Bord Gáis Networks compressor stations were built over a period of nineteen years, they all follow a similar basic design. The sites are divided into three distinct components

- The Turbine Hall contains the turbo compressor trains and ancillary equipment
- The AGI and associated pipework contains all the elements of a standard AGI including meters, filters, pigtraps, pipework and gas coolers
- The Administration Building contains offices, workshops, stores and control room

The primary components of the compressor site are the turbo-compressor trains. The rest of the site supports the operation of these units. The turbo-compressor train encompasses a centrifugal compressor, used to compress the gas, and a gas turbine, used to drive (or rotate) the centrifugal compressor. Figure 5.2 and 5.3 illustrate a centrifugal compressor and gas turbine.

Figure 5.2: Centrifugal Compressor

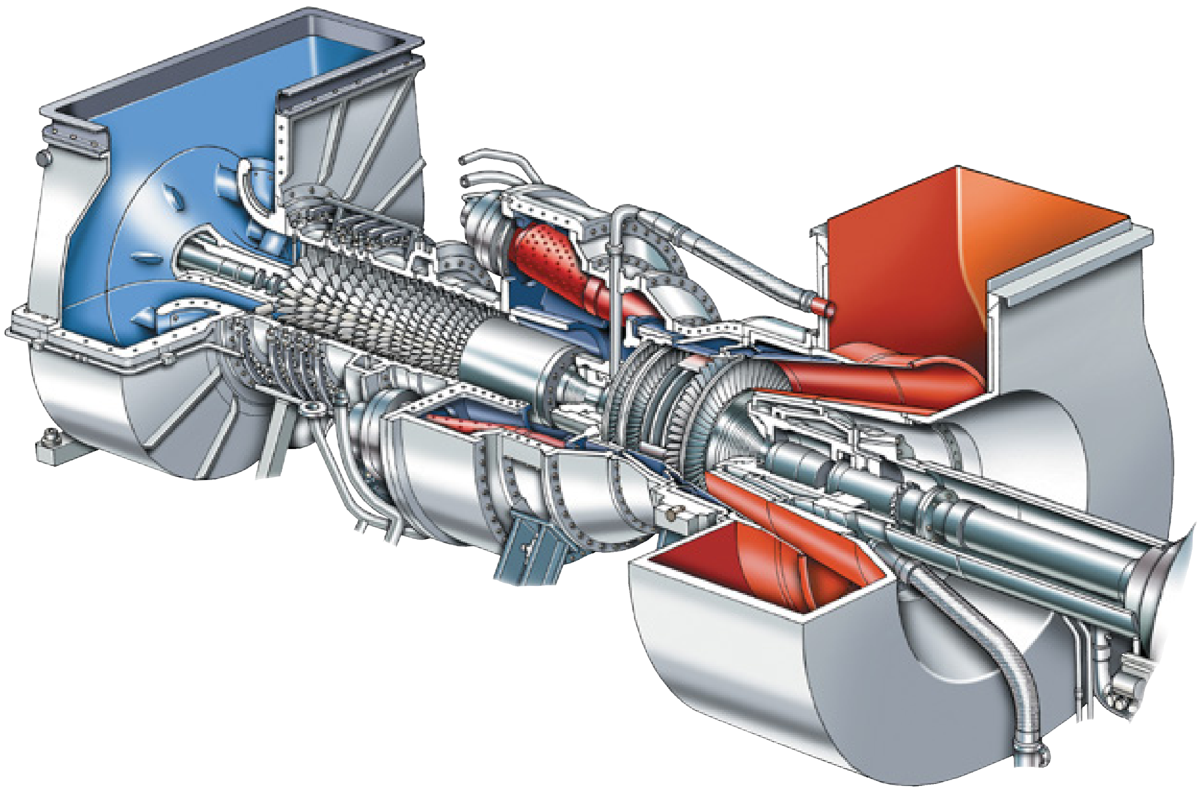


5.

The Gas Network Infrastructure

(continued)

Figure 5.3: Siemens Tornado SGT200 6.8 MW Gas Turbine (Brighouse Bay Turbine)



Source: Siemens AG

All the turbine units used by Bord Gáis Networks follow a common two shaft design. This design is optimal for mechanical drive applications such as driving a natural gas compressor.

This design allows for more flexibility in the power output, enabling the unit to operate at varying loads.

This wide operating range is as a result of flexibility given to gas shippers in an open gas market, particularly the power generation gas shippers. Power generation shippers require increasing flexibility in response to the effect that increasing wind generation is having on the operation of gas fired plant in the SEM, i.e. increasing generation volatility.

The operating range, particularly at Beattock, has been increasing, and is anticipated to continue increasing, in-line with the increasing volatility in power generation gas demand as more wind generation comes online. In addition to the demand volatility, the development of European network codes is likely to compound the need for even greater flexibility.

The existing compressor-turbine technology has a physical operating range with minimum and maximum limits, and within these limits, an optimal range of operation. The increasing operating range has resulted in the physical operating limits of the turbine-compressor units being approached and the units running outside their optimal range of operation. This impacts on both the efficiency and reliability of the units, raising economic (fuel gas usage and increased maintenance), environmental (increased emissions) and security of supply (unit failure) concerns.

Bord Gáis Networks highlighted last year that a study was in progress with regard to this issue. This study is nearing completion which will highlight the optimum solution to enhance its operations to meet the needs of the market, and to ensure the safe and secure operation of a flexible and reliable gas network.

5.2.2 Pressure Regulating Stations

The network includes a number of pressure regulating stations to control pressure and flow to operate the transmission system. The pressure of the gas in the system is controlled and delivered to large consumers, such as power stations or reduced for supply to the distribution system for delivery to domestic end users. On the distribution system, further pressure reduction occurs to supply high density locations such as those found within city and town centres.

5.2.3 Operational Information

The Supervisory Control and Data Acquisition (SCADA) system provides the operational information required by Transmission Grid Control to operate the gas network. SCADA information is monitored and recorded and allows for the transmission network pressure and flow rates to be controlled remotely by manipulation of control valves and compressor set points.

The SCADA system uses Remote Terminal Units (RTU) to retrieve information from the transmission network. The RTU relays information regularly relating to gas flows, pressures, temperatures, valve status signals, cathodic protection voltages and utility signals.

Discrete instrumentation is in place at all transmission installations to monitor process gas pressure, temperature, flow information, cathodic protection voltages and general ancillary signals. Sophisticated flow computers are used to correct pressure and temperature at the metering element and so provide accurate billing data. This data is then relayed via the telemetry units to the SCADA systems.

5.2.4 Pipelines

The gas network is composed of high pressure transmission pipelines and lower pressure distribution pipelines, which transport gas to end users. The two interconnectors which cross the Irish Sea, deliver the majority of gas to the ROI, and have a maximum operating pressure of 148 barg. The ROI system operates at a range of pressure tiers with lower pressures prevailing in major cities and towns.

Distribution mains carry the gas at a lower pressure from the transmission pressure regulating stations, for delivery to the end users. These pipelines are constructed primarily of high density polyethylene. Service pipes carry the gas from the main to the customer’s meter.

There is a continual programme to ensure the network complies with the relevant legislation, technical standards and codes of practice.

5.

The Gas Network Infrastructure

(continued)

5.2.5 Asset Integrity

Cathodic Protection (CP) is used to mitigate the effects of corrosion on buried steel pipe work. CP assets are routinely surveyed and monitored by undertaking Close Interval Potential (CIP) surveys. Bord Gáis Networks also carry out Direct Current Voltage Gradient (DCVG) surveys for assessing the effectiveness of corrosion protection on buried steel pipelines. The pipelines are monitored to identify coating faults and highlight any deficiencies in their cathodic protection system.

Bord Gáis Networks carried out a review of 2013 third party encroachments on transmission pipelines. The number of encroachments are a leading indicator of a potentially more serious incident that could impact on the integrity of the network. While the majority of encroachments did not pose a serve risk, Bord Gáis Networks are actively engaged with third parties to continually enhance the level of awareness & identification of the network. The encroachment figures for 2013 were average compared to previous years but were 5% up on 2012 which was the lowest recorded. Total detected encroachments have remained at a broadly consistent level since 2011.

5.2.6 Meters

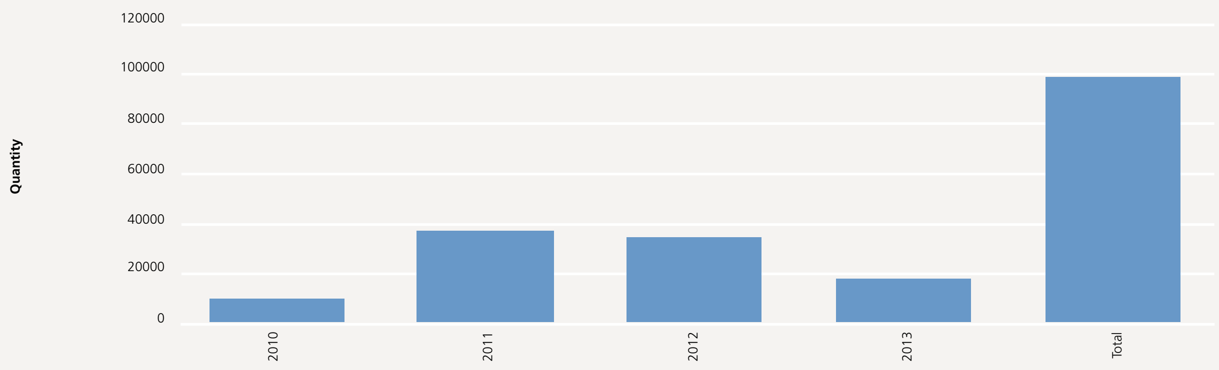
5.2.6.1 Meter Replacement & Maintenance Programme

There are currently a number of meter replacement programmes on-going, which are briefly outlined below:

Domestic Meter Replacement

This programme involves the replacement of the oldest meters on the gas network with ultrasonic meters. Figure 5.4 shows the volume of ultrasonic meters fitted to date under the meter replacement programme.

Figure 5.4: Meter Replacement Programme Installations



Industrial/Commercial Meter Replacement

This programme involves replacing older meters at low and medium pressure non-daily metered (NDM) distribution sites in the industrial/commercial sector.

Meter Maintenance

Bord Gáis Networks are actively carrying out a battery replacement programme, together with on-going general maintenance, as part of a larger preventative maintenance programme.

5.2.6.2 Smart Meters

The National Smart Metering Programme (NSMP) will result in the rollout of smart gas and electricity meters to all residential consumers and a significant proportion of small to medium enterprise (SME) consumers. Phase 2 of the NSMP has been underway since January 2013, overseen by the CER, with key stakeholders such as Bord Gáis Networks, ESB Networks, energy suppliers and others. During 2013, the High Level Design was developed through a series of Industry workshops and a public consultation process conducted by CER. This stage is due to conclude in mid-2014 with the publication of a series of decisions by CER which form the policy basis for the design. The decisions will cover aspects such as the fundamental data flows which will apply between market participants, how energy consumption information will be provided to end-customers and the model which will apply for prepayment metering. The conclusion of this stage will allow Bord Gáis Networks and ESB Networks to commence procurement of the components of the smart metering solution for gas and electricity respectively.

Phase 3 will involve the building and testing of a smart metering systems and infrastructure. There will be a joint deployment of gas and electricity smart metering using a single communications infrastructure. Phase 4 will entail the rollout of the smart meters themselves.

5.2.7 Asset Information

Within Bord Gáis Networks the Asset Information management function is integral to supporting the decision making process. The continued integrity of an asset is largely dependent on the manner in which the facility was designed, constructed, commissioned, operated and maintained over its lifetime. Asset Information is concerned with capturing and managing this data, and transforming it into information, in order to enable effective decision making. Access to accurate, consistent and complete data on historical and current assets supports an effective decision making process.

6.

System Operation

Control Room at Midleton Compressor Station

Key Messages:

- Increasing renewable generation is having an increasing impact on flow profiles and system operation, particularly at the Moffat Entry Point; and
- Bord Gáis Networks are currently progressing the implementation of a short term network planning tool, in response to increasing system operational challenges
- Bord Gáis Networks are currently implementing an Asset Management System inline with the industry recognised ISO 55000 standard

Gaslink and Bord Gáis Networks' primary responsibility is to transport gas from entry to exit, on behalf of our customers, while ensuring the network is operated safely and efficiently.

Managing the flow of the gas from the Entry Points to the end consumer is a sophisticated 24-hour operation. It involves constant monitoring of transmission gas flows and system pressures from the Grid Control building in Bord Gáis Networks headquarters in Cork through a Supervisory Control and Data Acquisition (SCADA) system and also via Gas Control management of the Distribution system, through a separate SCADA system, including GIS and on-line access to Bord Gáis Networks' systems. It uses telemetered data from all the operational sites to monitor the system.

The Grid Controllers man the control room 24/7 and are responsible for monitoring the alarms on the network via SCADA. The Grid Controllers are also responsible for monitoring the Gas Transportation Management System (GTMS) and managing the daily nomination and allocation process ensuring that the correct volume of gas is being transported at all times to meet shippers and customers requirements. Grid Control is also responsible for coordinating the response to emergencies. The National Gas Emergency Manager (NGEM) conducts regular emergency exercises from the control room.

Safe and efficient system operation is achieved on a daily basis by ensuring that:

- Pressure within the system is maintained so it does not exceed safety limits or fall below minimum levels to ensure the security of downstream networks;
- Alarms are responded to and escalated in a timely and appropriate manner;
- Quality of the transported gas meets the criteria defined under regulations;
- Operation of compressors are within environmental site specific licences; and
- Capabilities and processes are in place to effectively manage a natural gas emergency.

6.1 Challenges

The operation of the gas system has changed since the network was originally designed. These changes are a result of user requirements, resulting in very different gas flow patterns than those for which the network was originally designed. Non-uniform profiles may trigger system investment and will continue to be monitored through planning analysis.

6.1.1 Demand Variation

As wind generation increases, traditional thermal plants (operated by natural gas, coal or oil) have to accommodate the fluctuations in wind generation output to meet a moderately inelastic electricity demand. This has an impact on flow profiles and system operation of the gas network. Relatively small changes in power sector generation can have a disproportionate affect on gas demand.

As gas plants provide flexibility in the electricity sector, any generation changes such as increased wind powered generation and increased imports will result in reduced gas demand from conventional generation plant. Owing to operational requirements, the impact of these changes may have an impact on a disproportionately higher number of gas fired generators than may be expected.

