gasnetworks.ie

Gas Networks Ireland

Network Development Plan 2020

Table of 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 July 2020, 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
Gas Networks Ireland 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.

1.0 Foreword

Welcome to the 2020 ten-year Network Development Plan (NDP) published by Gas Networks Ireland.

This document provides a view of how the gas network may develop over a ten-year period. It is based on current supply and demand for gas, as well as projections for gas consumption and development of infrastructure. The document follows a process of engagement and consultation, both internally and through informal consultation with key industry stakeholders.

As noted in Section 3, the primary purpose of the NDP is to assess the gas network's capacity based on existing and forecast supply and demand in order to guarantee the adequacy of the gas transportation system and security of supply. As such, the supply and demand assumptions which define the scenarios presented in this NDP are based on a prudent assessment of current energy policy in Ireland. The Best Estimate scenario aligns to existing policy measures in place per Ireland's National Energy and Climate Plan (NECP) for 2021 – 2030. Gas Networks Ireland continue to monitor ongoing energy policy development and will incorporate additional policy measures into the NDP Best Estimate scenario as they are developed.

Throughout the COVID-19 pandemic, Gas Networks Ireland have implemented the recommendations and guidelines from the HSE and Irish Government to minimise the spread of the COVID-19 virus, and frequently update relevant Government Departments on our activities. The COVID-19 pandemic has had a notable impact on gas demand in the Industrial and Commercial sector, but gas demand in the Power Generation and Residential sectors have not been materially impacted and overall gas usage on the network is generally in line with pre-COVID-19 levels on aggregate. The impact of current ongoing COVID-19 related economic restrictions are incorporated in our gas demand projections. However, given the ongoing and dynamic nature of the pandemic and associated restrictions, certain modelling assumptions may evolve and become replaced relatively quickly – in this event, assumptions will be further calibrated in next year's NDP as necessary. Throughout 2020, gas supplies have been available to customers 24/7/365, which is testament to the underlying resilience of the gas network and the long-term investment strategies delivered and underpinned by the Network Development Plan process.

"Gas Networks Ireland continue to monitor ongoing energy policy development and will incorporate additional policy measures into the NDP Best Estimate scenario as they are developed."

Over the 10 year forecast horizon considered in this document, gas demand in Ireland is anticipated to increase, with strong growth of 23% projected in the Best Estimate scenario. The main drivers for growth are within the Power Generation sector, and include a significant projected growth in electricity demand, the need for additional gas-fired power generation to meet this demand, and the anticipated closure of certain non-gas fired thermal generation plant. The ambitious targets assumed for integration of renewable electricity sources result in the displacement of a certain amount of gas demand in this sector, thus off-setting the portion of growth that might otherwise occur. Industrial and Commercial sector gas demand is also projected to grow, as is Transport. The Residential sector is the only sector showing negative growth over the 10 years, this trend reflects the current policy positions that are built into the modelling assumptions.

Given the scope for growth, the current technical supply capacity at Moffat is anticipated to be exceeded in the latter half of the forecast horizon. While the capacity on the interconnector pipelines is more than adequate to meet all gas demand projections over the 10 year horizon, the potential constraint arises at the associated compressor station installations. Gas Networks Ireland will keep this potential constraint under review in subsequent Network Development Plans. Measures are being explored to relieve this constraint in the medium and long term.

Natural gas remains the fuel most required to assist Ireland's transition to a low carbon economy, as it is the optimal complementary energy source to intermittent renewable energy such as wind and solar, given its flexibility. Natural gas continues its key role in Ireland's energy system providing approximately 30% of the country's primary energy needs. Approximately 700,000 households and businesses in Ireland rely on natural gas for a secure and competitive source of heating. In 2019, 52% of Ireland's electricity was powered by natural gas[1].

Gas Networks Ireland welcomes the submission by the Department of the Environment, Climate and Communications (DECC), of Ireland's National Energy and Climate Plan

1 System and Renewable Data Summary Report – EirGrid

1.0 Foreword (continued)

for 2021 – 2030 to the European Commission. In recognising that Ireland must significantly increase its commitments to tackling climate disruption, Gas Networks Ireland published "Vision 2050 - A Net Zero Carbon Gas Network for Ireland" in October 2019 which sets out one potential pathway to reducing Ireland's total carbon emissions by one third, by creating a net zero carbon gas network by 2050 through a combination of technologies.

Renewable gas will provide an indigenous and sustainable energy source, contributing significantly to the reduction of emissions from Irish agriculture. The introduction of renewable gas onto the Irish gas network for the first time in 2019 at Cush, Co. Kildare marked a significant milestone for the gas network. The development of this first renewable gas injection facility delivers the capacity to facilitate enough renewable gas for 11,000 homes. As with other renewable energy technologies, renewable gas requires state policy and incentive supports to allow this industry to develop and grow to a long-term competitive fuel. Gas Networks Ireland also recognises that the renewable gas industry needs to take a series of steps to deliver long-term competitiveness and this will require a coordinated approach across all stakeholders.

Gas Networks Ireland is developing a network of Compressed Natural Gas (CNG) re-fuelling stations for public and private network operators. This will help establish a network of CNG refuelling facilities along Irelands TEN-T Core Road Network, as required under EU and National Policy on alternative fuels, and thus facilitating a transition to both natural gas and renewable gas as alternative fuels. The existing natural gas network can be utilised as a national vehicle refuelling network, giving the commercial transport sector access to a cleaner, cheaper fuel with a similar operational performance to diesel. Heavy goods vehicles (HGV) account for 20% of all energy related carbon dioxide (CO_2) emissions in the road transport sector, despite accounting for only 3% of the total number of road vehicles. Gas Networks Ireland is targeting the conversion of 24% of heavy goods vehicles and 13% of buses to Compressed Natural Gas (CNG) by 2030. To date, public access stations at Dublin Port and Cashel have been constructed, commissioned and are fully operational. A further nine publicly accessible sites are contracted with Forecourt Operators, with project plans in place to deliver these stations over the next 2 years.

Gas Networks Ireland welcomes the European Commission's 'Green Deal', in particular the ambition for a net zero emissions EU economy by 2050. As part of the EU Green Deal, the Commission announced its strategies for Energy System Integration and Hydrogen in July 2020. Both strategies signal a review of the gas legislative framework in 2021 which will deliver *"a competitive decarbonised gas market"*. Gas Networks Ireland will continue to monitor these developments and progression on delivering on the EU Green Deal and will proactively engage with EU and national stakeholders in the context of considerations and implications for the Irish gas market.

Gas Networks Ireland is active in a number of European gas organisations that are assessing the readiness of existing gas networks to carry hydrogen, including blends of natural gas and hydrogen. We are currently developing a Hydrogen Innovation Centre at the Brownsbarn AGI site in Dublin. In addition, various studies are ongoing internally to assess the unique aspects of the Irish gas network in this context.

"We are currently developing a Hydrogen Innovation Centre at the Brownsbarn AGI site in Dublin. In addition, various studies are ongoing internally to assess the unique aspects of the Irish gas network in this context."

Gas Networks Ireland wishes to acknowledge the key role the Kinsale gas fields have played in the supply of natural gas to Ireland since 1978, marking over four decades of operation. Gas Networks Ireland is fully committed to ensuring that gas will continue to flow through its other entry points and that security of gas supply will not be negatively impacted. Gas Networks Ireland will continue to ensure that a resilient, robust and safe gas network is maintained to ensure security of supply to customers through appropriate and efficient investment.

We would like to acknowledge the contribution of all stakeholders during the process of preparing this document. We welcome feedback at: ndp@gasnetworks.ie

Denis O'Sullivan,
Managing Director,
Gas Networks Ireland

Executive summary

The Network Development Plan (NDP) provides a view of how the gas network may develop over a ten-year period. It is based on current supply and demand for gas, as well as projections for growth in gas consumption and development of infrastructure. This report is being published in accordance with Gas Networks Ireland's statutory requirements.

The assessment horizon covered in this report covers the ten-year period from 2019/20 to 2028/29 inclusive. The input data and assumptions used for modelling gas supply and demand scenarios over the ten-year period were finalised in July 2020, in line with the modelling 'Data Freeze' date. Further to this modelling data freeze, production of the report extended to September 2020, and hence any non-modelling information such as historic gas demand, project status and other ancillary developments in the gas and wider energy industry, available up until 30th September 2020 have been included in this report.

The COVID-19 pandemic has had a notable impact on gas demand in Ireland, since restrictions were first applied in March 2020. Commentary has been included in this NDP on the resulting short-term impacts the pandemic has had on gas demand, as observed since March 2020. It is still very early stages in assessing the potential medium to long-term impact on the Irish economy and consequentially on projected gas demand in Ireland. The assumptions made in the NDP on the potential short-term future economic impact of COVID-19 are based on the best available information at the time of the modelling 'Data Freeze'. However, given the fluid nature of the pandemic and the associated economic impact, the gas demand forecasting assumptions for NDP 2020 carry a high degree of uncertainty. Next year's NDP (2021) will re-visit these assumptions and adjust them accordingly as further information becomes available on the potential longer-term economic impact of the COVID-19 pandemic.

Gas Networks Ireland, together with its parent company Ervia, published in October 2019, the Vision 2050 - A Net Zero Carbon Gas Network for Ireland. Through a combination of technologies, Gas Networks Ireland sets out one potential pathway to reducing Ireland's total carbon emissions by one third by creating a net zero carbon gas network. Vision 2050 outlines one potential role that the gas network and key technologies such as renewable gas, compressed natural gas for transport, Carbon Capture and Storage (CCS) and hydrogen can play in tackling climate change while also ensuring that Ireland has a sustainable and secure energy future. Vision 2050 demonstrates how the gas network supports decarbonisation for domestic customers, industrial users, transport, agriculture and power generation.

Gas Networks Ireland is currently preparing a Network Implementation Plan in compliance with S.I. No. 435/2004 – European Communities (Environmental Assessment of Certain Plans and Programmes) Regulations 2004, as amended ("SEA Regulations") and S.I. No. 477/2011- European Communities (Birds and Natural Habitats) Regulations, as amended ("AA Regulations"). The Network Implementation Plan will set out in more detail on the manner in which projects identified in the Network Development Plan will be developed and the potential for cumulative effects on the environment that may arise from these projects.

Annual Republic of Ireland (ROI) gas demands for 2019/20 were 1.5% higher than 2018/19 demands following on from a similar increase (2.0%) in the previous year. It is notable in the context of the COVID-19 pandemic, and the associated unprecedented changes to how we now operate in our daily lives, Industrial and Commercial (I/C) annual gas demand was the only sector which experienced negative growth in 2019/20 against the previous year. Gas demand in this sector decreased by 1.6%. Within this figure a tale of 2 halves has emerged over the 2019/20 gas year, whereby I/C gas demand was up by 3.5% in the first half of the gas year (October 2019– March 2020), whereas I/C gas demand was down by 7.4% in the second half of the gas year (April 2020 – September 2020), when compared against the same periods in 2018/19. This trend is linked to the economic impact of the COVID-19 related ongoing restrictions. Residential sector gas demand increased by 5.6% in 2019/20, the majority portion of this growth being weather-related, with the balance being related to new connections.

Through a combination of technologies, Gas Networks Ireland sets out one potential pathway to reducing Ireland's total carbon emissions by one third by creating a net zero carbon gas network.