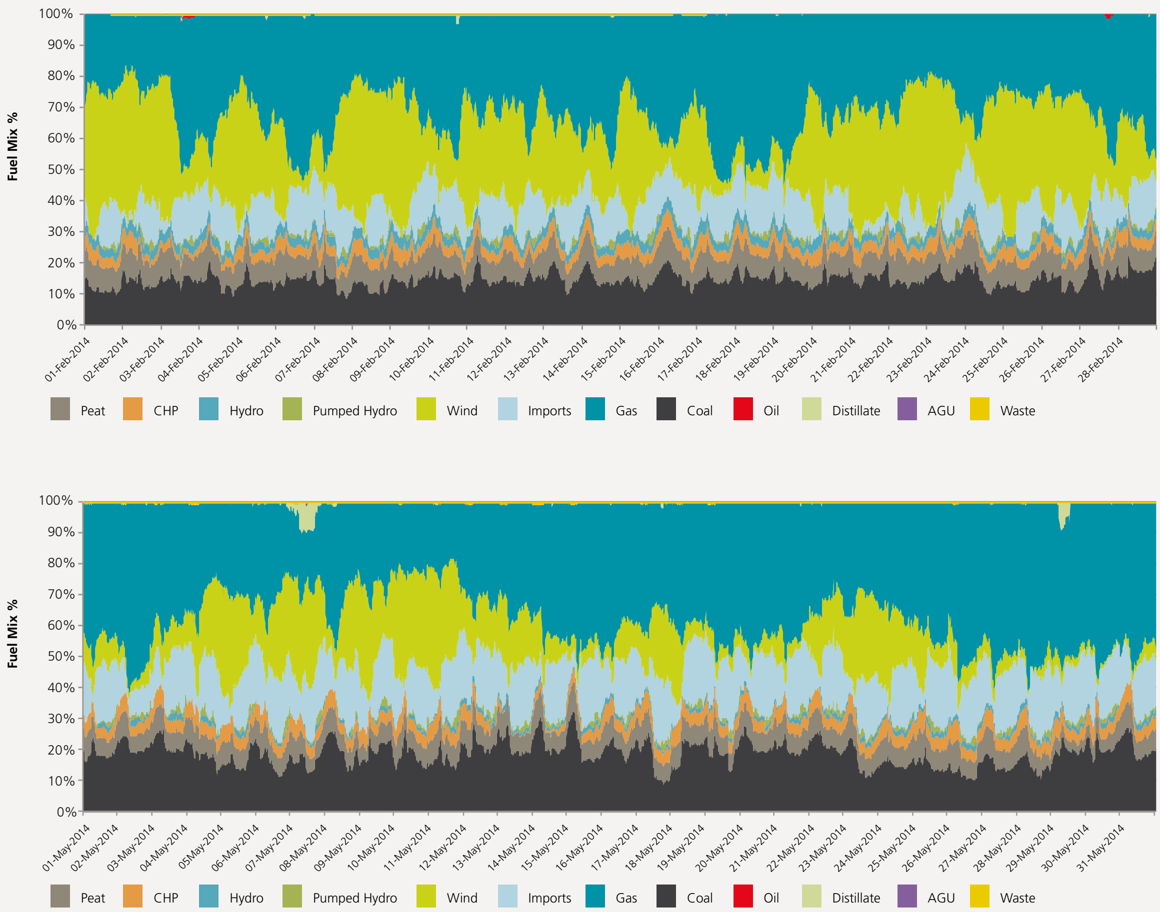
As traditional thermal plants are unable to change their production instantly, the electricity system cannot rely on wind alone due to its large and sudden variations. A significant dependency remains on the natural gas network to provide flexibility and ensure security of supply to end consumers. Figure 6.1 shows the impact on gas demand as a consequence of varying levels of wind powered generation. The fuel mix graphs for February and May 2014 illustrate this variability both in the short (within day) and longer term (monthly).

Across the month of February 2014, wind powered generation contributed between 3% and 52% to the power generation fuel mix. Gas fired generation contributed between 16% and 55% over the same period. In May, wind powered generation contributed between 0% and 40%, and gas fired generation contributed between 15% and 62% over the same period.

The monthly power sector gas demand was 10% higher in May 2014 when compared against February[26], despite the lower all-island electricity demand recorded in May. This was primarily due to the fact that May 2014 was a relatively low-wind month (wind capacity factor 21.3%) while February was a high-wind month (wind capacity factor 48.9%).

[26] Total Power Sector gas demand for May adjusted to 28-day month for comparison with February.

Figure 6.1: Power Generation Fuel Supply Mix February and May 2014



Source: EirGrid

In response to this increased flow variation and other challenges being faced in the operation of the transmission network, Bord Gáis Networks are currently progressing the implementation of a short term network planning tool. This tool will comprise of online and offline hydraulic models of the Interconnector system and the full BGE network (excluding NI), and will be primarily used to support operational decision making over short time horizons, such as within-day and day-ahead.

The online models will be required to accurately and reliably calculate the current/real-time pipeline state, based on real-time SCADA data. In addition to a highly accurate and reliable leak detection system, the online models will be capable of calculating and presenting key operational information such as linepack/inventory, system balancing requirements, local gas composition.

The offline model will assist in determining the optimal forward flow profiles in response to shipper nominations and re-nominations on the gas network, via look-forward functionality. In addition to the look-ahead functionality, the offline model will be required for simulating 'what-if' scenarios (to assess the impact of a network event, e.g. loss of a section of pipeline) and applications such as survival time analysis.

6.

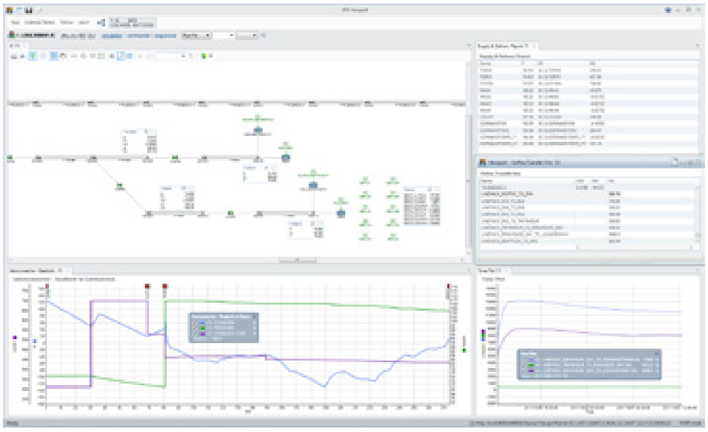
System Operation
(continued)

This tool is scheduled for deployment in transmission grid operations over the next 12 months. It will play a pivotal role in ensuring optimal operation of the transmission network, with regard to efficiency, economy, safety and security of supply.

6.1.2 Asset Life Cycle

The gas network has developed considerably over time and challenges exist with regard to managing whole-life cycle of an asset to ensure system performance. As equipment ages, increased challenges to maintain integrity must be managed. This may be a result of cumulative degradation over time, such as corrosion, wear or fatigue, or the unavailability of appropriate replacements, due to either obsolescence or changes in technological advances, technical standards and codes.

Figure 6.2: Short Term Network Planning Tool



6.1.2.1 Asset Management System Proposed Approach

Bord Gáis Networks are presently implementing an Asset Management System in line with an industry best practice to achieve BGE's organisational strategic plan, by optimising and sustainably managing our assets; their performance, risks and cost during their entire lifecycle.

The Asset Management System further enhances our capabilities in an integrated and systematic way to a recognised international industry standard; ISO 55000. This standard provides a tested framework for Asset Management and an auditable link back to the business' objectives while demonstrating to stakeholders that the physical assets are being properly managed.

ISO 55000 will easily integrate with the existing ISO 9001 and ISO 14001 systems to which BGE is presently accredited. Key components, included within the scope, are shown in Figure 6.3.

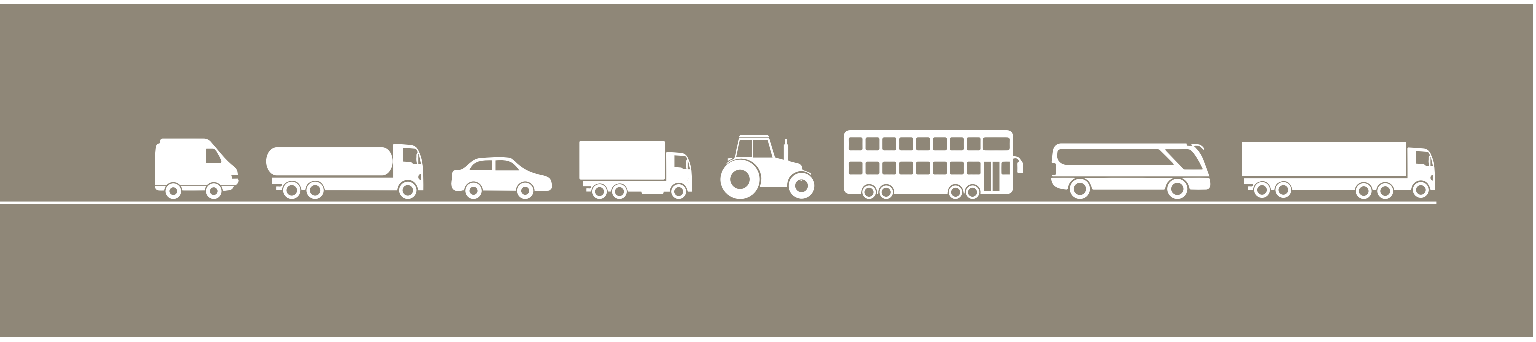
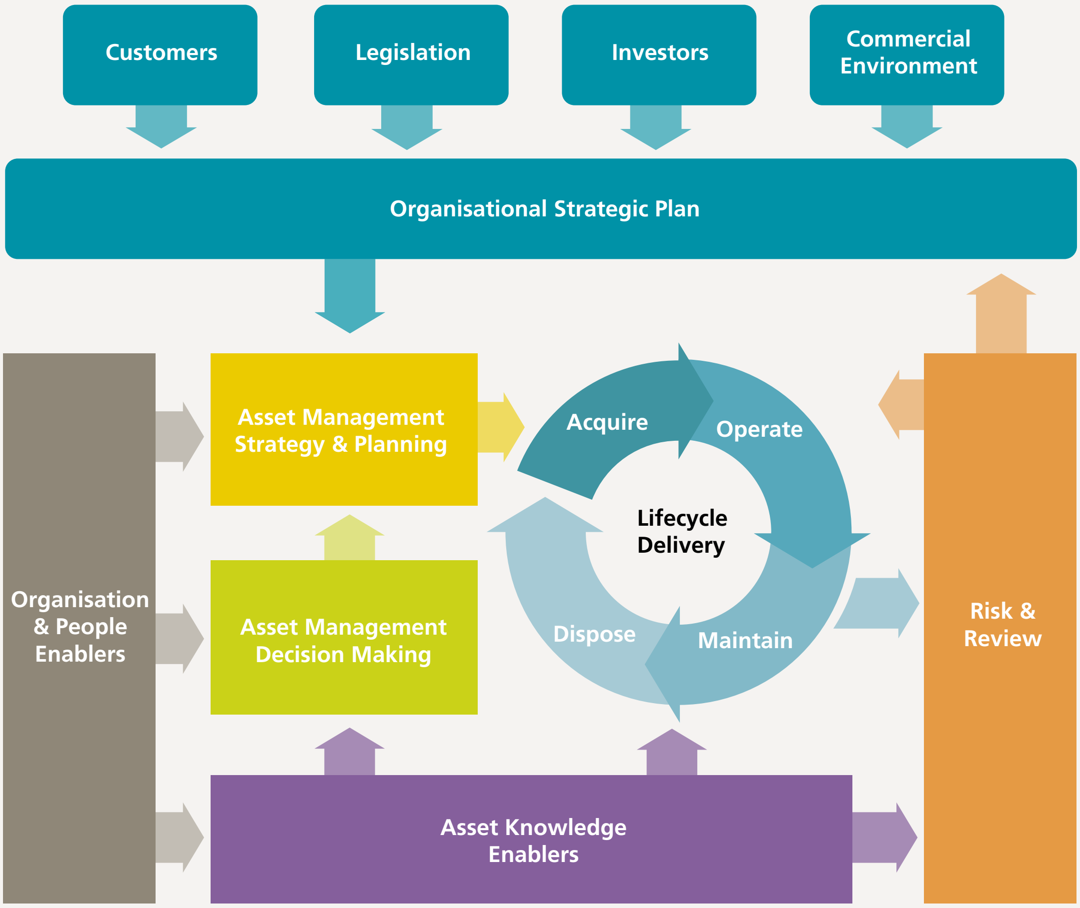
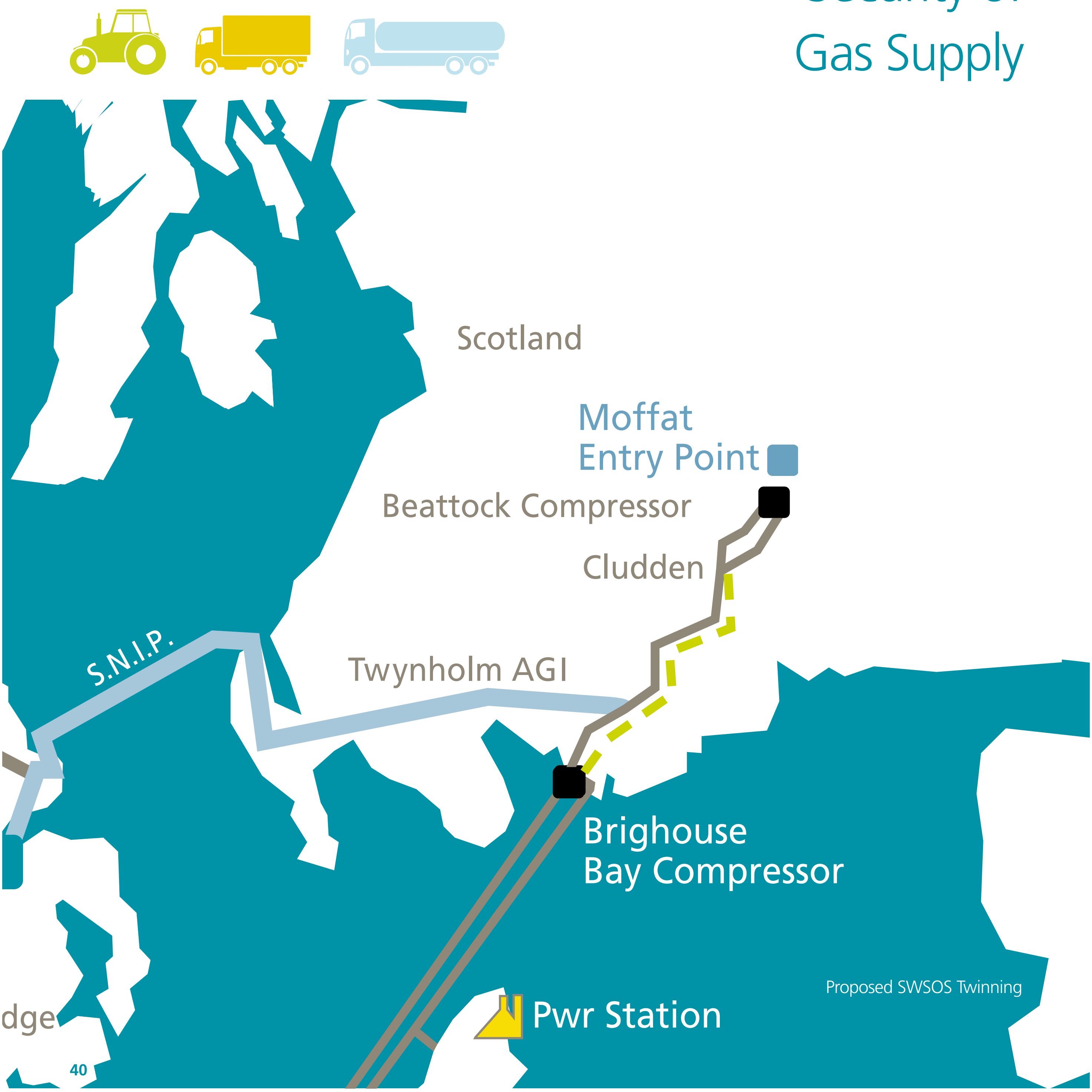


Figure 6.3: Institute of Asset Management Conceptual Model for Asset Management



7.