In the power generation sector, annual gas demand for 2019/20 was 2.2% above 2018/19 levels. This was despite an increase in installed wind generation over the same period, and a reduction in electricity demand following the introduction of the COVID-19 related restrictions in March 2020.

Gas fired power generation accounted for approximately 52% of Ireland's electricity generation in 2019, as the gas network continues to complement renewable generation. The partnership between flexible gas-fired power

2.0 Executive summary (continued)

generation and intermittent renewable generation will be a key factor in enabling Ireland's renewable integration ambition into the future, as set out in the Climate Action Plan and the National Energy and Climate Plan.

In 2019 approximately 47% of Ireland's gas demand (ROI) was supplied from indigenous sources. The balance of supply, almost 53% came through the subsea interconnectors via the Moffat Entry Point in Scotland. July 2020 marked the final commercial volumes of gas supply from the Kinsale gas fields onto the Gas Networks Ireland transmission system via the Inch Entry Point.

In order to inform how the gas network may develop over a ten-year period, and to provide a comprehensive analysis, Gas Networks Ireland has developed three gas demand scenarios for the period 2019/20 to 2028/29, namely Low, Best estimate and High demand scenarios. These scenarios are designed to represent a broad range of likely outcomes and are informed by a range of external and internal factors. The NDP Best Estimate scenario is aligned to the ENTSOG/ENTSOE TYNDP Best Estimate and National Trends scenarios.

In the Best Estimate demand scenario annual ROI gas demand is expected to grow by 23% between 2019/20 and 2028/29 with 7% growth forecast in the Low demand scenario and growth of 45% forecast in the High demand scenarios respectively over the same horizon. These trends are dominated by the strong continued requirement for gas fired power generation in the electricity system to meet the projected levels of demand growth in the electricity system.

The development of peak day demands across the various scenarios shows the same broad trends as the annual demand forecasts. However, there are a number of key differences, particularly regarding the power generation sector gas demand profile. Over the forecast horizon 1-in-50 peak day demand is predicted to grow by 19.1%, and by 21.5% for the average year peak in the Best Estimate demand scenario.

The Corrib gas field is expected to meet approximately 27% of annual Gas Networks Ireland system demands (35% of ROI demand) in 2020/21, with the Moffat Entry Point providing the remaining 73%.

There are a large number of properties located close to the gas network which are not connected to natural gas. It is estimated that there are over 700,000 households in Ireland using oil for central heating of which 300,000

"Gas Networks Ireland now facilitates direct grid injection projects through a connection policy framework and is also supporting remote cluster developments with Central Grid Injection (CGI) infrastructure."

are located in close proximity to the gas network and could be readily connected to gas resulting in significant benefits from an environmental perspective, considering natural gas emits 22% less CO_2 and negligible levels of nitrogen dioxide (NO_x) & sulphur dioxide (SO_x) versus oil. Where there is no natural gas network available, Gas Networks Ireland supports deep retrofit investment to bring as many of Ireland's homes to a B2 energy rating standard. However, where homes using oil (to provide heating and hot water) are located on or close to the natural gas network, Gas Networks Ireland recommends upgrading these homes to a B2 BER by carrying out basic insulation, switching to high efficiency condensing gas boilers and controls, replacing lighting with LED equivalents and installing solar PV panels. This work can be carried out at up to one third of the cost of the deep retrofit works, and with significantly less disruption. This proposal means that up to 300,000 homes could be upgraded to a B2 BER at one third of the cost of the alternative deep retrofit costs, reducing CO_2 emissions while also future proofing these homes for renewable gas as it becomes available in greater quantities on the network.

Ireland has rapidly emerged as a prime data hosting destination. Gas Networks Ireland has developed a combined offering of natural gas, renewable gas and dark fibre services (through its subsidiary Aurora Telecom) to provide the data centre sector with its primary source of energy and fibre connectivity. Natural gas can be used for onsite energy generation leveraging the existing reliable gas network infrastructure, offering data centre operators a primary source of power for data centres requiring 99.999% availability, flexible on-site generation capacity to complement flexible grid power connections, or back up generation to cater for grid power outages. Gas Networks Ireland expects the penetration of gas connections in this sector to increase in the coming years.

Gas Networks Ireland is targeting the conversion of 24% of heavy goods vehicles (HGV) and 13% of buses to Compressed Natural Gas (CNG) by 2030. By the end of the current NDP period (2028/29), Gas Networks Ireland is expecting to see annual CNG demand of circa 837.8 GWh/yr. Gas Networks Ireland is conducting a project for a nationwide CNG fuelling network, co-located in existing forecourts, on major routes and/or close to urban centres. This will help satisfy the requirements of the EU's (European Union) Alternative Fuels Directive which aims to establish CNG refuelling facilities along the TEN-T Core Road Network. The initial phase of this network rollout is through the Causeway Study which has begun to deliver this essential infrastructure. The CNG Stations will be strategically located to deliver the required outputs of the Causeway Study and to maximise utilisation of the assets.

Public access stations have been constructed at the Circle K Service Station in Dublin Port, and at Circle K Cashel on the M8 motorway. The stations are fully operational and have been integrated with Circle K's systems, and as such CNG is now sold through the forecourt in a similar fashion to diesel and petrol. A further nine publicly accessible sites are contracted with Forecourt Operators, with project plans in place to deliver these stations over the next 2 years. In addition, a private fast-fill CNG station is fully operational at the Clean Ireland Recycling premises in Smithstown Industrial Estate, Shannon, Co. Clare. Clean Ireland Recycling have replaced a portion of their diesel-powered fleet with dedicated CNG waste collection vehicles, the first of their kind to be operated in Ireland. The company plan to transition the rest of their fleet to these lower-emission CNG trucks in the coming years.

In 2017, Gas Networks Ireland launched its Compressed Natural Gas Vehicle Fund making up to €20,000 available to businesses towards the purchase of a new Natural Gas Vehicle (NGV). The Vehicle Fund has made a total of €700k of funding available to transport operators, supporting the purchase of a range of commercial vehicles including trucks, buses and vans powered by Compressed Natural Gas (CNG), and is part of a process to promote natural gas as a transport fuel in Ireland. The Vehicle Fund is supported by the Commission for Regulation of Utilities (CRU) and is co-financed by the European Union's TEN-T Programme under the Connecting Europe Facility as part of the Causeway Project. This has been successfully allocated supporting 39 dedicated natural gas vehicles in the market. These vehicles alone are expected to utilise up to 20 GWh/ of CNG, emitting approximately 4,600 tonnes less of CO_2 per year.

2.0 Executive summary (continued)

Gas Networks Ireland commissioned the first renewable gas grid injection facility in Cush, County Kildare, and it was officially declared an Entry Point in May 2020. Gas Networks Ireland now facilitates direct grid injection projects through a connection policy framework and is also supporting remote cluster developments with Central Grid Injection (CGI) infrastructure. As with other renewable energy technologies, renewable gas requires state policy and incentive supports to allow this industry to develop and grow to a long-term competitive fuel. With the pending implementation of the support scheme for the production and grid injection of biomethane, Gas Networks Ireland has produced three renewable gas production forecasts (Low, Best Estimate and High) based on assumed different levels of support. The National Energy and Climate Plan (NECP) has proposed an indicative target of 1.6 TWh/yr biomethane production by 2030, which will be reviewed in 2023 as part of the review process for the NECP. In maintaining alignment to current policy measures, the NDP Best Estimate scenario assumes 1.4 TWh/yr of renewable gas in the supply mix by the end of the current NDP period (2028/29), but further scope remains for renewable gas production beyond the NECP indicative target.

The landmark European 'Green Deal' was announced by the European Commission (EC) in December 2019, with the intention of transforming the EU into a *"fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050*". Following this, of keen interest to Gas Networks Ireland was the adoption of the constituent EU strategies for Energy System Integration and Hydrogen announced in July 2020. The Strategy for Energy System Integration sets out to establish the basis for *"the coordinated planning and operation of the energy system as a whole, across multiple energy carriers"*. In parallel, the EC's Hydrogen Strategy sets out an ambitious roadmap for the development of a European hydrogen economy by 2030. According to the Commission, hydrogen *"offers a solution to decarbonise industrial processes and economic sectors where reducing carbon emissions is both urgent and hard to achieve*". Both strategies signal a *"review of the legislative framework to design a competitive decarbonised gas market, fit for renewable gases"*, by 2021. Gas Networks Ireland will continue to monitor these developments and proactively engage with EU and national stakeholders, in the context of considerations and implications for the Irish gas market.

Gas Networks Ireland is in the fourth year of its fourth regulatory Price Control period (PC4) which concludes in September 2022. The CRU has given a capital allowance of €554m for investment in the distribution and transmission networks.

Capacity limitations are identified on the network and addressed through appropriate capital investment programmes in order to ensure continuity of supply to all customers. In 2019, 11 projects were completed including 3 AGI Capacity Upgrades, 7 Reinforcements of the Distribution Network and 1 CNG station located in Cashel. These projects were subject to the appropriate consenting and planning regimes as set out in Section 3.

Gas Networks Ireland continuously undertakes detailed system modelling of the network in order to assess the capacity of the network. The Best Estimate demand scenario identified in Section 6 is modelled to identify any potential capacity constraints. Gas Networks Ireland will mitigate against these modelled system constraints to maintain system resilience and security of supply. Any such mitigating works are identified as part of the Network Implementation Plan.

"Gas Networks Ireland will continue to ensure that a resilient, robust and safe gas network is maintained to customers through appropriate and efficient investment"

During late 2017 and early 2018, the gas network has again demonstrated its resilience through extreme weather events Storms Emma and Ophelia, with no loss of gas supply to households, businesses or the power generation sector.

Gas Networks Ireland will continue to ensure that a resilient, robust and safe gas network is maintained to customers through appropriate and efficient investment. In the context of Brexit, in addition to continued collaboration with our UK counterparts, Gas Networks Ireland is fully committed to ensuring that gas will continue to flow through its interconnectors and that gas supply will not be negatively impacted following completion of the transitional period.


Gas Networks Ireland
1850 20 50 50

3.0 Introduction

Key messages:

The gas network currently consists of 2,477 km of high pressure steel transmission pipelines and 12,044 km lower pressure polyethylene distribution pipelines.

Natural gas is available in 21 counties and there are circa 700,000 users in Ireland.

The Network Development Plan (NDP) provides a view of how the gas network may develop over a ten-year period. It is based on current supply and demand for gas, as well as projections for growth in gas consumption and development of infrastructure.

3.1 Licence/regulatory obligations

Gas Networks Ireland is a wholly owned subsidiary of Ervia and was established in accordance with the Gas Regulation Act 2013, as amended. It owns and operates the natural gas transmission and distribution networks in Ireland. As Ireland's gas Transmission System Operator (TSO), Gas Networks Ireland is required to submit a ten-year Network Development Plan to the Commission of Regulation of Utilities (CRU) in accordance with Article 22 of EU Directive 2009/73/EC and Article 11 of the EC[2] (Internal Market in Natural Gas and Electricity) (Amendment) Regulations 2015. Gas Networks Ireland is also obliged to submit a long-term development statement to the CRU in accordance with condition 11 of its Transmission System Operator and Distribution System Operator licences. The publication of the NDP also satisfies the requirements of Section 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 CRU to monitor and publish a report outlining gas supply and demand in Ireland over seven years.

In accordance with Article 3 of Regulation (EU) 347/2013, as amended, on guidelines for trans-European energy infrastructure, Gas Networks Ireland is obliged to confer with regional groups on relevant regional and national infrastructure plans.

The project of common interest (PCI 5.3), Shannon LNG, has been included on the 4th PCI list published in October 2019. This independent third-party project potentially involves a new entry point near Ballylongford in Co. Kerry and a connection to the ROI gas transmission system.

The project of common interest (PCI 12.6), the Ervia Cork Carbon Capture Utilisation & Storage (CCUS) project, was included on the 4th list of PCI projects as published in October 2019. This potential project will involve the development of the necessary infrastructure to transport captured CO_2 from a CCUS cluster of heavy industry (oil refinery) and two gas fired CCGTs to enable the CO_2 to be transported either to local geological store or if unavailable to another store managed by another CCUS project developer.

The project of common interest (PCI 12.4), the Northern Lights project, was included on the 4th list of PCI projects as published in October 2019. The project, being led by the Norwegian company Equinor and in which Ervia is a partner, is a commercial CO_2 cross-border transport connection project between several European capture initiatives where the captured CO_2 will be transported by ship to a storage site on the Norwegian continental shelf.

The 5th PCI list is expected to be published by the European Commission in October 2021. ENTSOG will evaluate all candidate gas projects as required, as part of its Ten-Year Network Development Plan (TYNDP) and project promoters will need to apply to the European Commission for inclusion on the 5th PCI list in 2021.

3.2 Environmental and planning considerations

The purpose of the NDP is to assess the gas network's capacity based on existing and forecast supply and demand in order to guarantee the adequacy of the gas transportation system and security of supply. While it outlines a number of capital projects which will be delivered over the coming years, future proposed large capital projects and proposed new technologies, these projects are subject to the appropriate consenting and planning regimes as set out under the Gas Acts 1976 to 2009, the Planning and Development Acts 2000 to 2011 and other relevant National and European law. In order to assist with its obligations in this regard, Gas Networks Ireland implements an environmental and planning assessment procedure for works designed and planned for Gas Networks Ireland. This procedure includes an environmental assessment tool known as 'envirokit' supported by a guidance document known as 'enviroplan'. Together they are a bespoke environmental planning and assessment tool modelled on environmental legal and regulatory requirements and best environmental practice, including requirements pursuant to the EIA Directive (85/337/EEC), as amended and the Habitats Directive (92/43/EEC), as amended. This procedure ensures that environmental and planning matters and appropriate mitigation measures are considered and communicated during the design and project planning stages of all Gas Network Ireland projects. Gas Networks Ireland is currently preparing a Network Implementation Plan which will be screened for the purposes of compliance with the SEA (Strategic Environmental Assessment) and AA (Appropriate Assessment) Regulations and which will set out in more detail the manner in which projects identified in the Network Development Plan will be developed and it will also assess the potential for cumulative effects on the environment that may arise from these projects.

3.0 Introduction
(continued)

3.3 Overview of the Gas Networks Ireland system

Gas Networks Ireland builds, develops and operates Ireland's world-class gas infrastructure, maintaining over 14,521 km of gas pipelines and two sub-sea interconnectors.

The Gas Networks Ireland transmission network includes onshore Scotland, interconnectors and the onshore ROI network. The interconnector (IC) sub-system comprises of two subsea interconnectors between ROI and Scotland; compressor stations at Beattock and Brighouse Bay. The interconnector system connects to Great Britain's (GB) National Transmission System (NTS) at Moffat in Scotland. It also supplies gas to the Northern Ireland (NI) market via Twynholm, Scotland and the Isle of Man (IOM) market via the second subsea interconnector (IC2).

From just 31 km of transmission pipeline in 1978, the Gas Networks Ireland network currently consists of 2,477 km of high pressure steel transmission pipelines and 12,044 km lower pressure polyethylene distribution pipelines, as well as Above Ground Installations (AGIs), District Regulating Installations (DRIs) and compressor stations. AGIs and DRIs are used to control and reduce pressures on the network.

The ROI onshore part of the system consists primarily of a ring-main system with spur lines serving various network configurations.

The gas infrastructure is differentiated by the following pressure regimes:

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

The natural gas network has demonstrated resilience and reliability through severe winter weather conditions, particularly during January and December 2010 when record sub-zero temperatures were recorded. During late 2017 and early 2018, the gas network again demonstrated its resilience through extreme weather events, storm Emma and Ophelia, with no loss of gas supply to households, businesses or the power generation sector. Natural gas is available in 21 counties and there are circa 700,000 users in Ireland. Gas Networks Ireland is responsible for connecting all new gas customers to the network, and for work on service pipes and meters at customers' premises, on behalf of all gas suppliers in Ireland.

Figure 3-1: Gas Networks Ireland total network breakdown

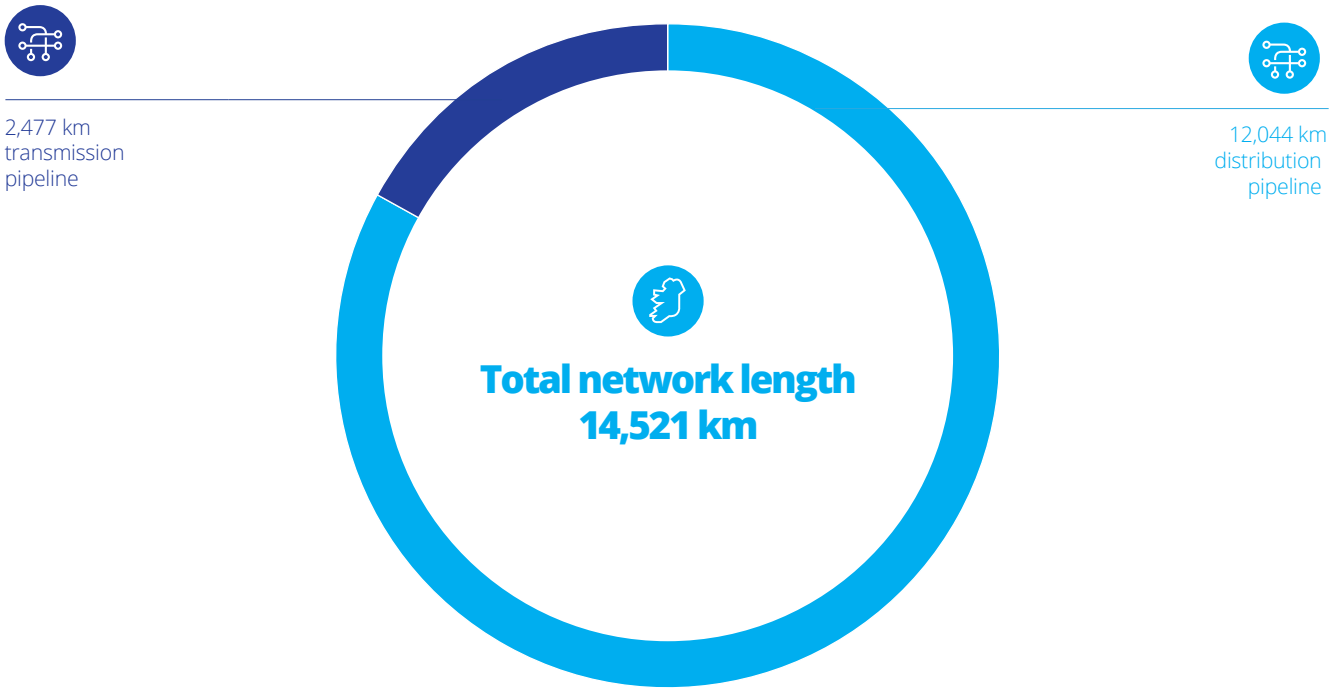


Figure 3-2: Overview of the Gas Networks Ireland transmission system

4.0 The future of the gas network

Key messages:

Gas Networks Ireland, together with its parent company Ervia, published "Vision 2050 - A Net Zero Carbon Gas Network for Ireland" on the 3rd of October 2019.

Replacing diesel in HGVs and buses with CNG can deliver immediate emissions reductions, air quality improvement (by eliminating particulate matter) and noise reduction.

CCS can capture up to 100% of the CO_2 emissions produced from the use of fossil fuels in electricity generation and industrial processes, significantly reducing the amount of carbon dioxide entering the atmosphere.

Hydrogen may be stored indefinitely and may be used in heat, transport, industry or power generation.

Gas Networks Ireland welcomes the strength of the ambition and the associated governance set out in the Climate Action Plan and recognises that Ireland must significantly increase its commitments to tacking climate disruption.

Gas Networks Ireland, together with its parent company Ervia, published "Vision 2050 – A Net Zero Carbon Gas Network for Ireland"[3] on the 3rd of October 2019. Through a combination of technologies, Gas Networks Ireland sets out one potential pathway to reducing Ireland's total carbon emissions by one third by creating a net zero carbon gas network.

Vision 2050 outlines one potential role that the gas network and key technologies such as renewable gas, compressed natural gas (CNG) for transport, carbon capture and storage (CCS) and hydrogen can play in tackling climate change while also ensuring that Ireland has a sustainable and secure energy future. Vision 2050 demonstrates how the gas network supports decarbonisation for domestic customers, industrial users, transport, agriculture and power generation.

Today, gas is used to generate approximately 52% of Ireland's electricity. A move to achieving a 70% renewable energy share in electricity generation (RES-E), such as from wind and solar, is planned by 2030 as part of ambitious national climate action targets. And while Ireland has excellent renewable resources, renewable energy, by its very nature, is intermittent – sometimes the wind doesn't blow, or the sun doesn't shine. As such, for renewable energy to achieve its full potential, investment in complementary energy is required. Natural gas is the optimal complementary energy source for renewable energy such as wind and solar. Achieving 70% RES-E will require a significant reliance on gas powered electricity generation to provide the balance of requirements and to ensure

Ireland has a secure energy supply at all times.