Security of Gas Supply

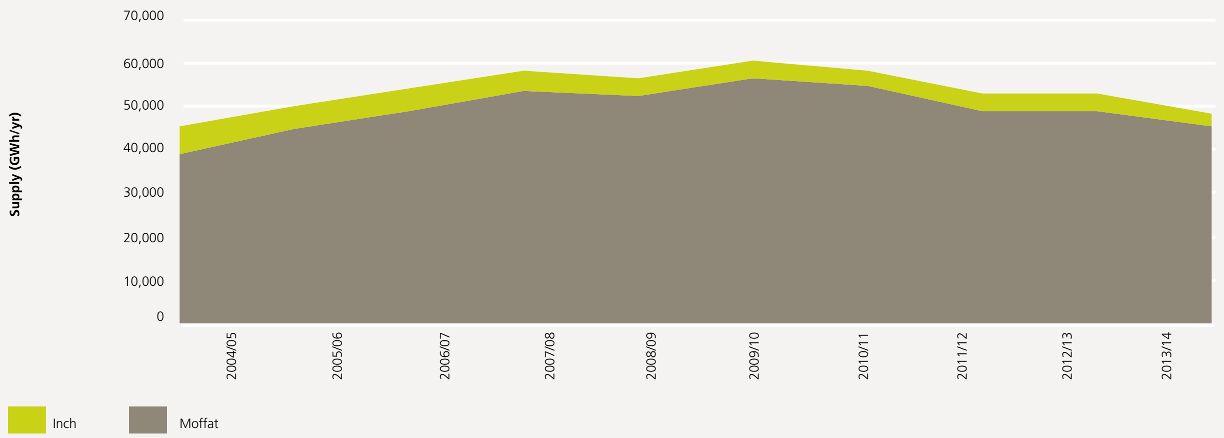


Key Messages:

- Twinning single 50 km pipeline in Scotland is a key priority for security of supply, cross border cost allocation agreed between regulatory authorities;
- CER submitted national and regional risk assessments to EU to safe guard security of supply; and
- Currently no demand from the market to enable physical reverse at Moffat

The vast majority of gas for the ROI is supplied through the Moffat Entry Point in Scotland, as presented in Figure 7.1.

Figure 7.1: ROI Gas Supply



7.
Security of Gas Supply
(continued)

7.1 Projects of Common Interest (PCI)

On 14th October 2013, the European Commission adopted a list of 248 key energy infrastructure projects. These projects have been selected by twelve regional groups established by the new guidelines for trans-European energy infrastructure (TEN-E).

Carrying the label "projects of common interest" (PCI) they will benefit from faster and more efficient permit granting procedures and improved regulatory treatment.

Gaslink submitted the following projects to the EU during 2012 which were approved as PCI projects 14th October 2013;

- PCI 5.2, Twinning of the South West Scotland Onshore System;
- PCI 5.1.1 Physical Reverse Flow at Moffat Interconnection Point (Ireland / United Kingdom)

One other ROI project was approved by the EU in October;

- PCI 5.3, Shannon LNG Terminal located between Tarbet and Ballylongford (Ireland)

There is a precondition that for inclusion in the PCI list, the project must have been included in the preceding European Ten-Year Network Development Plan (TYNDP). For example, projects to be included in the 2015 PCI list will have to demonstrate inclusion in the TYNDP 2014.

The Gaslink project PCI 5.2, twinning of the single 50 km section of pipeline between Cluden and Brighouse Bay in Scotland, is critical for the security of supply to the island of Ireland and brings many other benefits, such as being the key prerequisite for physical reverse flow at Moffat[27]. Consequently PCI 5.2 compliments another PCI, PCI 5.1.1 Physical reverse flow at Moffat interconnection point (Ireland/United Kingdom).

The twinning of the 50 km section of pipeline has been in the planning phase for a number of years with feasibility engineering completed. As required by the Regulation prior to any funding from the European Commission's Connecting Europe Facility, in Q2-2014 a cross border cost allocation decision was agreed between the relevant regulatory authorities. The project's level of grant funding will now be determined by the EU.

Gaslink estimate the project could be in place for 2016 if timely approvals were received in 2014.

7.2 Physical Reverse Flow

The EU Gas Security of Supply Regulation (EU) No 994/2010 requires that TSOs shall enable permanent bi-directional capacity on all cross-border interconnections between Member States by 3rd December 2013, unless an exemption has been granted.

Gaslink and National Grid in 2011 jointly undertook a market demand and security of supply assessment of enabling physical reverse flow at the Moffat Interconnection Point. This concluded there is currently no demand from the market for enabling physical reverse flow at Moffat interconnection point.

The CER granted Gaslink an exemption from the obligation to enable bi-directional capacity at Moffat.

Physical reverse flow will be kept under review following any requests from industry, which may initiate future market consultations.

Implementing physical reverse flow at Moffat would require significant investment. A key factor would be harmonising the odourisation practices as gas exiting the UK National Grid Transmission system is not odorised and odorant is introduced prior

[27] Currently flows at the Moffat interconnection point are uni-directional i.e. GB-IE. System modifications including the twinning would be required to accommodate bi-directional flows at Moffat.

to gas leaving Beattock compressor station for onward flow to Republic of Ireland, Northern Ireland and the Isle of Man. It is important to note a feasibility study would be required to assess the gas network as pressures could be impacted to enable physical reverse flow ultimately impacting security of supply for Republic of Ireland.

It is estimated this study could take 18 – 24 months as there are significant stakeholders involved.

7.3 European Regulation 994/2010

7.3.1 National and Regional Risk Assessment

As Ireland's designated Competent Authority under EU Regulation No. 994/2010, the CER is required to produce:

- Risk Assessment
- National Gas Preventive Action Plan
- National Gas Supply Emergency Plan

In the event that a Member State cannot fulfil the N-1 standard on a national basis, the Regulation permits the adoption of a regional approach towards meeting the N-1. If the regional approach is adopted, there is an obligation on the Member States involved to produce on a regional basis a:

- Joint Risk Assessment;
- Joint Preventive Action Plan; &
- Joint Emergency Plan.

In order to complete this Risk Assessments, the CER requested Ireland's gas network company Bord Gáis Networks to complete a technical risk analysis of the Irish gas network. This Risk Assessments will provide the basis for the Preventative Action Plans (PAP), which are currently being prepared and the CER will consult on in 2014.

As part of its compliance with the Regulation, the Competent Authorities in the UK (i.e. DECC) and Ireland (i.e. CER) submitted their respective national Risk Assessments to the European Commission in Q3-2014. While the UK's Risk Assessment shows that it is able to meet the N-1 standard, Ireland's Risk Assessment confirmed that it is unable to meet the N-1 standard in 2014. Given Ireland's current inability to meet the N-1 criteria, both the CER and DECC have agreed to adopt a regional approach towards meeting the N-1 criteria, these Risk Assessments were submitted to the EU commission in 2014.

Under Article 8 (Supply Standard) of the Regulation, Competent Authorities shall require that the natural gas undertakings[28] that it identifies take measures to ensure gas supply to the protected customers in the following cases:

(a) Extreme temperatures during a 7-day peak period occurring with a statistical probability of once in 20 years;
(b) Any period of at least 30 days of exceptionally high gas demand, occurring with a statistical probability of once in 20 years; and
(c) For a period of at least 30 days in case of the disruption of the single largest gas infrastructure under average winter conditions.

As a result of the UK and Ireland adopting a regional approach towards the implementation of Regulation 994, both the UK and Ireland are able to fulfil the supply standard on a national basis.

Bord Gáis Networks will continue to develop the network to ensure a safe, secure, robust and resilient gas network is maintained to ensure security of supply to end consumers.

[28] Natural Gas Undertaking defined in Directive 2009/73/EC means: "a natural or legal person carrying out at least one of the following functions: production, transmission, distribution, supply, purchase or storage of natural gas, including LNG, which is responsible for the commercial, technical and/or maintenance tasks related to those functions, but shall not include final customers."

7.4 Emergency Preparedness

7.4.1 Emergency Operations Arrangements

The CER has designated Gaslink to undertake the role of the National Gas Emergency Manager (NGEM) in accordance with SI. 697 of 2007. The NGEM has responsibility for declaring a natural gas emergency, as well as coordinating planning arrangements and any emergency response in accordance with the Natural Gas Emergency Plan (NGEP). Bord Gáis Networks on behalf of Gaslink manage the day to day operation of the gas networks.

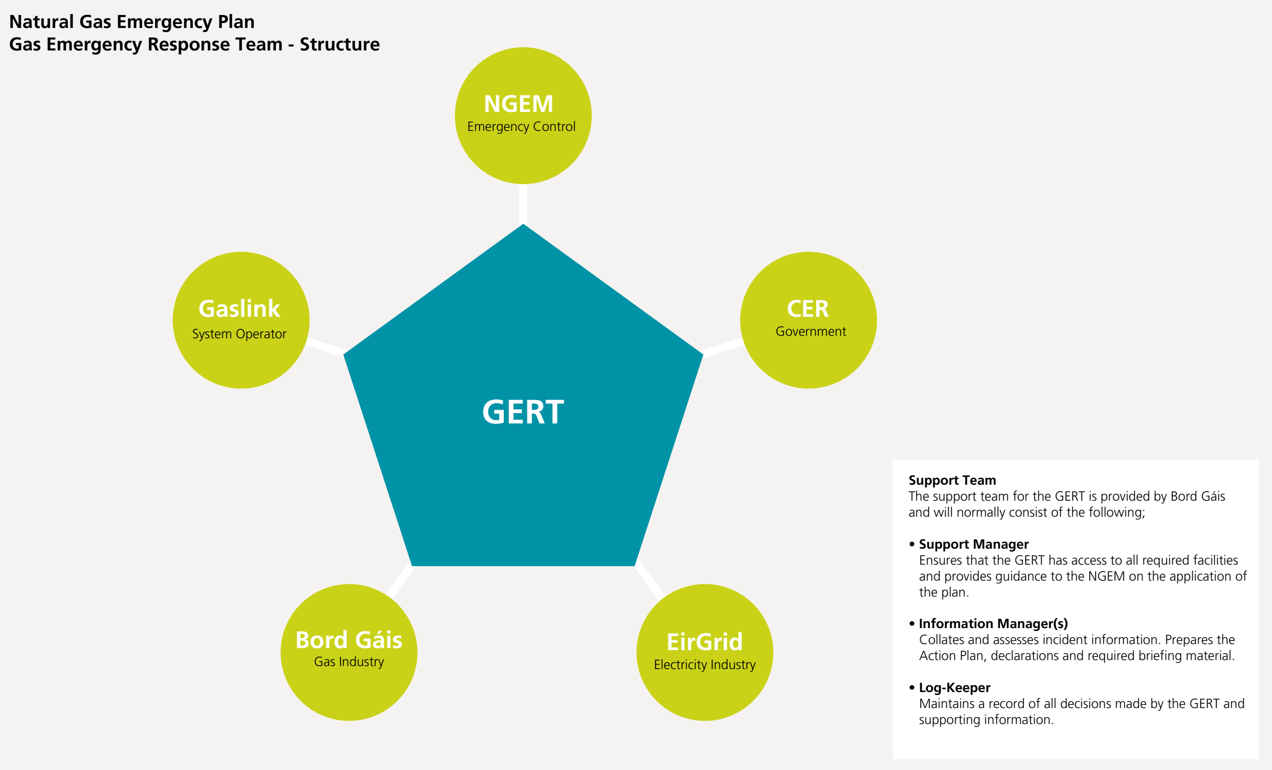
The aim of the NGEP is to;

- Protect the safety of the general public
- Protect property and key infrastructure
- Minimise disruption resulting from a gas supply emergency

The NGEM may activate the NGEP if it establishes that it is not possible to maintain an acceptable balance between supply and demand, or there is insufficient gas leading to the possibility of a natural gas emergency developing. As part of the NGEP, the NGEM will establish the Gas Emergencies Response Team (GERT), which will be responsible for implementing the directions of the NGEM to execute the necessary operational response.

The structure of the GERT is shown in Figure 7.2.

Figure 7.2: Natural Gas Emergency Structure



7.4.2 Emergency Planning Arrangements

Emergency Planning for the purposes of the NGEP will be under taken by the Gas Emergency Planning Group (GEPG).

In September 2013 Bord Gáis Networks participated in Exercise 'Ulysses' which was conducted by the UK National Emergency Coordinator (NEC). In October 2013 Bord Gáis Networks conducted its own Exercise 'Ler' between TSO's, regulatory authorities and Government Departments in Ireland and Northern Ireland. The exercise tested the formation of the GERT, the compilation of Situation Reports on the state of the emergency, and the development of Action Plans for the management of the gas supply emergency. The exercise was deemed successful.

In addition to the GEPG, there is also a Gas and Electricity Emergency Planning Group (GEEP), which is chaired by the CER and includes representatives from the DCENR, Gaslink, Bord Gáis Networks, EirGrid and ESB Networks.

The GEEP acts as a focal point for those involved in emergency planning, response and management in the gas or electricity sectors. It informs the parties of the relevant developments in the sectors, co-ordinates their work and encourages appropriate cooperation to ensure preparedness for, and robust response to, emergencies in the gas or electricity sector. It fosters an understanding of the gas and electricity sectors and the impact that an emergency, or potential emergency, in either sector can have on the other.

7.4.3 Operations Emergency Readiness

Grid Control within Bord Gáis Networks is responsible for the 24 hour technical operation and supervision of the gas network. Using a sophisticated Supervisory Control and Data Acquisition (SCADA) system they:

- Monitor live system operational data;
- Analyse demands and control linepack to meet NDM demands; and
- Manage nominations, transportation, balancing and settlement of the Transmission Network.

All shippers have access to the Gas Transportation Management System (GTMS) system. The system has been upgraded and re-platformed with improved process functionality and emergency management modules.

Bord Gáis Networks are advancing the implementation of a short term network planning tool, which will be deployed in Transmission Grid Control to inform and support day to day operational decision making, particularly during a peak demand or an emergency event.

As part of the Bord Gáis Networks operations business continuity plan, a designated disaster recovery site for Network Operations is established. All of the main operations are duplicated at this site to ensure full business continuity in the event of a major outage.

8.

Commercial Market Arrangements

Press conference by Günther Oettinger, Member of the EC in charge of Energy on the adoption of the final EU-wide list of energy infrastructure priority projects till 2020
Source: European Commission

Key Messages:

- Twinning of Southwest Scotland System Identified as a Project of Common Interest
- Congestion Management Procedure (CMP) implemented in October 2013; and
- Implementation of a Capacity Allocation Mechanism (CAM), by 1st November 2015.

8.1 Republic of Ireland Gas Market

Gaslink, in providing transportation services to shippers and suppliers operating in the wholesale and retail markets, also interacts with regulatory authorities and industry. Gaslink also supports the development of new entrants to both the retail and wholesale markets by facilitating and mentoring their entry into the gas market. The following is a non exhaustive list of Gaslink's responsibilities:

- Develop and maintain strategies for the Irish natural gas wholesale and retail markets;
- Establish market rules;
- Support initiatives from various industry bodies;
- Support compliance with EU legislation as well as playing a driving role in the development of market arrangements to meet with industry best practice;
- Implement legal and contractual arrangements required under Irish and European law in relation to shippers and suppliers;
- Coordinate industry meetings at both wholesale and retail levels; and
- Manage the contracts of the companies licensed to ship gas through the transportation system.

Gaslink plays a pivotal role in fostering relations with neighbouring transporters, regulators and government departments to further the aim of European gas market integration.

8.2 European Developments

The liberalisation of the European Gas market continues to progress. The passing into law of European legislation in 2009, referred to as 'The Third Package', was introduced to facilitate the development of a single European energy market. The ultimate aim of this single market is to reduce the barriers to transporting gas across the Common Market, to promote competition and to improve security of supply.

In order to integrate the many Member States participating within the EU into a single market, a number of key initiatives are underway to coordinate the roll out and implementation of the European Commission's vision of market integration. The Agency for Cooperation of Energy Regulators (ACER) was established in 2011. This aims to foster cooperation between European energy regulators and to ensure market integration and harmonisation of regulatory frameworks. As per Regulation No. 715/2009 ACER is responsible for the production of a series of Framework Guidelines.

8.

Commercial Market Arrangements

(continued)

Article 5 of the Regulation established the European Network of Transmission System Operators for Gas (ENTSOG). ENTSOG is responsible for the development of up to 12 Network Codes when requested to do so by the European Commission[29]. Such Network Codes are based on the Framework Guidelines as outlined above.

ENTSOG is also responsible for developing a Community-wide Ten-Year Network Development plan (TYNDP).

Gaslink, as the Irish System Operator, represents Ireland as a member of ENTSOG, along with TSO's from other Member States.

The objective of the CAM Network Code is to enable further development of European cross-border competition and market integration. The CAM Regulation EU 984/2013 was published in the Official Journal of the EU in 2012, and came into force on 4th November 2013, effectively becoming law in all Member States from that point forward. The Regulation is to be implemented from 1st November 2015. Gaslink is preparing a Project Plan for the implementation of the CAM Regulation and held internal and Industry Impact Assessment workshops during Q3 2013. The introduction of CAM will represent a significant change in the way that Capacity is sold in Ireland, including the introduction of capacity auctions via a booking platform which is operated jointly between adjacent TSOs at cross-border points. Gaslink has developed a proposal for the amendment of the Gaslink Code of Operations to reflect the requirements of CAM, with an Industry consultation paper issued in June 2014.

Gaslink, along with our neighbouring TSOs, Mutual Energy Limited (MEL) in Northern Ireland and National Grid, in Great Britain has decided to adopt PRISMA as its joint Capacity booking platform at each of its Interconnection points. PRISMA will implement the requirements of the CAM Network Code which include auctioning of capacity at interconnection points (IPs). The target date for the implementation of PRISMA at the Irish IPs is October 2015. Sixteen TSOs from Belgium, Denmark, Germany, France and the Netherlands joined forces during 2012 to develop the "PRISMA European Capacity Platform" based on the existing TRAC-X system in Germany. In December 2012, PRISMA announced that three further TSOs from Austria and Italy had also joined the platform and in the first six months of 2013, this number increased to twenty four. Gaslink recently joined the platform during 2014.

Congestion Management Procedures (CMP), were established first as a result of a revision to Annex 1 of EC Regulation No. 715/2009 as per European Commission Decision of 24th August 2012. The CMP Guidelines address the issue of contractual congestion at Interconnection Points between adjacent gas transmission systems, where Shippers cannot gain access to capacity in spite of the physical availability of such capacity. While contractual congestion has been identified as an issue in Europe, to date it has not been experienced at Irish Interconnection Points. In accordance with the Regulation, Gaslink introduced CMP mechanisms to the Gaslink Code of Operations in October 2013 and it is expected that the CMP mechanisms will require further amendment in 2015 in order to align with the requirements of CAM.

The Balancing Network Code was formalised as Regulation EU No. 312/2014 in March 2014 with an implementation date of 1 October 2015. The broad objective of the Balancing Network Code is to promote a harmonised European gas balancing regime which is market based and enables network users to trade gas efficiently, including across borders, thereby moving towards greater market integration. More specifically, the Network Code seeks to establish common rules in relation to nominations procedures, imbalance charges and operational balancing between adjacent systems. It seeks to ensure that TSOs provide sufficient, well-timed and reliable information to network users in relation to their balancing status and that of the system. Cost-reflective imbalance charges are to be established to incentivise network users to balance their portfolios and the system, with the aim of minimising the TSO's role in balancing and increase that of market participants. Gaslink issued a consultation paper in September 2014 outlining its proposal for the amendment of the Gaslink Code of Operations to address the requirements of the Network Code.

[29] As per Article 8 of Regulation No. 715/2009

The Interoperability Network Code aims to harmonise the operational aspects of gas flows between Member States' gas markets. The Code will impact on how TSOs communicate with one another at interconnection points and also how network users communicate with TSOs. The Code will also ensure that gas quality differences do not hamper physical flows of gas at IPs. The Interoperability Network Code is a keystone network code as it will ensure the smooth physical flow of gas across the EU. ENTSOG submitted the Interoperability network code to ACER on September 11th 2013, prior to its submission to the European Commission for Comitology. The Network Code will be finalised in 2014 and the requirements of the Network Code are expected to be implemented by 2016.

Major infrastructure projects identified in this document that have a cross-border impact will be included in ENTSOG's TYNDP. The TYNDP will be the basis for the identification of the list of PCI projects from 2015 on. Under the Regulation, only gas projects included in ENTSOG's TYNDP will be eligible for PCI status. PCI status will provide projects with fast-tracked consenting processes and the possibility of limited financial assistance. The next ENTSOG TYNDP will be published in February 2015.

The proposal by Gaslink to have the twinning of the existing onshore Scotland pipeline between Cluden and Brighouse Bay was approved by the European Commission for inclusion in the first list of PCIs. Subsequent to this approval, Gaslink submitted a Cost Benefit Analysis to the relevant Regulatory Authorities (CER, Northern Ireland Authority for Utility Regulation, Ofgem) including a request for Cross Border Cost Allocation (CBCA). The CBCA request is an essential part of the Regulation on Guideline for European Energy Regulation (EC 347/2013). An agreed CBCA, allocating costs among member states is a prerequisite for applying for funding under the Connecting Europe Facility. Gaslink will continue to advocate strongly during 2014 with regard to obtaining EU funding for this important Security of Supply project.

ACER finalised the Tariff Framework Guidelines (FGs) on 29th November 2013. These FGs set the basis for the drafting of a Network Code which will govern the setting of tariffs and the collection of revenues at all Interconnection Points in the EU. Four cost allocation methodologies are available for a TSO and all entry points will be aggregated for revenue collection purposes. Relatively lower priced short term capacity products are prescribed, which will facilitate Shippers to optimise their capacity booking portfolio. ENTSOG hosted stakeholder workshops during 2014 to allow all stakeholders to contribute to the formulation of a draft Network Code which was published for consultation on 28th May 2014, and will be finalised and presented to ACER by 31st December 2014.

The ENTSOG Transparency workgroup is working to determine the reporting content of information required by ACER under REMIT. TSOs are obliged to publish a wide range of aggregated data on the existing ENTSOG Transparency Platform. Further obligations became live from 1st October 2013, following the publication of CMP obligations. Under the various Network Codes and the REMIT provisions, there exists many transparency requirements for TSOs relating to the publication of data items, such as Capacities, Flows and Tariffs. The new ENTSOG Transparency Platform went live on October 1st 2013 at which point Gaslink began publishing all required data, which is also published on the Gaslink website.

REMIT (Regulation on Wholesale Energy Market Integrity and Transparency) is designed to identify manipulation and insider trading in wholesale energy markets. Both aggregated and disaggregated (Shipper level) information will be required to be reported to ACER under REMIT. Disaggregated information will not be issued by ENTSOG to ACER.

9.

Adequacy of the Gas Network

Pipework at Midleton Compressor Station

Key Messages:

- Reinforcement of the 50 km single section of transmission pipeline in South West Scotland remains a priority;
- Flexibility is required to meet changing network conditions and the review of compressor systems in Scotland is concluding;
- Midleton Compressor Station is important to the ROI system, and in particular the southern region;
- High pressure section of the ROI transmission system has largely sufficient capacity to meet future gas flow requirements in the short to medium term; and
- Southern region of the transmission system likely to require reinforcement in the medium to long term.

9.1 The ROI Transmission System

The ROI transmission system consists primarily of the high pressure (70 barg) ring-main linking Dublin, Galway and Limerick, a number of spur lines to Cork, Waterford and lower pressure (40 barg and 19 barg) local area (regional) networks in large urban centres. In addition the Mayo-Galway pipeline[30] connects the ring-main to the Corrib Bellanaboy terminal, Co. Mayo.

The results of the network analysis indicate that the high pressure sections of the ROI transmission system have sufficient gas to meet forecasted gas flow requirements in the short to medium term. However, some of the lower pressure regional transmission networks are likely to require capital investment to meet future capacity needs, this is being reviewed in conjunction with strategic reinforcement study.

In the medium to long term, the southern region of the ROI transmission system is anticipated to require reinforcement, which would involve reinforcing the 400 mm transmission pipeline between Goatisland, Co. Limerick and Curraleigh West, Co. Tipperary.

As noted in previous development plans, reinforcing this section of the network would also enhance the transmission network's capacity to transport large volumes of gas from potential future new supply sources located on the south or west coast of Ireland.

[30] The Mayo-Galway pipeline has a maximum design pressure of 85 barg.

9.2 South West Scotland Onshore System

The ROI will continue to depend on the Moffat Entry Point and Interconnector system to provide approximately 94% of its gas demand until Corrib supply commences. The current outlook indicates that the ROI will revert to a similar level of dependency towards the end of this decade, when indigenous supplies have depleted and if no other new supply sources materialise.

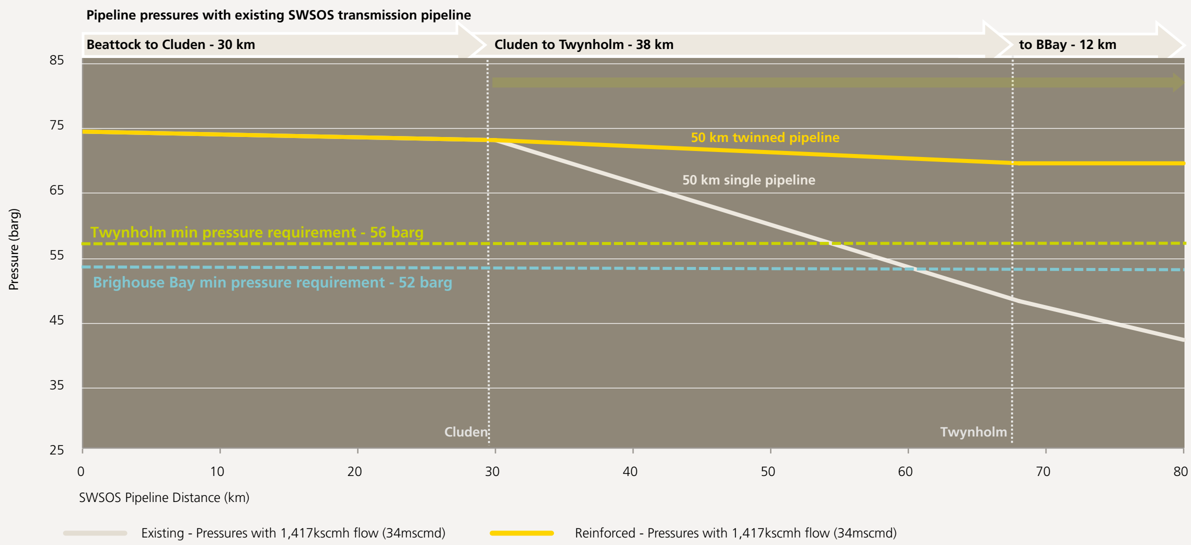
The outlook for the Moffat Entry Point in this year's NDP is similar to previous development plans where capacity limits of the Moffat Entry Point are anticipated to be approached.

Interconnectors 1 and 2 exit Beattock as two separate pipelines for a distance of 30 km and converge at Cluden into single section of pipeline for 50 km to Brighouse Bay compressor station. The twinning of this 50 km section of pipeline remains a priority and will resolve the capacity constraint at the Moffat Entry Point once completed. As shown in Figure 9.1 below, the pressure constraint circa 20 bar is removed once the twinned section of pipeline is completed.

This provides;

- enhanced security of supply
- enhanced operational efficiency
- enhanced capacity
- enhanced storage
- enhanced pressures on sub-sea interconnectors

Figure 9.1: SWSOS Pipeline Pressure Losses[31]



[31] The pressure profiles presented in figure 9.1 are based on an assumed flow of 1,417 kscmh (34 mscmd) and the Moffat ANOP pressure, 47 barg, and have been determined by a steady state hydraulic analysis of the SWSOS. Though the assumed flow, 34 mscmd, exceeds the current technical capacity of the Moffat Entry Point, 1,292 kscmh (31 mscmd), it corresponds with actual historic with-in day flows observed for a number of hours during peak demand events in December 2010. It should be noted, the SWSOS had the capacity to transport these high within-day flows due to favourable pressure conditions at Moffat during the high flow period; the SWSOS would not have had the capacity to transfer these hourly flows if pressures had approached or were equal to the 47 barg ANOP.

To date Bord Gáis Networks have not received approval to proceed with the twinning of the single 50 km section of pipeline. Consequently, should peak day demands occur, there may be limited system flexibility to accommodate within-day shipper re-nominations at Moffat.