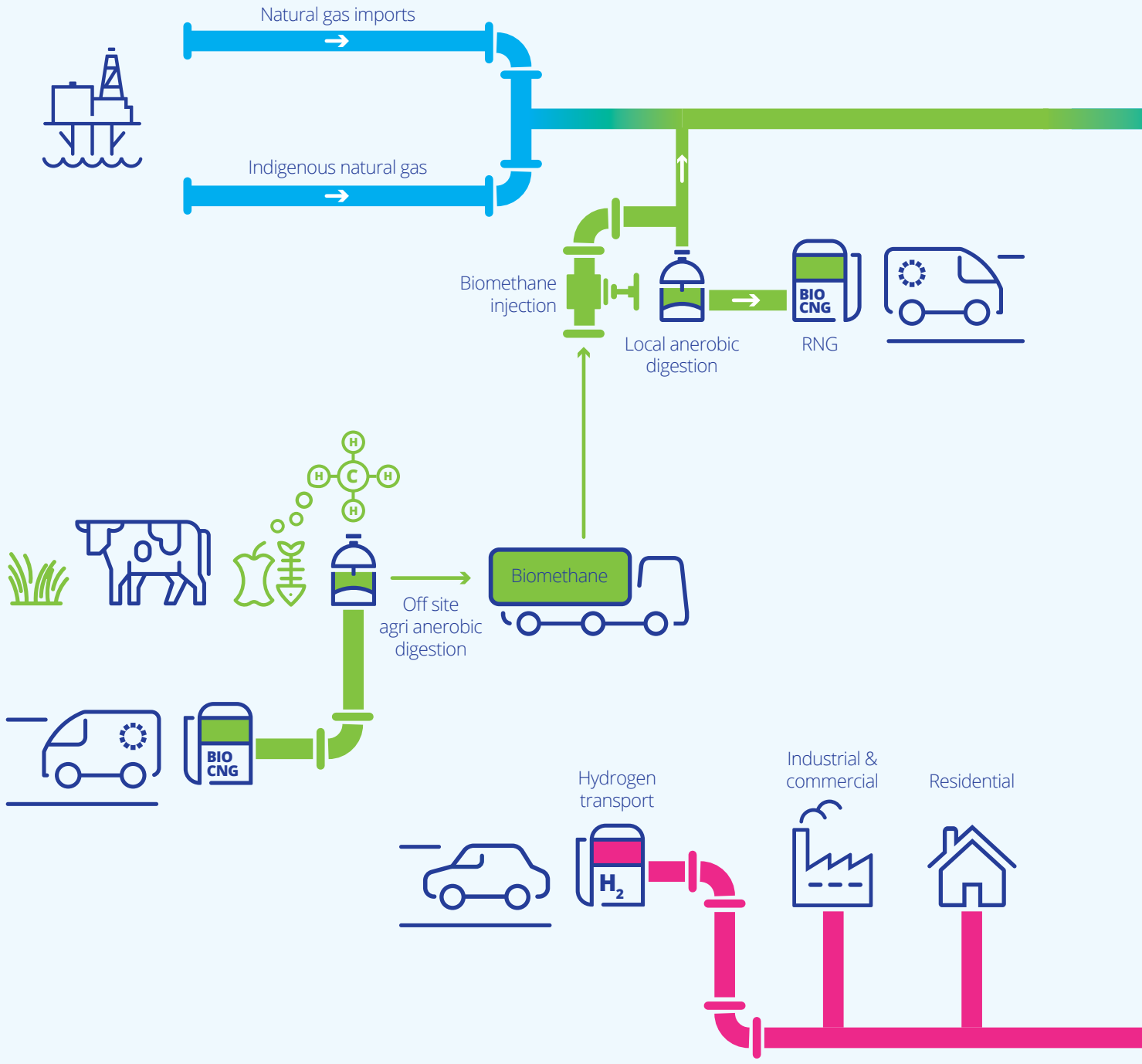
Natural Gas is the earth's cleanest fossil fuel. It emits 40% less CO_2 than coal and 22% less CO_2 than oil[4]. It also produces negligible levels of nitrogen dioxide (NO_x) and sulphur dioxide (SO_x) compared to oil or coal. Switching from these higher carbon fuels to natural gas can deliver immediate emissions benefits. The existing gas network is already capable of taking on significant new energy demands. Crucially, up to 100% of the carbon dioxide emissions from gas powered electricity generation can be captured through CCS, meaning Ireland can continue to benefit from the reliability of the gas network in a low carbon future.

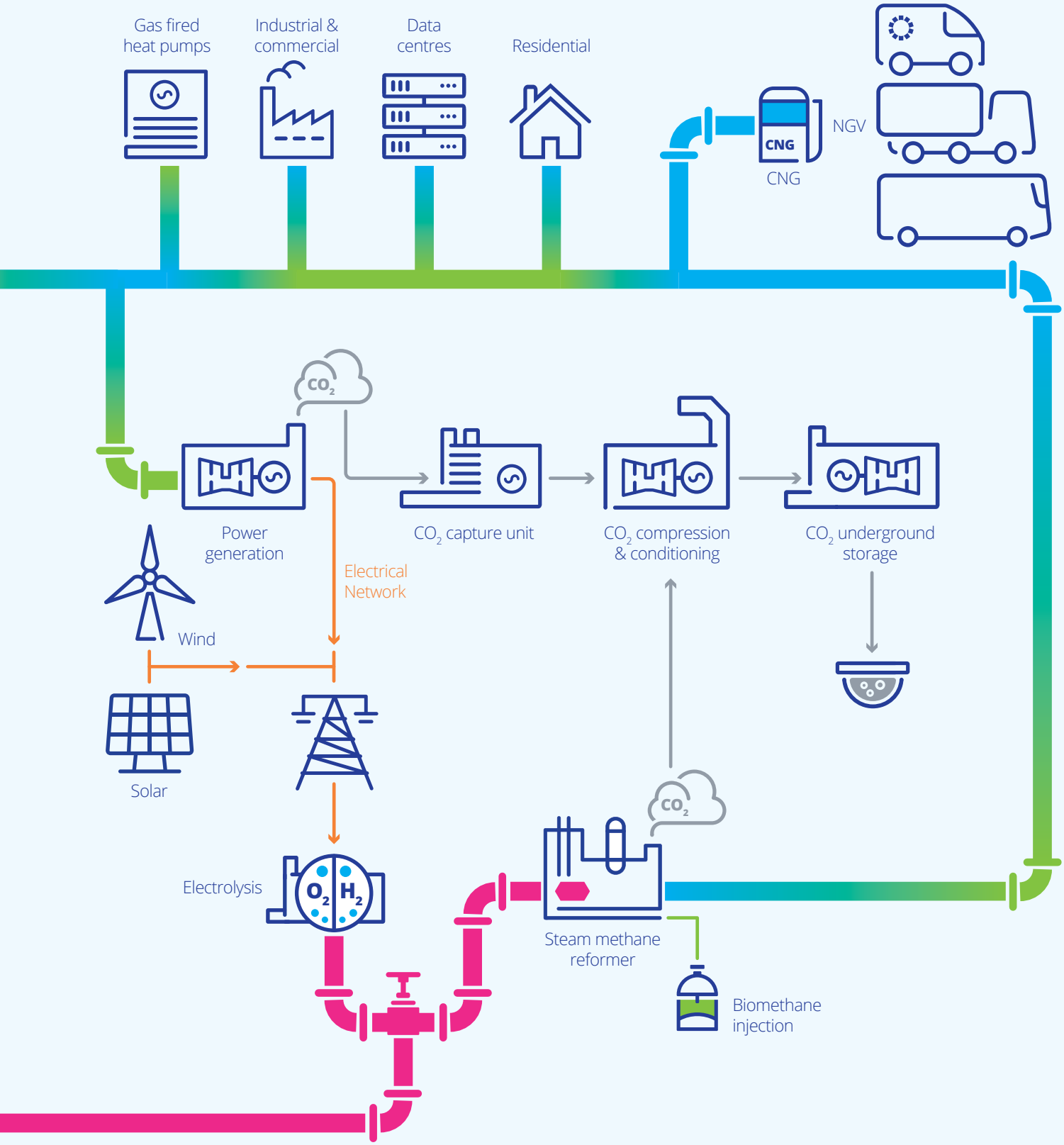
In line with emerging energy policy and climate ambition targets, Gas Networks Ireland is continuously reviewing and developing further potential pathways to achieve a decarbonised gas network by 2050, with a view to complementing and enhancing the pathway set out in Vision 2050. It is intended to share these pathways as the Vision 2050 publication is refreshed through future editions.

3 https://www.gasnetworks.ie/vision-2050/future-of-gas/GNI_Vision_2050_Report_Final.pdf
4 Government of Ireland, 2019, Climate Action Plan, https://www.gov.ie/en/publication/ccb2e0-the-climate-action-plan-2019/

4.0 The future of the gas network
(continued)

Figure 4-1: The future of the gas network




Gas fired heat pumps
Industrial & commercial
Data centres
Residential
CNG
CNG
NGV
CO_2
Power generation
CO_2 capture unit
CO_2 compression & conditioning
CO_2 underground storage
Electrical Network
Wind
Solar
Electrolysis
O_2
H_2
CO_2
Steam methane reformer
Biomethane injection

4.0 The future of the gas network (continued)

4.1 Compressed Natural Gas (CNG)

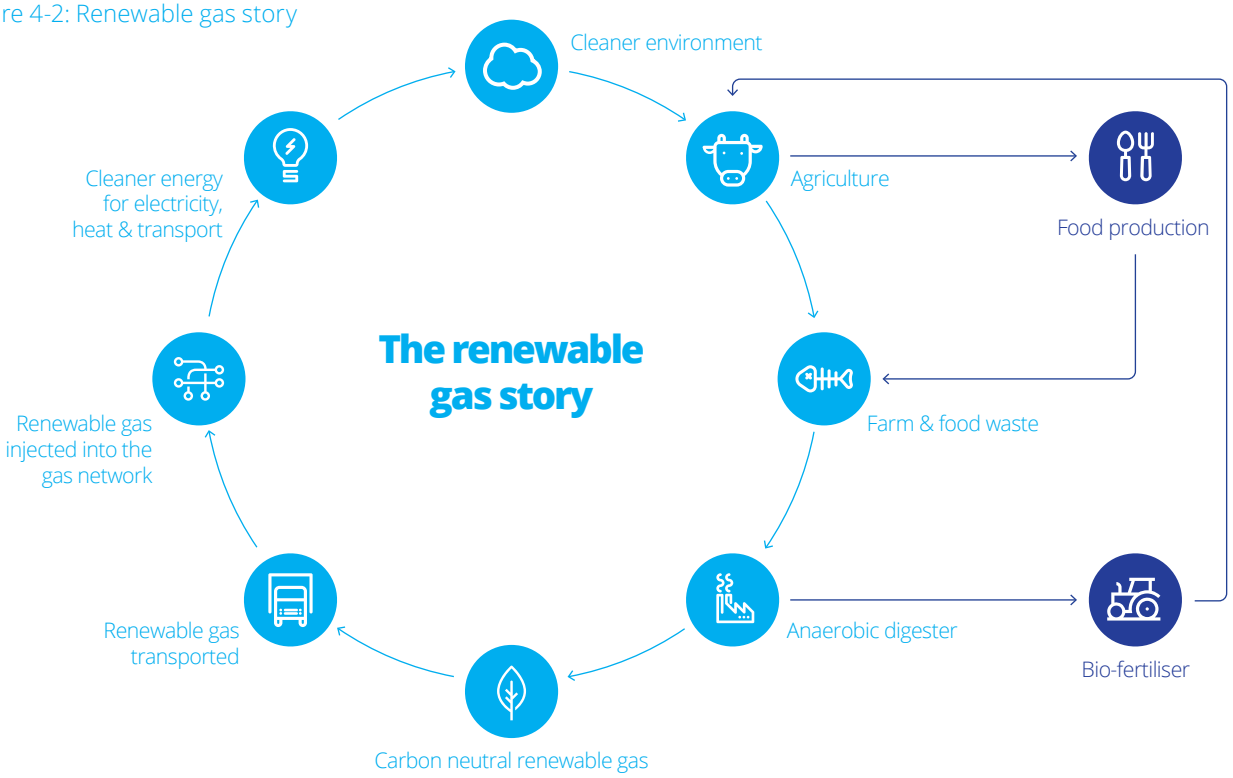
CNG is natural gas stored under high pressure. Replacing diesel in HGVs and buses with CNG can deliver immediate emissions reductions, air quality improvement (by eliminating particulate matter) and noise reduction. CNG is particularly well suited to delivering the high power and distance requirements of heavy-duty transport including HGVs, buses and ships. Bio-CNG is renewable gas stored under high pressure. It can be used as a renewable transport fuel in the same way as CNG but delivers even greater emissions savings. Gas Networks Ireland is conducting studies for a nationwide CNG fuelling network, co-located in existing forecourts, on major routes and/ or close to urban centres. This comprehensive refuelling station network will allow a transition to both natural gas and renewable gas as alternative fuels. Section 8.4 (Transport) provides more detail in relation to CNG.

4.2 Renewable gas

Renewable Gas is biomethane (purified biogas) produced from existing waste streams and a variety of sustainable biomass sources, including grass, animal waste, crop residues and food waste. It is net zero carbon, extremely versatile and fully compatible with existing gas network infrastructure. It is identical in standard to natural gas and can be used for all the same applications, using the same machinery (boilers, appliances, etc.). It can be blended with, or can act as a substitute for, natural gas.

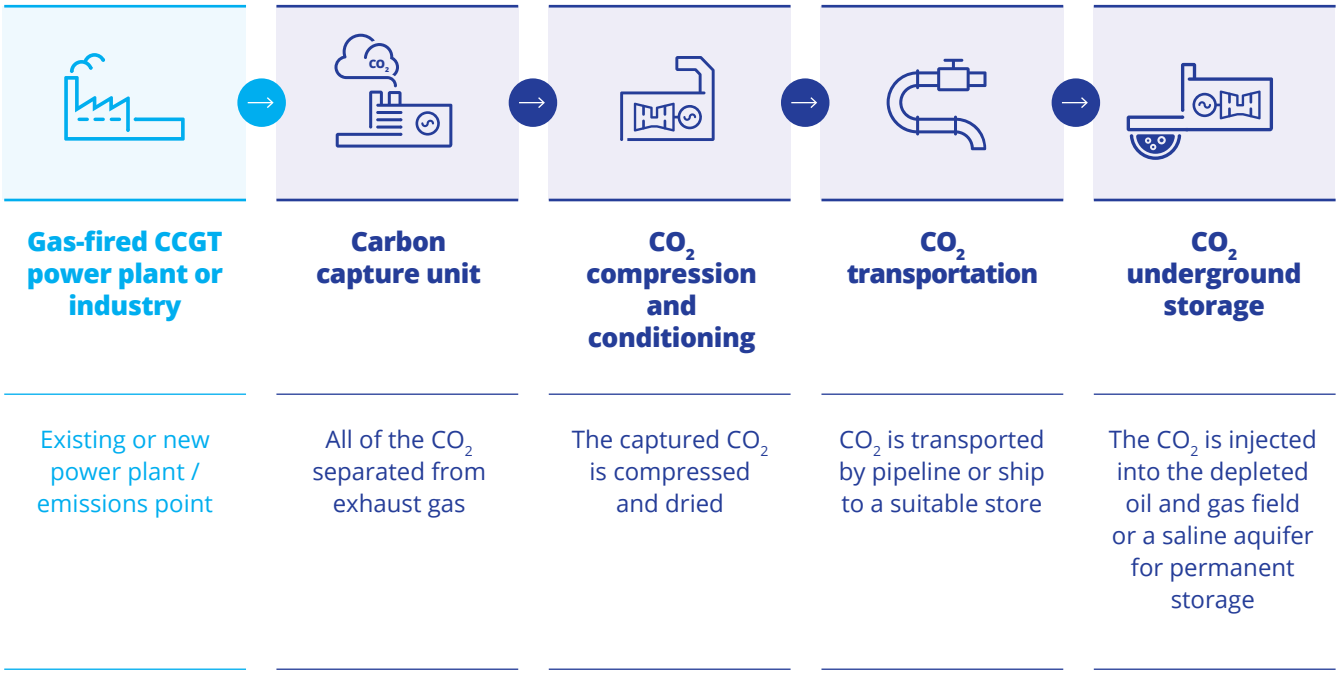
Action 130 of the Climate Action Plan sets out the Government's intention to set a target for the level of energy to be supplied by indigenous biomethane injection in 2030, taking account of the domestic supplies of sustainable feedstock and consider how the supports necessary to reach such a target would be funded[5]. Gas Networks Ireland is active in facilitating the emergence and uptake of this new energy source via the existing gas network. A network of renewable gas injection points is under development with the first commissioned in 2019. Gas Networks Ireland is working with Teagasc, Marine and Renewable Energy Ireland (MaREI) and other key stakeholders to develop plans for a renewable gas industry for Ireland in partnership with farmers and communities. Gas Networks Ireland has implemented a registry system to issue certificates for renewable gas injected into the Gas Networks Ireland grid (Green Gas Certificates). This system provides proof of the origin and sustainability of renewable gas sources which will stimulate the use of renewable gas by industry and other sectors.

Figure 4-2: Renewable gas story



5 https://www.gov.ie/en/publication/43721d-annex-of-actions/

Figure 4-3: Carbon capture and storage



It is envisioned that a number of Centralised Grid Injection facilities will be geographically dispersed across the country at locations in close proximity to the existing gas grid. Renewable gas producers within 60km of the existing gas grid will be able to avail of these facilities, using high capacity gas storage trailers to transport their gas via road, and inject into the national gas grid. The locations of these Central Gas Injection facilities are not yet finalised, and Gas Networks Ireland is currently assessing their feasibility.

4.3 Carbon Capture and Storage (CCS)

Carbon Capture and Storage (CCS) is a suite of technologies that can capture up to 95% of the carbon dioxide (CO_2) emissions produced from the use of fossil fuels in electricity generation and industrial processes, significantly reducing the amount of carbon dioxide entering the atmosphere. The captured CO_2 is then compressed and conditioned and transported to a suitable storage site, either an offshore depleted gas field or a saline aquifer.

From a policy perspective, the Irish Government's National Mitigation Plan[6] (NMP) (2017) recognised that "CCS could facilitate decarbonisation of our electricity sector while allowing an appropriate level of gas fired generation to balance intermittent renewable generation". The policy document committed to an action to "explore the feasibility of utilising suitable reservoirs of CO_2 storage" while also recognising that a feasibility study should be undertaken to determine the potential application of CCS in Ireland in the future.

Leading on from the NMP, in June 2019 the Government published its "Climate Action Plan 2019 – To Tackle Climate Breakdown". Action 33 from the Climate Action Plan further identified the potential for CCS and set about the establishment of a Steering Group to examine and oversee the feasibility of the utilisation of CCS in Ireland. Working in conjunction with the Government's CCS Steering Group, Gas Networks Ireland and Ervia are currently carrying out a study into the feasibility of CCS for Ireland. In October 2019, EirGrid, published their Tomorrow's Energy Scenarios (TES) 2019 report. The TES sets out a range of credible pathways for Ireland's clean energy transition, with specific focus on what it means for the electricity transmission system over the next 20 years. The TES is based on Government policy objectives around renewable energy share in electricity (RES-E) and emission reductions targets. Two of the three scenarios modelled deliver 70% RES-E by 2030 with both scenarios deploying CCS as a decarbonising technology. The scenario which does

6 https://www.gov.ie/en/publication/48d4e-national-mitigation-plan/

4.0 The future of the gas network (continued)

"The Norwegian government has committed to supporting the Northern Lights project with c. €1.5 bn to develop a store which will be open to receive CO_2 from across Europe. "

not deploy CCS does not meet either the RES-E or the emissions reduction targets. EirGrid identify the benefit of 'pursuing both CCS and renewable gas options for Ireland as this reduces the reliance on a single option, while helping to mitigate as much as possible a long-term reliance on non-abated fossil fuels'.

Currently in Ireland, natural gas fired power generation makes up approximately 52% of Ireland's current electricity needs and at certain times of the year, June/July 2018, this has averaged at over 70% and has peaked at up to 90%. Ireland also has a large percentage of its electricity needs met by renewable generation (approximately 31% in 2019) which in the long term is expected to need low-carbon dispatchable generation to back it up and to provide electricity when there isn't any renewable generation available.

Given Ireland's limited alternative options for low-carbon dispatchable generation, CCS on gas-fired power generation has emerged as a viable option.

Globally it is also recognised that there are certain manufacturing industries that have no solution to decarbonise other than CCS. These include oil refining, cement manufacturing and incineration, all of which are operating in Ireland and producing significant emissions.

Gas Networks Ireland in conjunction with Ervia is investigating the potential for a large-scale CCS project in Ireland to capture the CO_2 from a number of gas-fired CCGT power plants (so that they can provide low-carbon electricity) and from large-scale industrial emitters. The initial phase of the feasibility study looked to quantify the potential for CCS across electricity generation and industry and concentrated on indigenous storage at the depleted Kinsale Head gas field. Initial assessments of the potential for storage at the Kinsale field are positive and over the coming years Ervia will progress further the feasibility and the potential for CCS with indigenous storage.

During this phase of the feasibility study, Ervia engaged with the Norwegian company Equinor, a world leader in CCS technology. In September 2019, Ervia signed a Memorandum of Understanding with Equinor and will now work with Equinor and the Norwegian Government's wider 'Northern Lights' project which aims to drive CCS development across Europe. The Norwegian government has committed to supporting the Northern Lights project with c. €1.5 bn to develop a store which will be open to receive CO_2 from across Europe. If successful, the project would see carbon emissions from Ireland's electricity production and large industry captured and exported via ship to be permanently stored in Norway's vast geological reserves in the North Sea. This is known as the 'Export Option' and will be explored further, in parallel with the indigenous storage option. Through an export model, Ireland can access CCS solutions with lower risk and commitment.

The project has been granted Project of Common Interest (PCI) status in October 2019 which enables it to apply for Connecting Europe Facility (CEF) funding. The title of the project is the Ervia Cork Carbon Capture Utilisation & Storage (CCUS) Project (PCI 12.6). This project will involve the development of the necessary infrastructure to transport captured CO_2 from a CCUS cluster of heavy industry (oil refinery) and two gas fired CCGTs to enable the CO_2 to be transported either to local geological store or if unavailable to another store managed by another CCUS project developer. The import infrastructure and geological store will also be made available as a backup storage facility to other CCUS developments. The utilisation of CO_2 was included in the project scope to account for the reuse of a proportion of CO_2 as a feedstock to industry.

In May 2020 Ervia applied to the CEF fund to undertake pre-Front End Engineering and Design (FEED) studies of the key components of a CO_2 transportation network under the Ervia PCI. Following on from this, in October 2020 Ervia received notification that the application was successful. The study will examine different scenarios of CO_2 emissions, including volume and supply profiles, and will focus initially on the Cork CCUS cluster but will be applicable to all other potential clusters in Ireland.

Ervia and Gas Networks Ireland will continue to assess CCS options for power generation and industry, and in addition for low-carbon hydrogen production.

4.4 Hydrogen

Hydrogen is a carbon free flammable gas that can be produced from renewable electricity and be stored indefinitely.

Internationally hydrogen is primarily produced for the industrial gas market by separating it from natural gas. It is anticipated that this process will be enhanced by capturing and storing the resulting carbon dioxide in the short

to medium term and in the long term renewable hydrogen production from water electrolysis will dominate.