Gaslink and Bord Gáis Networks continue to recommend the reinforcement of the single 50 km section of transmission pipeline in South West Scotland, in order to meet future capacity requirements and guarantee the secure supply of gas to Republic of Ireland, Northern Ireland and the Isle of Man.

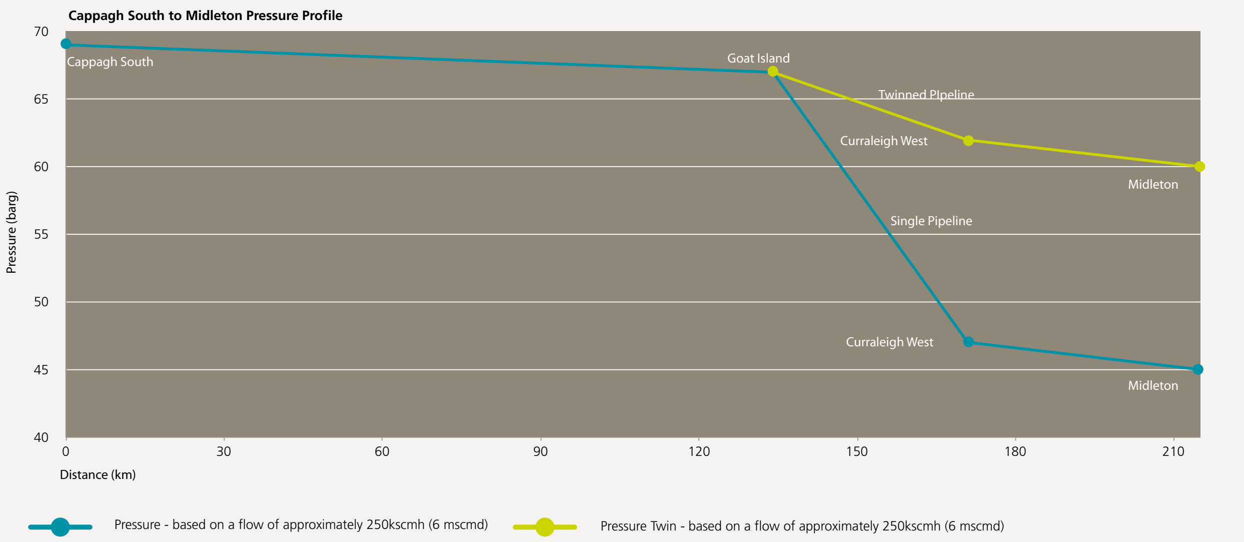
The Moffat Entry Point and Interconnector system play a very significant role in facilitating the increasing levels of renewable generation on the electricity system. Gas fired power plants provide the generation flexibility required by the electricity system to accommodate intermittent renewable generation. These gas fired plants require the gas network to provide an equal level of system flexibility, and in particular, the Moffat Entry Point and Interconnector system, which supply the large majority of power generation gas demand.

9.3 Strategic Reinforcement

Network analysis undertaken for the NDP, and previous development publications, highlighted the requirement to reinforce the 37 km transmission pipeline between Goatisland, Co. Limerick and Curraleigh West, Co. Tipperary. A proposal to reinforce the pipeline was included with Bord Gáis Networks' 3rd Price Control (PC3) Capex submission. The reinforcement of the section remains a priority in the medium to long term as both the Cork to Dublin and Goatisland to Curraleigh West pipelines individually lack capacity to meet winter peak demand in the southern region in the event of a disruption to either line.

The benefits to system pressures of twinning the pipeline are presented in Figure 9.2.

Figure 9.2: Cappagh South to Midleton Pressure Profile



In the long term, as Corrib supplies decline and in the absence of other new indigenous supplies of gas, there will be a requirement to transport larger amounts of imported gas to the southern half of the country.

In conjunction with the Goatisland to Curraleigh West pipeline, the Cork to Dublin Pipeline may require reinforcement to ensure supplies to domestic and power generation customers can be maintained.

In 2013, Bord Gáis Networks commenced a strategic reinforcement study, with a view to identifying the strategic pipelines and installations on the major urban 40, 19 and 4 barg systems.

The study is expected to conclude in 2015, the results of this study will determine what, if any, system modifications are required to safeguard customers against the consequences of the loss of a strategic pipeline(s) or pressure regulating installation(s).

9.4 Increasing flow flexibility and minimum system limits

With the changing dynamics on the gas network, flexibility is, and will continue to be, a key factor in meeting the needs of our customers. Currently the power generation shippers require increasing flexibility in response to the effect that increasing wind generation is having on the operation of gas fired plant in the SEM, i.e. increasing generation volatility. This requirement for system flexibility will continue to increase and will be essential in facilitating the 2020 renewable generation target set by the Irish Government, i.e. 40% of Ireland's electricity supply will be generated from renewable sources.

In addition to this, the demand and supply forecast indicates that once Corrib production commences, the Moffat Entry Point will be required to provide low volumes (albeit essential) of balancing supplies during low demand periods.

Further to this, the implementation of new European network codes and products such as Virtual Reverse Flow (VRF), compound the requirement for greater system flexibility.

Bord Gáis Networks highlighted last year a study was in progress, this study is nearing completion which will highlight the optimum solution to enhance its operations to meet the needs of the market, and to ensure the safe and secure operation of a flexible and reliable gas network.

It's important to note that there will be no impact on indigenous ROI supplies in the delivery of the optimum solution that will ensure the system flexibility required by our customers.

9.5 Midleton Compressor Station

Midleton Compressor Station is the only compression facility in the Republic of Ireland and is important to the southern section of the transmission system.

It delivers Inch gas supplies into the ROI 70 barg transmission system at a point on the network which is a significant distance from the landfall stations[32] at Loughshinny, Co. Dublin and Gormanston, Co. Meath. Midleton compressor station helps to maintain capacity in a relatively isolated part of the network, i.e. the southern section of the network, where a significant proportion of ROI gas is consumed and approximately 50% of Ireland's gas fired generation capacity is located.

The southern section of the transmission network is strategically important to both Ireland's gas and electricity systems. Midleton compressor station plays a pivotal role in ensuring the security of supply for this part of the network.

[32] Where gas enters the ROI system from the subsea interconnectors.

10.

Capital Investment

Gas to Macroom

Key Messages:

- €387 million to be invested under Bord Gáis Networks third Price Control;
- Extension of the gas network to Wexford Town, Co. Wexford and Nenagh Town, Co. Tipperary; and
- Committed to development of Compressed Natural Gas (CNG) in the transport sector.

10.1 Overview

This section provides information on planned capital investment and indicates possible future investments proposals in order to comply with legislation and other requirements.

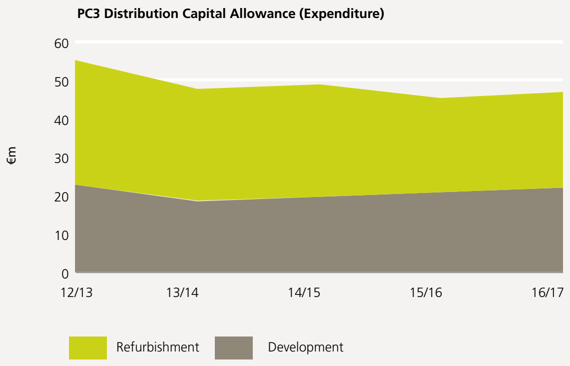
Future investment proposals are subject to approval from the Commission for Energy Regulation. System Operator requirements continue to evolve and both environmental and European legislative requirements will impact on future system operation.

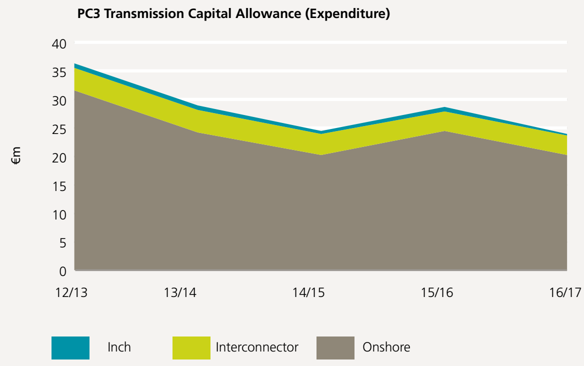
10.2 Regulatory Capital Allowance

Bord Gáis Networks is currently in its third regulatory Price Control period ("PC3"). This is a five year period and runs from October 2012 to September 2017. The CER has given a capital allowance of €387m for investment on the distribution and transmission network as illustrated in Figure 10.1 (excluding non-pipe and work in progress).

10.
Capital Investment
(continued)

Figure 10.1: PC3 Capital Allowance excluding non-pipe and work in progress[33]





The allowance provided does not include any provision to complete the twinning of the single 50 km section of pipeline between Cluden and Brighouse Bay in South West Scotland. This project is progressing as a project of Project of Common Interest (PCI 5.2).

Cross border cost allocation has been agreed between the regulatory authorities. The project is well advanced regarding the planning and feasibility stage. The next phase of the project will be a consideration regarding the level of potential European funding the project may receive.

Outside of the price control capital allowance, Bord Gáis has been granted approval by the Commission for Energy Regulation to extend the natural gas network to Wexford Town, County Wexford and Nenagh Town, County Tipperary.

Both these projects will progress over the next 18 – 24 months, timelines subject to connection agreements being in place with the anchor loads and securing necessary statutory approvals.

Gaslink and Bord Gáis Networks welcome new sources of gas supply and as always remain willing to discuss prospective projects with project promoters.

10.3 Planned Capital Programmes

A significant number of projects were completed within time and budget during 2013. The following set out further projects to be completed over next 36 month period.

10.3.1 Pipelines

Some of the key pipeline programmes to be completed over the next 36 months include;

- Dundalk reinforcement, Co. Louth;
- Ballymun transmission pipeline replacement, Co. Dublin;
- Mungret to Inchmore transmission pipeline replacement, Co. Limerick;
- Spur off Banlusk to Great Island transmission pipeline to Belview Co. Kilkenny[34];
- Transmission pipeline marker post refurbishment (national programme);
- Extension of the gas network to Wexford Town, Co. Wexford and Nenagh, Co. Tipperary; and
- Bypass solution around Ballough AGI

[33] References:- "Commission for Energy Regulation Decision References:- "Commission for Energy Regulation Decision on October 2012 to September 2017 transmission revenue for Bord Gáis Networks", Decision Paper (CER/12/196) Table 32 and "Commission for Energy Regulation Decision on October 2012 to September 2017 Distribution revenue for Bord Gáis Networks", Decision Paper (CER/12/194) Table 20.

[34] Third party funding provided.

10.3.2 Pressure Regulating Station Refurbishment

The following are some major transmission rolling programmes to be completed within the PC3 period.

- Refurbishment of Sword's Road and Scholarstown Road AGIs
- Replacement of all non-condensing boilers on some regulating installations; and
- Replacement of all waterbaths on the system

The following are selection of distribution rolling programmes to be completed within the PC3 period.

- Removal of distribution buried gun barrel service pipes;
- Relocation/rehabilitation of polyethylene services within the building line;
- Refurbishment of district regulation installations;

10.3.3 Communications & Instrumentation

There are rolling programmes across PC3 to refurbish and upgrade AGI & DRI site instrumentation which will facilitate enhanced SCADA integration on the gas network.

10.3.4 Meters

While Bord Gáis Networks is working with all stakeholders in developing a smart metering solution, a decision on a rollout has not been made and the CER has not given a capital allowance at this stage. Bord Gáis Networks has a rolling age-based replacement programme for both domestic and Industrial/commercial meters which will continue until it is consumed by a smart metering rollout programme.

10.3.5 Compressors

Bord Gáis Networks has rolling refurbishment programmes across the three compressor sites. The programmes consist of:

- Pipework modifications;
- Turbine intake modifications; and
- Turbine ancillary equipment modifications.

In 2013, the vent stacks were replace at Beattock compressor station as shown in Figure 10.2.

10.

Capital Investment

(continued)

Figure 10.2: Vent Stack Replacement at Beattock Compressor Station

Bord Gáis Networks uses gas compressors to move gas through and around the transmission system. As a participant of the European Emission Trading Scheme (ETS) each of the three compressors have a CO2 emissions allowance.

Bord Gáis Networks is committed to the monitoring and reduction of emissions from these compressors. The compressors are also required to meet environmental compliance legislation such as noise monitoring and mitigation.

In order to meet legal obligations and compliance, it is essential to develop and maintain a robust strategy for operation, maintenance, upgrading and replacement of the compressors.

This strategy is key to the delivery of efficient and effective operation of the compressors. As a consequence of changing gas flows, Bord Gáis Networks is nearing completion of a study which will identify the requirements to ensure operation flexibility and efficiency is maintained.

10.4 Future Investment

The following have been identified as strategic in terms of network development and in particular to ensure security of supply.

10.4.1 SWSOS Reinforcement

Bord Gáis Networks and Gaslink continue to recommend the reinforcement of the single 50 km section of transmission pipeline in South West Scotland, in order to meet future capacity requirements and to guarantee the secure supply of gas to the island of Ireland.

As noted earlier, the EU authorities have recognised the importance of this investment, identifying the SWSOS reinforcement as a PCI in the trans-European energy infrastructure regulation.

Bord Gáis Networks will also undertake detailed studies regarding the long term requirements for the compression facilities at Beattock and Brighouse Bay in South West Scotland, as part of the planning strategy for the future development of the Moffat Entry Point.

10.4.2 The Goatisland to Curraleigh West Reinforcement

As stated in section 9.3, in the long term as Corrib supplies decrease there is likely be a requirement to reinforce the Goatisland to Curraleigh West pipeline to ensure continued supplies. This situation will continue to be monitored in future development plans.

10.4.3 Midleton Compressor Station

Midleton compressor station is strategically important to the ROI transmission system, and, in particular the southern section of the transmission system, given the level of demand in the region due to the proximity of the three Combined Cycle Gas Turbines (CCGT's) in the south/southeast of the country.

With evolving environmental legislation and the need to ensure positive pressures in the region it is anticipated future capital investment will be required to ensure maximum efficiency of Midleton Compressor Station.

10.4.4 Longer Term Projects – local area (regional) reinforcement

A key part of Bord Gáis Network's planning process is understanding what capital investment is required to mitigate against capacity limitations on the network. It is anticipated that capital investment will be required to support the existing infrastructure in a number of regions. The regions identified are indicative and, considering the need for project reinforcement, will be in response to changing supply and demand patterns. The following geographical regions are considered:

- Cork
- Waterford
- Dublin
- Limerick

The transmission and distribution system in the north east region has been (and continues to be) identified as a reinforcement priority for both capacity and strategic reasons. Bord Gáis Networks continue to recommend that this reinforcement should proceed.

Bord Gáis Networks are undertaking a strategic reinforcement study to identify any necessary system modifications required to safeguard customers against system failure, such as loss of strategic pipeline(s) or pressure regulating installation(s).

As the network continues to age it is anticipated that there will be a requirement for capital investment, refurbishment or upgrades, to satisfy integrity, performance and safety requirements of the gas infrastructure.

Capital investment may result due to customer enquiries for either increased load or a new connection where no spare capacity exists or the network is operating close to its current capability.

With continued growth in renewable energy, investment may be required as a result of different flow patterns and injection points other than those for which the network was originally designed. Bord Gáis Networks are already experiencing different flow profiles as a result of the amount of wind powered generation on the network.

Bord Gáis Networks and Gaslink will continue to monitor and analyse the network. Future projects may be required to improve network capability in response to these changing flow requirements.

10.5 Innovation Investment

Bord Gáis Networks seek to promote innovation within the Irish gas industry in order to further increase network utilisation and increase overall system efficiencies. Bord Gáis Networks aim in particular to promote innovation in the areas of materials, methodology and market development.

10.5.1 Gas Innovation Fund

The Gas Innovation Fund is a central funding pool approved by the Commission for Energy Regulation, under the Price Control 3 decision (CER\12\196), to promote and accommodate an environment of innovation in the gas industry. The fund is available to support projects identified by the Gas Innovation Group.

10.
Capital Investment
(continued)

Figure 10.3: Bord Gáis Networks Fast Fill Station, Gasworks Road Cork

10.5.2 Gas Innovation Group
The Gas Innovation Group consists of members from Government Agencies, Research Institutes and Academia. The Group is administered by Bord Gáis Networks and chaired by the CER. The Group's focus is to promote the use of natural gas and biogas for the benefit of energy users throughout Ireland. This will be achieved by promoting and supporting projects and research activities which bring benefit to all natural gas users.

10.5.3 What progress has been achieved?
Bord Gáis Networks are currently facilitating companies to test the feasibility of natural gas in their own transport fleet. The country's first fast fill station has been commissioned at Bord Gáis Networks Head Quarters in Gasworks Road Cork. The station was commissioned in January and is currently refuelling the Bord Gáis Networks NGV fleet.

10.5.4 CNG Trials
Bord Gáis Networks continue to develop the role of Compressed Natural Gas (CNG) within the transport industry through the promotion of Natural Gas Vehicles (NGVs). A number of CNG trials are currently being supported to demonstrate the suitability of CNG in the Irish Transport Sector. The trials are being carried out with companies from the target commercial operator market including the dairy sector, public transport and haulage companies. The results of the trials completed to date have proven CNG is a viable alternative to traditional fuels proving them to be:

- Cheaper – On average over 30% cheaper than traditional fuels;
- Cleaner – significant reductions in emissions including Carbon Dioxide, nitrogen oxide and particulates; and
- A Proven Technology – the use of existing OEM vehicles has demonstrated the practical application of this technology.

10.5.5 What's the plan for the future?
Bord Gáis Network's objective is that by 2024 at least 5% of the commercial transport market and 10% of the bus market in Ireland will be operating on CNG or Biogas. The market will be fuelled through a private and public refuelling network, attached to the natural gas network. It is intended that all Bord Gáis Networks' company vehicles, including vans, trucks and cars will be operating on natural gas by 2024.

Figure 10.4: NGV Dual Fuel Receptacle

To facilitate commercial fleet operators, Bord Gáis Networks are planning to support the establishment of a number of publicly accessible fast-fill stations at strategic locations throughout Ireland. These stations will be located along core transport networks to support the movement of goods and services across Ireland.

10.5.6 Why is the Gas Industry promoting CNG?

Using natural gas within the freight haulage and fleet vehicle sector offers a number of benefits to both operators, gas users and the wider population.

Operators of haulage and fleet vehicles will benefit from cost savings of approximately 30% on their normal petrol or diesel fuel costs. This saving offers a more competitive position from which to attract new business for the operator and to the Irish road haulage industry in general. Gas customers with high demand profiles can employ efficiencies of scale in relation to their commodity purchase for gas when they integrate gas vehicles as part of their wider gas usage. CNG as an existing technology is well established as a transport fuel throughout Europe and as such offers a low risk alternative fuel option for operators.

Increased utilization of the gas network outside of peak demand periods allows further efficiencies to be obtained in the operation of the network. This in turn could reduce the per unit cost of transporting the gas through the network. Availing of natural gas as an alternative to diesel or petrol within the transport sector would assist Ireland in reducing its dependency on oil as a transport fuel while at the same time providing emissions reductions within the sector. This would help Ireland achieve the 2020 targets and in turn reduce any penalties which could result from excess emissions. CNG in transport offers a gateway for sustainable gas to penetrate the transport market. The combination of renewable synthetic gas or biogas could offer a source of CO2 neutral transport fuel for Ireland.

10.6 Renewable Gas

Energy from biomethane (renewable gas) has the potential to contribute significantly to Ireland's renewable energy targets. In particular renewable gas could greatly assist Ireland in meeting the EU targets for thermal energy from renewables (RES-H) and transport fuel from renewable RES-T).

Given the revised corporate policies the major Multinational Corporations (MNCs) have published in recent years aimed at carbon footprint reduction across their organisations, renewable gas can also play a significant role in maintaining and attracting new MNC investment in Ireland.

Biomethane is produced when feedstock, such as organic wastes (agricultural and municipal), and energy crops, such as grass silage, are converted into biogas using anaerobic digestion technology. The 'raw' biogas can be cleaned and upgraded into biomethane (renewable gas) and injected into the national gas grid to be used as a heating fuel in homes and businesses.

Ireland has significant unexploited potential for biomass in the form of agricultural land and recycled waste from municipal, agricultural and industrial sources. Further potential exists for biomethane production from waste treatment plants, now under the responsibility of Irish Water, a subsidiary company of BGE.

Figure 10.5: Renewable Gas Plants

10.6.1 Demand

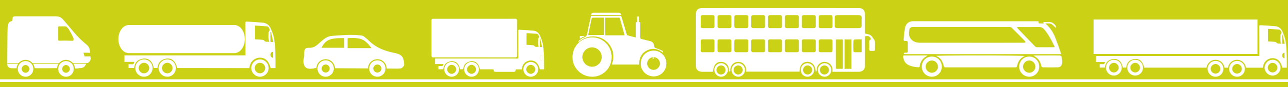
There are 3 primary market sectors where demand for Renewable Gas is coming from.

10.6.1.1 Multinational Corporations

Many of the Multinational Corporations (MNCs) have in recent years published corporate policies aimed at carbon footprint reduction across their organisations internationally. Some of the largest blue chip MNCs such as Apple, Intel, Microsoft, Google, Twitter, Facebook, for example have gone as far as obliging 100% Renewable Energy targets.

These MNCs are currently major employers within Ireland and have significant growth potential.

These policy decisions are now manifest in all new projects and expansion plans of these MNCs, where mandatory decision criteria for location of such projects includes the availability and access to as much as 100% renewable energy sources at competitive rates. Energy demand of such operations can be as much as 95% in Heat (including combined heat and power and combined heat, power and cooling), Process, and Transport, so the significant availability of renewable electricity in Ireland is not the competitive and efficient option that can meet this demand. Longer-term power and energy contracts with these MNCs will also require switching to competitive renewable alternatives as they come up for retendering/renewal.



Competitively priced renewable gas is the ideal and primary energy source option for these GMN's in most cases for its operational and cost effectiveness, but also for its flexibility, security of supply, and lowest capital investment cost among the alternatives. In the context of attracting and maintaining foreign direct investment, Ireland should consider its competitive position with regard to development of renewable gas. Renewable gas is already heavily developed and available at competitive rates (with State subventions) and in meaningful quantities in many other EU Member States.

10.6.1.2 Commercial Fleet and Public Transport

Renewable Energy Sources (RES) targets for transport in Ireland are perhaps one of the most difficult to be achieved. Alternative liquid bio-fuels cannot be produced in Ireland in sufficient quantity, and there are relatively low levels of imports of biodiesel and ethanol from international sources. In line with the Bord Gáis Networks strategies to support CNG use in Transport initiatives, the scale and available options for indigenous production of sustainable second and third generation biomethane and synthetic methane in Ireland are more than sufficient to bridge the RES-T target shortfall, and have further growth potential beyond 2020, to support the 2030 and beyond targets.

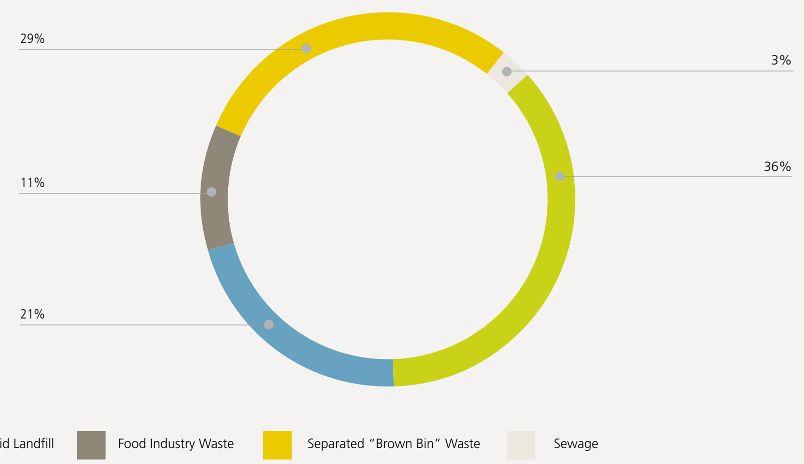
10.6.1.3 Public Sector Renewable Energy Sources Objectives

The current National policy to achieve 33% renewable energy in the Public Sector is a significant challenge and potential cost burden (capital cost and security of supply). Renewable gas would however be the lowest cost alternative in many cases on the basis of its operational and cost effectiveness, but also for its flexibility, Security of Supply, and lowest capital investment cost among the alternatives.

10.6.2 Potential in Ireland for Renewable Gas

Assessments have been undertaken in conjunction with the Technology Centre for Bioenergy & Biorefining (TCBB) focussed exclusively on 2nd Generation Waste & Residue sources in Ireland that are most suitable and cost effective for biomethane production utilising currently available and proven technologies. These assessments will be published in detail during 2014 in conjunction with the Irish Bioenergy Association (IrBEA) but the findings are summarised here. From currently available sources of waste, the data has shown that over 4,000 GWh/annum could be produced in Ireland (equivalent to 7.5% of current gas demand). Targeting the harvesting of 66% of this potential will form the basis of an industry business plan currently being developed within IrBEA (i.e. 2,750GWh/a or 5% of current gas demand).

Figure 10.6: Biogas Potential Waste Sources



When considering other sources of renewable gas potential, such as third generation biomethane and synthetic methane, the longer term predictions beyond 2020 see the potential scale of Irish capacity at over 11,000 GWh/a (18% of current gas demand).

11.

CER Commentary

The CER welcomes the publication of Gaslink's second annual Network Development Plan (NDP). This report represents an important stock-take of the Irish gas network, identifying what issues might arise and what needs to be done to meet demand in the coming years.

In the short term, the CER notes that Irish gas demand will continue to be met by imports from Great Britain via the Moffat Entry Point, and gas production and storage at Inch. Flows from Corrib are forecast in this report to commence in the next year, subject to the necessary consents.

The CER recognises that increased volumes of indigenous gas raises challenges for the system, as flow profiles change from the current predominantly east-to-west direction (Moffat to the East Coast and beyond), to west-to-east pattern (from Corrib on the west coast). In particular, the Southwest Scotland onshore system will face periods of extreme low use during Summers in the medium term. The CER welcomes the analysis being undertaken by Bord Gáis Networks to ensure that system integrity and minimum pressures are maintained. It is evident from the findings of this year's NDP that network analysis will continue to be required over the coming years.

The timing and availability of indigenous gas projects have implications to ensure that capacity limits at the Moffat Entry Point are not breached. The CER notes that the Twinning of the South West Scotland Onshore System (SWSOS) is the preferred option advocated by Gaslink and Bord Gáis Networks. Where any such capital investment may be approved, the CER will ensure that it is necessary, appropriate and efficient.

Expected changes in demand profiles are noted in this NDP. While peak-day demand is projected to increase by 6% over the timespan (2014-2023), the aggregate annual gas demand is expected to drop by 2% over the same period.

Considerable work has been completed during the last year to safeguard security of supply. A Joint Regional Risk Assessment and a Joint Regional Preventative Action Plan was prepared by the CER with support by Gaslink and Bord Gáis Networks, and in conjunction with regulatory colleagues in Northern Ireland and Great Britain. The three regulators are also working closely on the implementation of the Third Energy Package Network Codes, geared towards harmonising European energy markets in areas such as capacity allocation, balancing and congestion management. The CER notes that Gaslink and Bord Gáis Networks are undertaking a major project, working with their counterparts in Northern Ireland and Great Britain, to implement the Network Codes. These Network Codes will have a major impact on nearly all aspects of how the Irish gas market operates.

Over the past year, Bord Gáis Networks has been engaged with the CER regarding continual enhancements to the safety of the gas network. The CER wishes to acknowledge the enhancements referred to in the Network Development Plan 2014.

When weather corrected, aggregate annual demand was within 3% of the forecast in the 2013 NDP. The CER notes the broad accuracy of Gaslink and Bord Gáis Networks' short term forecasts. That said, longer term forecasts, by their nature, are less reliable. In light of significant changes to the gas market stemming from implementation of the Third Package Network Codes, changes to the Irish electricity generation market brought by the new I-SEM market structure, and increasing levels of renewable energy in the power generation sector, it is difficult to say with confidence what gas demand will be in the medium term. For this reason, the CER welcomes Gaslink\Bord Gáis Networks' intention to model a number of demand scenarios in future NDPs. This will provide additional insight into the needs of the gas system in the medium term under a number of different trends – further supporting balanced and informed investment decisions by the TSO and the CER.

Appendix 1: Historic Demand

Historic Daily Demand by Metering Type

The historic demand data in Chapter 3 is presented by sector (i.e. residential, I/C and power), as this is more useful for forecasting purposes and is also considered to be a more familiar classification for the users of this document. The actual demand data is collected by metering type:

- Large Daily Metered (LDM) sites with an annual demand of 57 GWh or greater, and includes all the power stations and the large I/C sites;
- Daily Metered (DM) sites with an annual demand greater than 5.55 GWh and less than 57 GWh, and includes the medium I/C, hospitals and large colleges etc; and
- Non-Daily Metered (NDM) with an annual demand of 5.55 GWh or less, and includes the small I/C and residential sectors.

The demands of the above categories are then re-combined into the following categories for reporting and forecasting purposes, using the monthly billed residential data to split the NDM sector into its residential and I/C components:

- Power sector: The individual power stations are separated out from the LDM total;
- The I/C sector: Which is comprised of the demand from the remaining LDM sites, the DM sector and the NDM I/C sector (calculated as the residual of the total NDM demand and the residential demand); *and*
- Residential sector: Which is calculated as a percentage of the NDM demand, using the ratio of the total billed monthly NDM and residential demand.