The EC has recently released a communication 'A hydrogen strategy for a climate-neutral Europe '. This landmark document sets out the ambition for hydrogen in Europe and the phases it foresees in its development. There is recognition that hydrogen is required to achieve full decarbonisation of the energy use and will be needed to decarbonise high heat applications in industry and heavy use transport. Hydrogen is also envisaged as playing a role in space heating and dispatchable power generation. The EC has signalled an intention to put substantial investment into hydrogen and establish it as a major pillar in a future decarbonised energy system.

Research

Gas Networks Ireland is active in a number of European gas organisations that are assessing the readiness of existing gas networks to carry hydrogen and blends of natural gas and hydrogen. There is increasing confidence of the ability of the polyethylene distribution networks in particular to carry up to 100% hydrogen. The polyethylene material itself is compatible and experience is being gained through demonstration projects on new and existing networks. Work on assessing the compatibility of steel transmission pipelines in ongoing and there is progress in identifying the challenges and mitigations associated with transporting hydrogen. The evaluation of the suitability of the gas network in Ireland will be a major focus for Gas Networks Ireland in the coming years to establish the suitability of safely transporting hydrogen and blends of hydrogen.

Gas Networks Ireland is developing a Hydrogen Innovation Centre at the Brownsbarn AGI site with funding from the Gas Innovation Fund. This is facility is independent of the gas network and will use certified blends of natural gas and hydrogen for the purposes of assessing the compatibility of elements of the distribution network and appliances typically used in Ireland. The facility will be able to begin the process of evaluating aspects of the network that are particular to Ireland and provide an opportunity for Gas Networks Ireland staff and stakeholders to gain experience of hydrogen blends.

Gas Networks Ireland in conjunction with Ervia maintain links with a number of Ireland's leading academic institutions who are conducting research into the potential role of hydrogen in Ireland. Gas Networks Ireland is part of the Energy Systems Integration Partnership Programme (ESIPP) and works closely with University College Dublin (UCD) in a number of projects including modelling how power to gas may interact with gas network. Gas Networks Ireland are an associate partner in the GenComm project led by Belfast Metropolitan College and in which the National University of Ireland Galway (NUIG) and Viridian are key participants. This Interreg funded project plans to produce renewable hydrogen for supply to buses in Belfast. Gas Networks Ireland are associate partners in the Hydrogen Utilisation and Green Energy (HUGE) project in association with NUIG examining the potential role of hydrogen in remote communities.

Gas Networks Ireland are currently working with Hydrogen Ireland Association which is proposing project *HyLight* – a project focused on the production and injection of hydrogen to the gas network.

Power to gas

Power to gas describes the production of hydrogen by electrolysis, the chemical decomposition of water into hydrogen and oxygen. The hydrogen produced is classified as green hydrogen when it is produced by renewable electricity and carbon does not feature in the production process or gas itself. Green hydrogen is the preferred production method in the long term once both the production equipment and renewable electricity sources such as offshore wind scale up sufficiently.

Renewable electricity developers have engaged with Gas Networks Ireland, exploring the potential for hydrogen production and this has resulted in several connection enquiries being submitted and responded to. This is a particularly interesting development in two respects. Firstly, it provides an early indication of the level of interest there may be from renewable developers to enter a new green hydrogen production market. Secondly it has encouraged us to start looking into the implications of hydrogen producers connecting to the network, raising questions such as where the appropriate locations for connection are, and the need for storage to ensure both gas quality and the available quantity can be maintained for customers. Further engagement with prospective producers will also result in the development of the technical requirements and identifying the costs associated with hydrogen injection.

The EC launched its 'Strategy for Energy System Integration' on 8th of July 2020. This is one of the most ambitious and all-encompassing elements of the European 'Green Deal' (refer to Section 9.2.5), providing the basis for "the coordinated planning and operation of the energy system as a whole, across multiple energy carriers, infrastructures, and consumption

4.0 The future of the gas network (continued)

sectors". It envisages an integrated energy system which delivers decarbonisation "at the least cost across sectors while promoting growth and technological innovation". One of the key interfaces in an integrated system will be between gas and electricity grids. By leveraging the bulk storage capability of gas infrastructure and utilising innovative technologies such as Power to Gas and hydrogen networks, a decarbonised and secure energy system can be achieved.

Transport

Ervia, the parent company of Gas Networks Ireland, is a member of Hydrogen Mobility Ireland which is an initiative focussed on developing hydrogen refuelling infrastructure for Ireland. Hydrogen may play a long-term role in heavy use transport, either carrying heavy loads or vehicles in constant use. It is noted that hydrogen fuel cell vehicles require high level of hydrogen purity and that this may necessitate a final purification process at the hydrogen refuelling station. This challenge may also influence the choice of odorant in the future, where it is injected and those parts of the gas network that supply hydrogen refuelling stations. In the short to medium term compressed natural gas vehicles supplied by the gas network remain our transport decarbonisation focus. Gas Networks Ireland also note developments in hydrogen for rail and maritime applications and will continue to monitor these market segments.

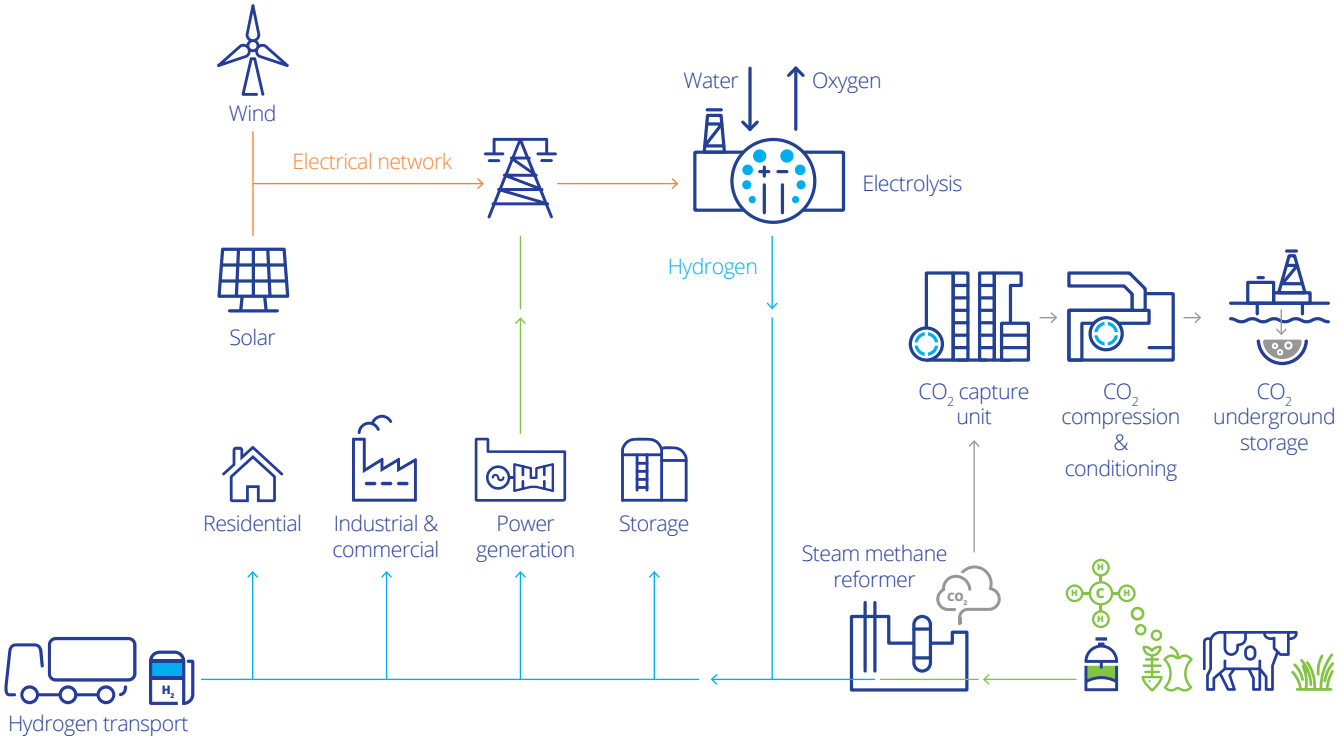
Heating

Hydrogen is a flammable gas and therefore may be utilised in applications ranging from domestic boilers to high heat industrial processes. Hydrogen boilers are under development for domestic and commercial applications. A recent development is the concept of hydrogen ready boilers entering the market, these are compatible with natural gas and facilitate a lower cost, low disturbance conversion in the future. Hydrogen heating may be particularly suited to existing buildings, providing a carbon free heating technology without the need for the expense of a deep retrofit.

Power generation

Hydrogen fuelled power generation is at an early stage of development. It is however noted that major power generation equipment suppliers are engaged in evaluating both the use of hydrogen blends and 100% hydrogen in gas turbines. This opens the prospect of carbon free large scale, long duration dispatchable power generation.

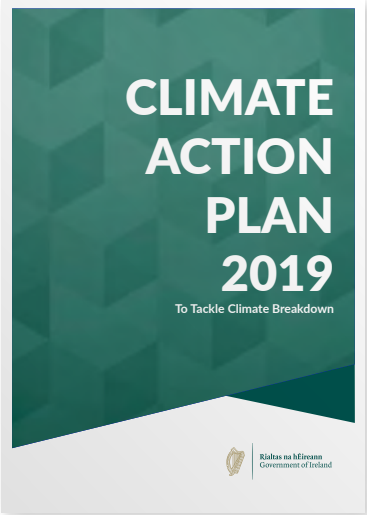
Figure 4-4: Sector coupling/power to gas



4.5 Climate Action Plan and the NECP

The Climate Action Plan 2019[7] (CAP), which was published by the Government on 17th June 2019, tackles climate breakdown by setting out sectoral targets, actions and timelines for implementing specific actions. There are over 180 actions in the Plan that focus on setting out a pathway to 2030, consistent with achieving a net zero target by 2050. The CAP also sets out clear governance arrangements which will significantly enhance accountability and purpose in implementing the proposals. Gas Networks Ireland welcomes the strength of the ambition and the associated governance set out in the CAP. Ireland must significantly increase its commitments to tackling climate disruption, Gas Networks Ireland is delighted to share its vision for the significant role that the gas network can play in supporting Ireland's climate commitments, as outlined in Vision 2050. Gas Networks Ireland welcomes the CAP as a living document which will be updated annually. As Gas Networks Ireland achieves progress towards its vision, the Vision 2050 document will be periodically refreshed to chart the progress achieved, and to share critical developments in new and emerging clean gas technologies. The gas network plays a critical role in Ireland's economy today, delivering approximately 31% of the country's primary energy needs; serving homes, businesses and electricity generation. Gas is a critical component of Ireland's electricity generation, producing 52%[8] of the country's annual electricity requirement in 2019.

The Department of the Environment, Climate and Communications (DECC) submitted Ireland's National Energy and Climate Plan (NECP) for 2021 – 2030 to the European Commission. In 2019, the Climate Action Plan outlined the need to set a 2030 target for the level of energy to be supplied by indigenous biomethane injected into the gas grid and consider how necessary supports would be funded. Currently there is a lack of certainty regarding the mechanism by which biomethane will be supported, therefore the NECP has proposed an indicative target of 1.6 TWh which will be reviewed in 2023 as part of the review process for the National Energy and Climate Plan. The 2023 review will take account of the development of supports and market development for biomethane as it progresses towards the indicative target. This is an important step in the development of the biomethane market in Ireland and in furthering the decarbonisation of the heat, transport and agriculture



7 Government of Ireland, 2019, Climate Action Plan, https://www.gov.ie/en/publication/5350ae-climate-action-plan/
8 System and Renewable Data Summary Report – EirGrid

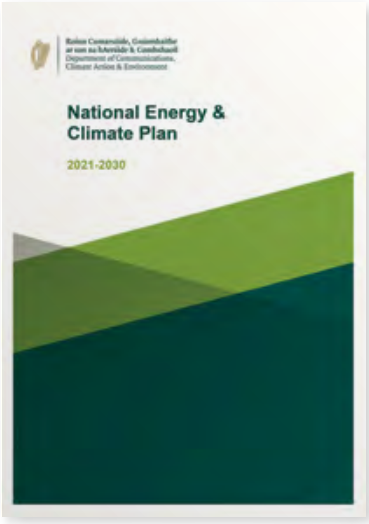
4.0 The future of the gas network
(continued)

sectors. The NECP highlights the business opportunities that new technologies such as anaerobic digestion, biomethane, biomass, heat recovery, carbon capture and micro-generation will bring. The NECP also outlines that the Climate Action Plan and the recommendations from the Low Emission Vehicle Taskforce recognise the need to incentivise the growth of low emission vehicles and that supports for the growth of CNG and hydrogen vehicles are being considered. This is essential to decarbonise the transport sector and particularly HGVs which are difficult to decarbonise.

4.6 The energy policy landscape

As noted in Section 3, the purpose of the NDP is to assess the gas network's capacity based on existing and forecast supply and demand in order to guarantee the adequacy of the gas transportation system and security of supply. As such, the supply and demand assumptions which define the scenarios presented in this NDP are based on a prudent assessment of current energy policy in Ireland. The Best Estimate scenario aligns to existing policy measures in place at the time of the NDP modelling data freeze. As a result, the Best Estimate scenario aligns to the measures and ambition outlined in the Climate Action Plan 2019 and the National Energy and Climate Plan (NECP) for 2021 – 2030.

Further to the above energy policy publications, Ireland's Programme for Government sets out a commitment of reducing overall greenhouse gas emissions by 7% per annum from 2021 to 2030, with the aim of achieving net zero emissions by 2050. The Climate Action and Low Carbon Development (Amendment) Bill 2020 sets a commitment to net-zero emissions by 2050. These are significantly higher levels of ambition than set out in the CAP and NECP respectively, and are set to shape the Irish energy landscape into the coming decades. Gas Networks Ireland continue to monitor ongoing energy policy development and will incorporate additional policy measures into the NDP Best Estimate scenario as these measures become available.



"Gas Networks Ireland continue to monitor ongoing energy policy development and will incorporate additional policy measures into the NDP Best Estimate scenario as these measures become available."

5.0

Historic demand & supply

Key messages:

Annual ROI gas demands for 2019/20 were 1.5% above 2018/19 demands.

In 2019 approximately 47% of Ireland's gas demand was supplied from indigenous sources. The balance of supply, almost 53% came through the subsea interconnectors via the Moffat Entry Point in Scotland.

Restrictions relating to the COVID-19 pandemic, first introduced in March 2020 have had an impact on 2019/20 Industrial and Commercial sector gas demand.

The potential for the COVID-19 pandemic to influence future gas demand projections has been considered in this document, but a high degree of uncertainty remains.

This section relates to a Gas Networks Ireland review of the historic profiles for supply and demand. Historic annual gas demand and peak day gas demands are analysed as well as historic gas supplies.

5.1 COVID-19 demand impact

Since the COVID-19 related restrictions were first introduced in March 2020, a notable impact on gas demand has been observed. While it is still very early stages in assessing the potential medium to long-term impact on the Irish economy and consequentially on gas demand in Ireland, Gas Networks Ireland have tracked the resulting trends in actual gas demand in the period following introduction of the restrictions (i.e. since March 2020). Annual ROI gas demand for 2019/20 increased by 1.5% on the 2018/19 total. Notably, based on a sector by sector breakdown, Industrial and Commercial (I/C) was the only gas demand sector which showed a decrease against the previous year. I/C annual gas demand in 2019/20 was 1.6% behind on 2018/19, whereas the Power Generation (+ 2.2%) and Residential (+5.6%) were both ahead of 2018/19 figures.

Noting that the COVID-19 related restrictions commenced at the end of March 2020, the impact of the pandemic on gas demand figures becomes more apparent if comparing gas demand by half years. A comparison of the first half of the gas year (October 2019 – March 2020) showed growth in total ROI gas demand (+3.4%) against the same period in 2018/19, while the second half of the gas year (April 2020 – September 2020) demonstrated a reduction (-0.5%) in ROI gas demand against this period in 2018/19.
Within power generation, the first half of that gas year showed a marginal increase (+0.34%) against the same period in 2018/19. The second half of the gas year yielded a higher increase of + 3.79%. The drivers for gas demand in the power generation sector are multiple and varied, and therefore it is difficult to isolate the impact of any one driver. It is noted in the EirGrid / SONI All-Island Generation Capacity Statement 2020-2029 that from the period when the COVID-19 restrictions commenced in March 2020, up to the end of June 2020, a 7% average reduction in electricity market demand was observed in Ireland. The equivalent figure in Northern Ireland was 15%. All else being equal, this reduction in electricity demand would have manifested in a reduced demand for gas in the power generation sector in the second half of the gas year. However other factors in the electricity market such as wind capacity factors, wholesale fuel prices (in particular gas and coal), and interconnector flow patterns can strongly influence the demand for gas in the power generation sector. The influence from drivers such as those mentioned here, appear to have strongly counteracted the impact COVID-19 had on electricity demand, resulting in a strong growth figure over the period.
I/C gas demand experienced a 3.4% increase in the first half of 2019/20, followed by a 7.4% reduction in the second half, when compared with the equivalent periods in 2018/19. The impact on gas demand in this sector is directly attributed to the economic consequences associated with the COVID-19 pandemic.

It is unlikely that the COVID-19 impact was as influential in the Residential sector. While Residential sector gas demand in the first half of the gas year significantly outperformed growth in the second half of the year, the key factors influencing the trends in Residential gas demand were likely to be prevailing weather conditions coupled with new connections numbers and the timing of same.

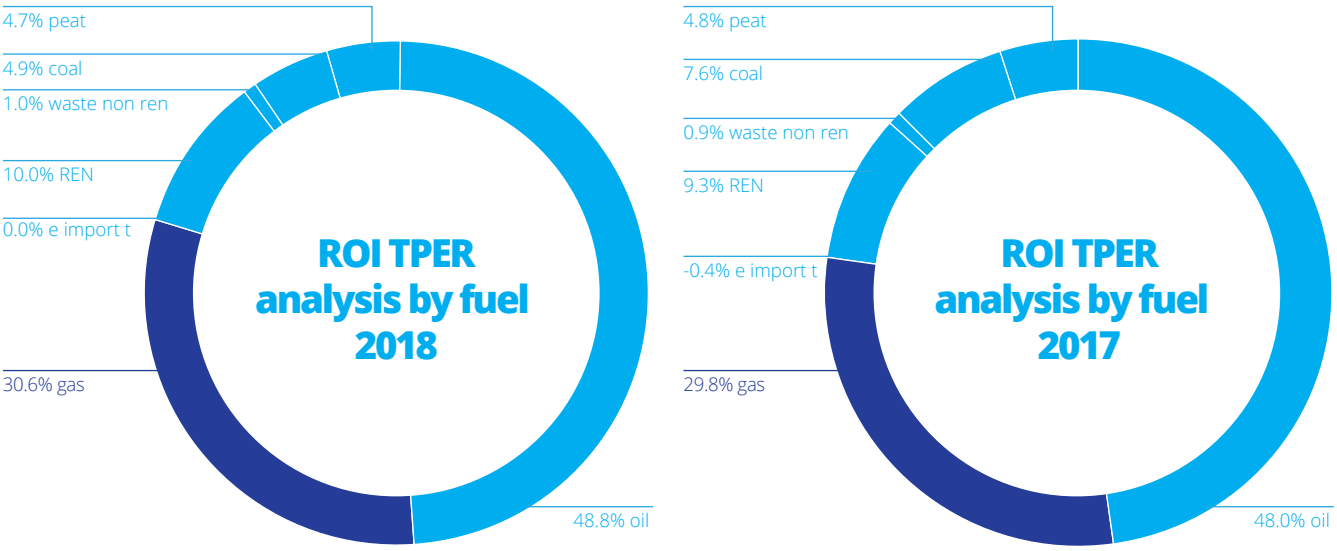
5.2 ROI annual primary energy requirement

The Sustainable Energy Authority of Ireland (SEAI) reported that Ireland's Total Primary Energy Requirement (TPER) for 2018[9] grew by 1.2% compared to 2017. Oil continued to dominate the 2018 TPER accounting for 48.8% of total energy demands, as shown in Figure 5-1. Gas accounted for 30.6% of 2018 energy demands, reflecting its role in electricity generation, process and heating use. Renewable energy sources accounted for 10.0% of TPER in 2018.

"While it is still very early stages in assessing the potential medium to long-term impact on the Irish economy and consequentially on gas demand in Ireland, Gas Networks Ireland have tracked the resulting trends in actual gas demand in the period following introduction of the restrictions. "

5.0 Historic demand & supply (continued)

Figure 5-1: ROI TPER analysis by fuel (2017 & 2018)



5.3 Historic annual gas demand

This section refers to both Gas Networks Ireland System Demand and ROI gas demand. The Gas Networks Ireland System demand refers to the combined demands for ROI, Northern Ireland (NI) and Isle of Man (IOM). Annual ROI gas demands for 2019/20 increased 1.5% on 2018/19. This follows increases (2.0% and 2.3% respectively) in the previous years as shown in Figure 5.2. In the power generation sector, annual gas demand for 2019/20 was 2.2% above 2018/19 levels, following a 3.5% increase the previous year. It is noted that power sector gas demand has grown by over 36% since 2014/15. The increase in power sector gas demands in this period, despite growth in wind capacity can be attributed to increasing electricity demand, reduced electricity interconnector imports from Great Britain, and more recently carbon and fuel prices favouring gas-fired generation ahead of coal in the merit order for electricity generation. Following the introduction of updates to the wholesale electricity market in October 2018, electrical interconnector behaviour has generally displayed efficient behaviour in that the interconnectors are generally importing to Ireland when Irish electricity prices are higher than Great Britain markets, and exporting at times of high wind when Irish electricity prices are lower than in Great Britain.

The Industrial & Commercial (I/C) sector annual gas demand for 2019/20 decreased by 1.6% compared to 2018/19 levels. It is noted that the first half of the gas year demonstrated strong growth in this sector (3.5% based on year-on-year comparison of October – March period), while the impact of the COVID-19 pandemic and the associated restrictions drove a 7.4% reduction in this sector in the second half of the gas year. Within the I/C sector, Daily Metered (DM)[10] demand reduced by 1.2%, with the Non-Daily Metered[11] (NDM) portion of I/C demand down by 2.5%. It is worth noting that the NDM sector is heavily influenced by weather.