The historical daily demand on the transmission and distribution systems is shown in Figure A1.1 and A1.2, with the corresponding annual and peak-day demands tabulated in Table A1.1. to Table A1.4. It should be noted that the figures in the tables may not sum to total due to rounding. The transmission and distribution daily demands have been broken down into the following sub-categories:

- Transmission demand has been subdivided into the power sector demand, with all of the remaining LDM and DM I/C demand combined into the TX DM I/C category; *and*
- Distribution demand has been subdivided into the DX NDM demand, with all of the remaining LDM and DM I/C demand combined into the DX DM I/C category.

Table A1.1: Historic BGÉ Annual Gas Demands (Actual)[1]

GWh/yr	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14[2]
ROI	56,505	54,734	58,239	55,726	50,435	50,072	45,305
NI & IOM	19,294	18,022	17,232	17,852	15,142	15,031	14,491
Total	**75,799**	**72,756**	**75,471**	**73,578**	**65,577**	**65,103**	**59,796**

[1] Actual demands shown are not weather corrected and do not include own use gas
[2] End of year total forecast from actual year to date totals

Table A1.2: Historic BGÉ Peak Day Gas Demands (Actual)[1]

GWh/d	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
ROI	205.9	227.5	247.6	244.1	211.7	213.2	187.0
NI & IOM	74.8	67.7	80.0	79.3	74.1	62.7	68.2
Total	**280.7**	**295.2**	**327.6**	**323.4**	**285.8**	**275.9**	**255.2**

[1] Actual demands shown are not weather corrected and do not include own use gas

Table A1.3: Historic ROI Annual Gas Demands (Actual)[1]

GWh/yr	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14[3]
Power[2]	37,758	36,007	39,338	35,365	29,864	28,156	25,323
I/C	10,507	10,415	10,409	12,021	13,244	13,700	13,076
Res	8,239	8,312	8,492	8,340	7,326	8,216	6,906
Total	**56,504**	**54,734**	**58,239**	**55,726**	**50,434**	**50,072**	**45,305**

[1] Actual demands shown (not weather corrected), with residential estimated as % of NDM
[2] Power sector gas demand is amended to account for those I/C connections which generate electricity for their own use less process gas
[3] End of year total forecast from actual year to date totals

Table A1.4: Historic ROI Peak Day Gas Demands (Actual)[1]

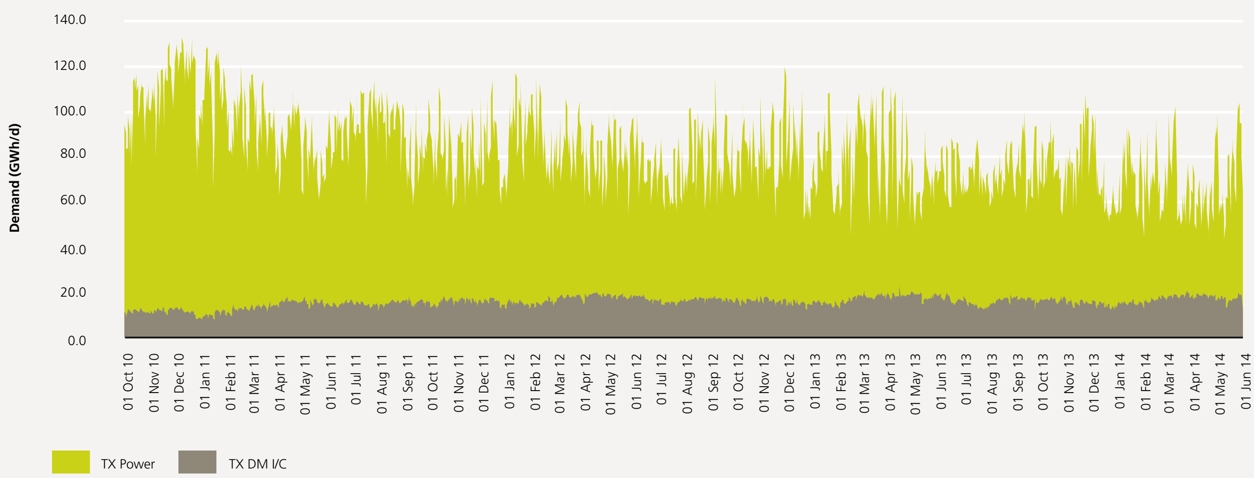
GWh/d	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Power[2]	119.7	126.4	134.3	132.2	114.1	119.9	102.0
I/C	43.4	44.4	46.3	49.6	49.4	50.4	46.8
Res	52.5	56.7	67.0	64.2	48.2	44.2	39.9
Total	**215.6**	**227.5**	**247.6**	**246.0**	**211.7**	**214.5**	**188.7**

[1] Actual demands shown (not weather corrected), with residential estimated as % of NDM
[2] Power sector gas demands is amended to account for those I/C connections which generate electricity for their own use less process gas

The transmission connected demand, Figure A1.1, does not appear to be particularly weather sensitive. The gas demand of the power sector in particular is driven by relative fuel-prices rather than the weather (although the gas-price can be weather related as well).

It can be seen from Figure A1.2 that the distribution connected demand is very weather sensitive, peaking in the colder winter period and falling off in the warmer summer period. The NDM demand is particularly weather sensitive, as it includes the residential and small I/C sectors, which primarily use gas for space heating purposes.

Figure A1.1: Historic Daily Demand of Transmission Connected Sites



Appendix 1: Historic Demand
(continued)

Figure A1.2: Historic Daily Demand of Distribution Connected Sites

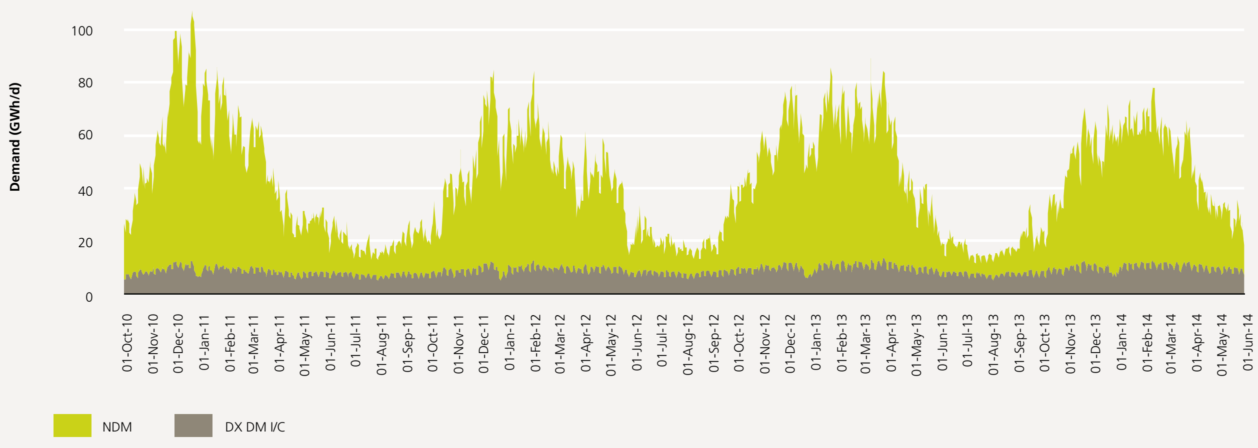


Table A1.5 and Tables A1.6 present the historic annual and peak day gas supplies for the BGÉ system.

Table A1.5: Historic Annual Gas Supplies through Moffat and Inch[1]

GWh/yr	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14[3]
Moffat[2]	72,645	70,446	73,843	72,320	64,103	64,148	59,566
Inch	4,772	4,259	4,128	3,765	3,952	4,014	3,288
Total	**77,417**	**74,705**	**77,971**	**76,085**	**68,055**	**68,162**	**62,854**

[1] Daily gas supply taken from Gas Transportation Management System (GTMS)
[2] End of year total forecast from year to date totals
[3] Table shows total Moffat supplies including ROI, NI and IOM

Table A1.6: Historic Peak Day Gas Supplies through Moffat and Inch[1]

GWh/d	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14
Moffat[2]	245.6	251.4	292.5	303.9	255.7	251.2	232.7
Inch	40.0	35.6	34.8	33.7	32.0	26.7	26.4
Total	**285.6**	**287.0**	**327.3**	**337.6**	**287.7**	**277.9**	**259.1**

[1] Daily gas supply taken from Gas Transportation Management System (GTMS)
[2] Table shows total Moffat supplies including ROI, NI and IOM

The peak-day demands shown in Table A1.7 represent the coincident peak-day demands, i.e. the peak-day demand of each sector on the date of the overall system peak-day demands. Each sector may have had a higher demand on a different date. The non-coincident peak-day demand of each sector is shown in Table A1.8.

Table A1.7: Historic Coincident Peak Day and Annual ROI Demands

	2007/08 (GWh)	2008/09 (GWh)	2009/10 (GWh)	2010/11 (GWh)	2011/12 (GWh)	2012/13 (GWh)	2013/14[1] (GWh)
Peak Day							
TX Power	119.7	126.4	134.3	132.2	114.1	119.9	102.0
TX DM I/C	10.7	10.4	9.1	12.0	17.7	17.8	16.1
DX DM I/C	11.2	11.0	11.7	12.3	11.9	12.2	12.6
DX NDM	74.1	79.7	92.5	89.5	68.0	64.6	57.9
Total ROI	**215.7**	**227.5**	**247.6**	**246.0**	**211.7**	**214.5**	**188.6**
Annual							
TX Power	37,758	36,007	39,338	35,365	29,864	28,156	25,323
TX DM I/C	3,793	3,518	3,701	4,978	6,147	6,088	6,026
DX DM I/C	2,828	2,835	2,858	3,020	3,235	3,419	3,373
DX NDM	12,125	12,374	12,342	12,363	11,188	12,409	10,582
Total ROI	**56,504**	**54,734**	**58,239**	**55,726**	**50,434**	**50,072**	**45,304**

[1] End of year Annual total forecast from actual year to date totals

Table A1.8: Historic Non-coincident Peak ROI Demand by Sector

	2007/08 (GWh)	2008/09 (GWh)	2009/10 (GWh)	2010/11 (GWh)	2011/12 (GWh)	2012/13 (GWh)	2013/14 (GWh)
Peak Day							
TX Power	129.3	135.7	134.3	133.0	117.4	119.9	108.7
TX DM I/C	12.9	12.7	13.7	18.4	20.4	22.9	20.7
DX DM I/C	11.3	11.2	11.8	12.3	12.7	13.7	12.8
DX NDM	74.1	79.7	95.2	94.9	73.0	75.5	65.8
Total ROI	**227.6**	**239.3**	**254.9**	**258.5**	**223.5**	**231.9**	**208.1**
Peak Day by Sector							
Power	129.3	135.7	134.3	133.0	117.4	119.9	108.7
I/C	46.9	46.8	51.7	57.5	53.7	59.1	54.2
RES	51.4	56.8	68.9	68.0	52.4	52.9	45.2
Total ROI	**227.6**	**239.3**	**254.9**	**258.5**	**223.5**	**231.9**	**208.1**

Appendix 2: Demand Forecasts

Assumptions

As outlined in chapter 4 a number of assumptions are made regarding a number of key demand drivers. These are presented in tables A2.1 to A2.3.

Table A2.1 New and Retired Power Station Assumptions

Name	Type	Export (MW)	Date	Location
New			*Start*	
Great Island	CCGT	431	Oct-14	Co. Wexford
Unspecified	OCGT	98	Jan-16	Unspecified
Total		**529**		
Retiring			*End*	
Great Island	LSFO	212	Oct-14	Co. Wexford
Tarbert (1,2,3&4)	LSFO	592	Dec-20	Co. Kerry
Total		**804**		

Table A2.2: Future GDP Assumptions

Year	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
GDP	2.2	3.1	3.3	3.3	3.3	3.3	2.5	2.2	2.2

Table A2.3: Residential Connections

	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
New[1]	2,400	2,880	3,360	3,629	3,919	4,233	4,571	4,937	5,000
One-off[2]	4,550	4,600	4,650	4,700	4,750	4,800	4,850	4,900	4,950
Disconnections	1,729	1,729	1,729	1,729	1,729	1,729	1,729	1,729	1,729
Total	**5,221**	**5,751**	**6,281**	**6,600**	**6,940**	**7,304**	**7,692**	**8,108**	**8,221**

[1] New connections refer to new buildings connecting to the gas network
[2] One-off connections refer to existing buildings which are newly connected to the gas network

Forecast

The demand forecasts are summarised in Tables A2.4 to A2.6. Table A2.7 presents the various supply sources by entry point, both existing and proposed. The values represent the maximum supply volume each source could potentially provide.

The ROI demand is broken down by sector, while the total demand is given for NI and the IOM. It should be noted that the figures in the tables may not sum to total due to rounding.

The forecasts are based on the following weather scenarios:

- Table A2.4: Peak-day gas demand under severe 1 in 50 weather conditions, i.e. weather so severe that it only occurs once every 50 years;
- Table A2.5: Peak-day gas demand under 'average year' weather conditions, i.e. the weather conditions that typically occur each year; and
- Table A2.6: Annual gas demand in average year weather conditions.

The NI peak-day demand used for both the 1 in 50 and average year weather forecast is based on information published by the Northern Ireland Utility Regulator (UREGNI) in the Northern Ireland Gas Capacity Statement 2013/14. The IOM peak-day is based on information provided by the Manx Electricity Authority (MEA).

The electricity demand for the average year is as per EirGrid's All-Island Generation Capacity Statement 2014-2023 under the low electricity demand forecast. The 1 in 50 year electricity demand is calculated by projecting forward the actual peak of 5,090 MW and growing this figure forward in line with the low electricity demand forecast growth rate.

The weather correction is only applied to the distribution connected load, i.e. primarily to the residential and small I/C sectors. There is no weather correction applied to the power sector gas demand forecast.

Table A2.4: Peak Day Demand (1 in 50) & Base Supply (GWh/d)

	14/15 GWh	15/16 GWh	16/17 GWh	17/18 GWh	18/19 GWh	19/20 GWh	20/21 GWh	21/22 GWh	22/23 GWh
Demand									
Power	135.6	135.2	136.1	137.4	138.1	138.1	150.6	149.9	150.0
I/C	63.4	65.0	66.1	67.4	68.5	69.7	70.4	70.9	71.4
RES	64.8	64.0	63.0	62.0	60.9	59.8	58.7	57.6	56.5
Transport	0.0	0.0	0.1	0.2	0.3	0.5	0.7	1.0	1.6
Own use	5.4	3.8	3.8	4.2	4.3	4.7	5.2	5.2	5.2
Sub total	269.2	268.0	269.1	271.2	272.1	272.8	285.6	284.6	284.7
Injection	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IOM	4.9	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
NI	98.8	93.5	96.9	98.3	99.7	101.0	102.4	103.6	104.8
Total	**372.9**	**367.3**	**371.8**	**375.3**	**377.6**	**379.6**	**393.8**	**394.0**	**395.3**

Notes

[1] Injection refers to storage injections from the transmission system into storage facilities

[2] Own-use refers to fuel-gas used by the transmission system to transport the gas, e.g. fuel-gas used by the compressor stations and heat exchangers at Above Ground Installations (AGIs)

Table A2.5: Peak Day Demand (Average Year) & Base Supply (GWh/d)

	14/15 GWh	15/16 GWh	16/17 GWh	17/18 GWh	18/19 GWh	19/20 GWh	20/21 GWh	21/22 GWh	22/23 GWh
Demand									
Power	124.0	123.3	123.7	124.2	133.0	124.0	132.0	131.6	131.2
I/C	55.1	56.5	57.5	58.6	57.0	60.5	61.0	61.5	62.0
RES	49.4	48.7	48.0	47.2	44.2	45.5	44.6	43.8	43.0
Transport	0.0	0.0	0.1	0.2	0.3	0.5	0.7	1.0	1.6
Own use	3.4	2.4	2.4	2.6	2.6	2.9	3.2	3.2	3.4
Sub total	231.9	230.9	231.7	232.8	237.1	233.4	241.5	241.1	241.2
Injection	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
IOM	4.2	4.7	4.7	4.7	4.4	4.7	4.7	4.8	4.8
NI	57.9	60.9	61.3	62.2	63.0	63.9	64.7	65.5	66.3
Total	**294.0**	**296.5**	**297.7**	**299.7**	**304.5**	**302.0**	**310.9**	**311.4**	**312.3**

Table A2.6: Annual Demand (Average Year) & Base Supply Scenario (TWh/y)

	14/15 TWh	15/16 TWh	16/17 TWh	17/18 TWh	18/19 TWh	19/20 TWh	20/21 TWh	21/22 TWh	22/23 TWh
Demand									
Power	27.2	26.5	26.0	25.8	26.1	25.7	26.7	26.0	25.4
I/C	14.4	14.7	14.9	15.1	15.3	15.6	15.7	15.8	15.9
RES	7.3	7.2	7.1	7.0	6.9	6.7	6.6	6.5	6.4
Transport	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.4	0.6
Own use	0.8	0.4	0.4	0.4	0.5	0.4	0.5	0.5	0.6
Sub total	49.7	48.8	48.4	48.4	48.9	48.6	49.7	49.2	48.9
Injection	2.1	2.2	2.2	0.5	0.8	0.0	0.0	0.0	0.0
IOM	1.2	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.4
NI	12.7	12.4	14.1	14.5	13.8	14.4	13.7	14.5	14.6
Total	**65.7**	**64.7**	**66.0**	**64.7**	**64.9**	**64.4**	**64.8**	**65.1**	**64.9**

The forecast assumes that the peak-day gas demand of the power sector is coincident with that of the residential and I/C sectors, as this gives the worst case scenario for gas system planning purposes.

The power peak-day gas demand forecast assumes that all of the non gas-fired thermal power stations are available on the day, i.e. all of the peat, coal and oil-fired power stations. If there is a forced outage of one or more of the non gas-fired thermal power stations, then the peak-day gas demand of the sector may be higher than indicated in the above forecasts.

Table A2.7: Maximum Daily Supply Volumes

	14/15 GWh	15/16 GWh	16/17 GWh	17/18 GWh	18/19 GWh	19/20 GWh	20/21 GWh	21/22 GWh	22/23 GWh
Supply									
Corrib	0.0	103.1	103.1	80.7	69.0	74.8	63.5	60.5	50.6
Inch[1]	33.3	32.9	32.4	32.1	43.1	12.5	7.1	5.7	4.1
Moffat[2]	342.4	342.4	342.4	320.3	320.3	320.3	320.3	320.3	320.3
Total	**375.7**	**478.4**	**477.9**	**433.1**	**432.4**	**407.6**	**390.9**	**386.5**	**375.0**

[1] Combination of existing storage and forecast production levels

[2] The capacity of Moffat is based on the capacity of Beattock compressor station

Appendix 3: Energy Efficiency Assumptions

National Energy Efficiency Action Plan (NEEAP) 2

The NEEAP 2 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). 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 Energy Savings Directive (ESD) target of a 9% reduction in energy demand by 2016 in the non-ETS sectors.

Table A3.1 outlines the NEEAP 2 energy efficiency targets over the period to 2020.

Table A3.1: NEEAP 2 Energy Efficiency Savings Targets

	2010 PEE target (GWh)	2016 PEE target (GWh)	2020 PEE target (GWh)
Public Sector			
Public Sector Programme	75	645	1,255
Green Public Procurement (via ACA)	25	155	285
SEEEP and EERF (public sector)	90	90	90
Public Sector Building Demonstration Programme	140	140	140
CHP (public sector)	120	160	185
ReHeat (public sector)	110	125	125
Public transport efficiency	90	160	160
Better Energy (public sector)	0	500	1,000
Total Public Sector savings	650	1,975	3,240
Business			
SEAI Large Industry Programmes	1,595	2,235	2,730
SEAI SME Programme	150	400	505
ACA (private sector)	55	370	690
SEEEP and EERF (private sector)	175	175	175
CHP (private sector)	280	370	430
ReHeat (private sector)	250	290	290
Better Energy (commercial sector)	0	500	1,000
Total business savings	2,505	4,340	5,820
Buildings			
2002 Building Regulations – Dwellings	1,280	1,280	1,280
2008 Building Regulations – Dwellings	85	1,210	2,110
2011 Building Regulations – Dwellings	0	380	835
Building Regulations – Nearly Zero-Energy Dwellings	0	15	225
2005 Building Regulations – Buildings other than dwellings	185	300	300
2012 Building Regulations – Buildings other than dwellings	0	390	865
Energy-efficient boiler regulation	200	800	1,200
Domestic Lighting (Eco-Design Directive)	200	1,200	1,200
Greener Homes Schemes (GHS)	120	120	120

Warmer Homes Schemes (WHS)	125	130	130
Home Energy Saving (HES) scheme	365	365	365
Smart Meter rollout	0	375	625
Better Energy Homes (residential retrofit)	0	3,000	6,000
Total buildings savings	2,560	9,565	15,255
Mobility - Transport			
Electric vehicle deployment	0	265	690
Vehicle registration tax (VRT) and annual motor tax (AMT) rebalancing	185	825	655
Improved fuel economy of private car fleet (EU regulation)	190	1,575	3,015
More efficient road traffic movements	0	375	715
Aviation efficiency	255	255	255
Total transport savings	880	3,295	5,330
Energy Supply			
Electricity generation efficiency improvements	1,690	1,675	4,055
Transmission and distribution savings	275	325	360
Total energy supply savings	1,965	2,000	4,415
Totals	8,310	21,175	34,060

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 NDP 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[35], which are anticipated to result in improved whole-dwelling energy performance, equivalent to 60% better than 2005 standards; 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 impact of the Better Energy Homes schemes.

The NEEAP 2 assumes a total reduction of 11,715 GWh in residential energy demand by 2020 (allowing for savings realised up to 2010), comprising of a saving of 3,085 GWh associated with the building regulations (for dwellings) and 8,630 GWh of a saving associated with existing dwellings.

[35] As per the Building Regulations introduced in May 2011

The NDP forecast assumes that:

- New build gas connections will consume 60% less gas than 2005 levels.
- Total energy efficiency savings of 7,630[36] GWh in existing residential heat demand between 2010 and 2020 from the measures (excluding building regulations and lighting measures);
- Approximately 30% of this target reduction will be achieved in gas-fired residential homes, based on the gas share of residential heat in 2012, i.e. the gas share of total residential TFC after excluding the electricity and renewable components;
- 50% of the gas related energy efficiency savings are expected to be realised (based on studies completed by the Energy Research Institute, UCC); and
- This would lead to a reduction of 114.5 GWh/y in residential annual gas demand, which is equivalent to 1.7% of the estimated residential gas demand in 2013/14.

Impact on I/C Gas Demand

The NEEAP 2 assumes a total reduction of 3,160 GWh in I/C energy demand by 2016, and a total reduction of 5,905 GWh by 2020, allowing for the savings already realised in the period up to (and including) 2010. The NDP forecast assumes the following:

- That the total I/C energy demand will reduce by 3,160 GWh by 2016 and a further 2,745 GWh by 2020 (totalling 5,905 GWh), an annual reduction of 527 GWh/y up to 2016 and 686 GWh/y up to 2020;
- The gas share of these reductions is assumed to be 30%, based on gas share of total I/C TFC in 2012; and
- This would lead to an average annual reduction of 158 GWh/y in I/C annual gas demand up to 2016/17, and 206 GWh/y from 2016/17 onwards (which is equivalent to 1.2% and 1.6% of the estimated 2013/14 I/C annual demand respectively).

[36] 7,630GWh is equivalent to the total residential savings net of Building Regulations and Domestic Lighting savings.

Appendix 4: Transmission Network Modelling

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

Network analysis was carried out using hydraulic network modelling software, Pipeline Studio®. A single hydraulic model of the Interconnector and ROI transmission systems[37] was constructed using Pipeline Studio®. This simulation software was configured to analyse the transient 24 hour demand cycle over a minimum period of three days to obtain consistent steady results.

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 to 2021/22:

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

These demand days, which were generated from the gas demand forecast, have been chosen as they represent the maximum and minimum flow conditions on the transmission system.

The ability of the ROI transmission system to accommodate the forecast gas flow requirements was validated against the following criteria;

- Maintaining the specified minimum and maximum operating pressures at key points on the transmission systems;
- Operating the compressor stations within their performance envelopes; and
- Ensuring gas velocities do not exceed their design range of 10 – 12 m/s.

Entry Point Assumptions

The main Entry Point assumptions are summarised in Table A4.1;

Table A4.1: Entry Point Assumptions

	Moffat	Inch	Corrib	Shannon
Pressure (barg)	47.0[1]	30.0	Up to 85.0	Up to MOP[3]
Gross Calorific Value (MJ/scm)	39.8	37.8	37.5	40.5
Max Supply (mscmd)	31.0[1]	3.2	9.9[2]	11.3

[1] Reduces to 45 barg and 29.0 mscmd from 2016/17
[2] Maximum daily supply capacity for first year of production
[3] Maximum Operating Pressure of the pipeline

As per the existing Pressure Maintenance Agreement (PMA), National Grid is required to provide gas at a minimum pressure of 42.5 barg at Moffat for flows up to 26 mscmd. They have also advised a higher Anticipated Normal Off-take Pressure (ANOP) pressure for Moffat of 47 barg (i.e. the expected pressure under normal circumstances). The ANOP pressure has been used in the network modelling. This ANOP pressure is assumed to reduce to 45 barg from 2016/17, which reduces the technical capacity of the Moffat Entry Point.

A minimum pressure of 30 barg is provided at Inch, and the Corrib Operator is required to provide up to 85 barg at Bellanaboy.

[37] NI transmission system is not included in the modelling. NI is treated as a demand at Twynholm, Scotland.

Glossary

ACER	Agency for Cooperation of Energy Regulation
AGI	Above Ground Installation
ANOP	Anticipated Normal Off take Pressure
BETTA	British Electricity Trading and Transmission Arrangements
BGÉ	Bord Gáis Éireann
CAM	Capacity Allocation Mechanism
CBA	Cost benefit analysis
CBCA	Cross Border Cost Allocation
CCGT	Combined cycle gas turbine
CER	Commission for Energy Regulation
CHP	Combined heat and power
CIP	Close Interval Potential
CMP	Congestion Management Procedure
CNG	Compressed Natural Gas
CO2	Carbon dioxide
CP	Cathodic protection
DCVG	Differential Current Voltage Gradient
DD	Degree Day
DECC	Department of Energy and Climate Change
DM	Daily Metered
DRI	District Regulating Installation
EC	European Commission
ENTSOG	European Network of Transmission System Operators for Gas
ESBN	Electricity Supply Board Networks
ESD	Energy Services Directive
ETS	European Emission Trading Scheme
EWIC	East West Interconnector
EU	European Union
FG	Framework Guideline
GB	Great Britain
GDP	Gross Domestic Product
GEEP	Gas and Electricity Emergency Planning Group
GEPG	Gas Emergency Planning Group
GERT	Gas Emergencies Response Team
GIS	Geographic Information System
MNC	Multinational Corporation
GNI	Gas Networks Ireland
GTMS	Gas Transportation Management System
GWh	Gigawatt hour
GWh/d	Gigawatt hours per day
GWh/yr	Gigawatt hours per year
I/C	Industrial and Commercial
IC	Interconnector
IDA	Industrial Development Agency
IP	Interconnection Point
IrBEA	Irish Bioenergy Association
INFR	Implied Nominal Flow Rate
IOM	Isle of Man
Km	Kilometre
KTOE	Thousands of tonnes of oil equivalent
LDM	Large Daily Metered
LNG	Liquefied natural gas
LSFO	Low Sulphur Fuel Oil
MEA	Manx Electricity Authority
MEL	Mutual Energy Limited
MOP	Maximum operating pressure
Mscm/d	Million standard cubic metres per day
MW	Megawatt
MWh	Megawatt hour
MWh/house/yr	Megawatt hour per house per year
NDM	Non Daily Metered
NDP	Network Development Plan
NBP	National Balancing Point
NEC	National Emergency Corridor
NEEAP	National Energy Efficiency Action Plan
NGEM	National Gas Emergency Manager
NGEP	National Gas Emergency Plan
NGV	Natural Gas Vehicle
NI	Northern Ireland
No.	Number
NSMP	National Smart Metering Programme
NTS	National Transmission System
OECD	The Organisation for Economic Co-operation and Development
OEM	Original Equipment Manufacturer
PAP	Preventative Action Plan
PAS	Publicly Available Specification
PC3	Third Price Control
PCI	Projects of Common Interest

PMA	Pressure Maintenance Agreement
PSO	Public Service Obligation
REMIT	Regulation on Wholesale Energy Market Integrity and Transparency
Res	Residential
RES	Renewable Energy Sources
ROI	Republic of Ireland
RTU	Remote Terminal Units
SCADA	Supervisory Control and Data Acquisition
SEAI	Sustainable Energy Authority of Ireland
SEM	Single Electricity Market
SME	Small to Medium Enterprise
SNP	South-North Pipeline
SWSOS	South West Scotland Onshore System
TCBB	Technology Centre for Bioenergy & Biorefining
TEN-E	Trans-European Energy Infrastructure
TFEP	Task Force on Emergency Procedures
TPER	Total Primary Energy Requirement
TSO	Transmission System Operator
TWh/yr	Terawatt hours per year
TYNDP	European Ten Year Network Development Plan issued by ENTSOG
UREGNI	Utility Regulator for Northern Ireland
UK	United Kingdom
VRF	Virtual Reverse Flow

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