Residential demand increased by 5.6% for 2019/20, following a decrease of 8.1% in 2018/19 on the previous year. As Residential demand is highly dependent on weather factors the increase in Degree Day (DD) and Composite Weather Variable (CWV) for 2019/20 by 7% and 4% respectively were in line with the demand increase. Similarly, the relatively high demand winter period experienced an even larger increase in DD (13%) and CWV (7%) in 2019/20 over the milder winter of 2018/19 which contributed significantly to the overall demand increase.

10 In this instance Daily Metered (DM) customers refers to Daily Metered (DM) and Large Daily Metered (LDM) customers i.e. any customer which consumes over 5.55 GWh annually

11 The Non-Daily Metered (NDM) sector refers to those who consume less than 5.55 GWh of gas annually. This covers small I/C and residential properties.

Figure 5-2: historic annual gas demand

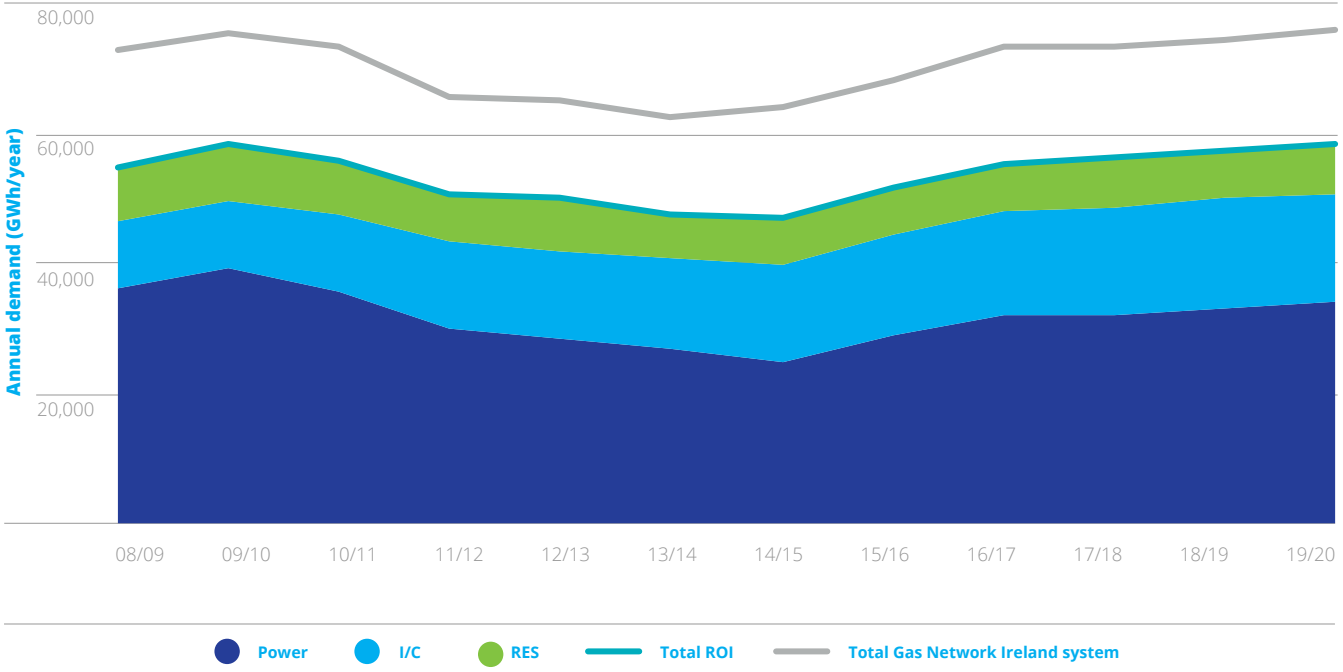
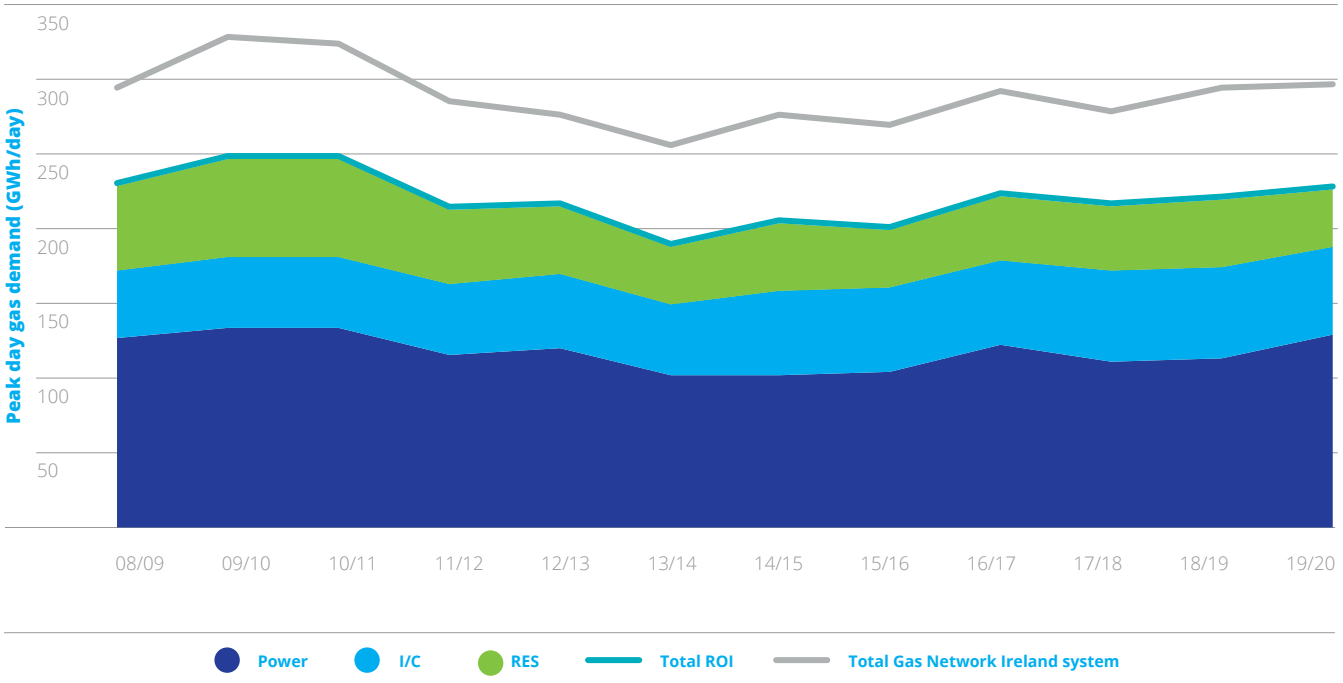


Figure 5-3: Historic peak day gas demand



5.0 Historic demand & supply (continued)

Total Gas Networks Ireland annual system gas demand for 2019/20 was 2.1% above the previous year's gas demand. As noted in Section 5.2, ROI gas demand was up 1.5%. NI and IOM gas demand increased 4.1% against 2018/19. The historic gas demand is presented in Figure 5-2. The overall throughput for ROI in 2019/20 was 58,344 GWh or approximately 5.4 bcm.

5.4 Historic peak day gas demand

In 2019/20 ROI peak day gas demand of 225.4 GWh/d was 3.2% higher than the 2018/19 peak day gas demand. The ROI peak day occurred on the 4th March 2020. Gas demand in the power generation sector, which represented 57% of the total gas demand on the peak day increased by 14.5% in comparison to the 2018/19 peak day. Gas demand in the power generation sector was the driver for the overall increase in peak day gas demand, given that I/C peak day demand (representing 26% of total peak day demand) decreased by 2.3%, and Residential (representing 17% of total peak day demand) was down by 17.8% on the previous year.

On the 2019/20 ROI peak day, gas fired power generation accounted for c. 69% of the SEM fuel mix, with wind generation accounting for c. 9%. The peak day demand in the NDM sector occurred on the 11th of February, with gas demand reaching 74.8 GWh/d. This was lower (-2.0%) than the corresponding NDM peak day in 2018/19, the difference being correlated to differing weather and temperature conditions. The Gas Networks Ireland system 2019/20 peak day gas demand was up by 0.5% compared to the 2018/19 peak. The NI and IOM combined peak day gas demand was 7.1% lower than in 2018/19.

5.5 Ireland's weather

Based on a Degree Day (DD) comparison, the most recent winter (October 2019 to March 2020) was approximately 13% cooler than the previous year. Relative to the long run degree day average, winter 2019/20 was approximately 0.4% cooler. The coldest day in winter 2019/20, occurred on the 5th March, with an average temperature of 1.8°C, or a 13.8 DD. The corresponding coldest day in 2018/19 occurred on the 31st January with an average temperature of -0.9°C, or a 16.4 DD.

The overall demand on 5th March 2019 was not the peak gas demand day for winter 2019/20 but did coincide with a period of high gas demand from 3rd to 5th March, during which the 2019/20 peak day for gas demand of 225 GWh/d, occurred on the 4th March. The average temperature on the 4th March 2020 was 3.95°C or 11.55 DD.

5.6 Wind powered generation

The installed all-island wind generation capacity increased by 9% in 2019 from the previous year[12]. Wind powered generation output grew by 8%[12] in 2019 compared to 2018, suggesting that wind generation load factors were slightly reduced in 2019.

On the peak day for wind generation in winter 2019/20, daily wind powered generation accounted for up to 72.5% of ROI daily electricity demand (21st of February 2020) and as little as 2.6% of demand on the minimum day for wind generation (22nd of January 2020). On the 2019/20 peak day for gas demand (4th of March 2020) wind accounted for circa 4.9% of electricity system demand.

5.7 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, with import capacities of 500 MW and 450 MW respectively.

Up until early 2015, the prevailing market conditions on the Single Electricity Market (SEM)[13] and its UK equivalent, BETTA (British Electricity Trading and Transmission Arrangements) resulted in a predominantly GB-IE flow on the EWIC, i.e. import of electricity from Great Britain. Following this, the carbon price floor in Great Britain was raised to £18 per ton CO_2 in April 2015 and this relationship, along with changing fuel price dynamics and tightening capacity margins in the UK, contributed to reversing the balance of electricity flows on the interconnectors, in favour of IE-GB exports.

Subsequently following the upgrade of the Single Electricity Market (SEM) via the Integrated Single Electricity Market (I-SEM) project in October 2018, electrical interconnector behaviour has generally displayed efficient behaviour in that the interconnectors are generally importing to Ireland when SEM prices are higher than Great Britain markets, and exporting at times of high wind when prices in the SEM are lower than in Great Britain[14].

Carbon prices on the European Emission Trading Scheme (EU ETS) continue to rise in line with various projections. It is expected that this trend will continue in the short to medium term in all scenarios. However, the trend may gradually swing back in favour of imports from Great Britain to Ireland over the back end of

12 System and Renewable Data Summary Report – EirGrid
13 The Single Electricity Market (SEM) is the wholesale electricity market operating in the Republic of Ireland and Northern Ireland.
14 SEM committee Single Electricity Market Performance Quarterly Reports, available at https://www.semcommittee.com/publications

the forecast horizon should carbon prices on the ETS continue to rise as forecasted[15]. This will depend on how carbon policy develops in the UK following the Brexit transition period. It has been indicated that the UK government will legislate to prepare for a UK ETS, which could be linked to the EU ETS35.

It is noted there are a number of proposed electrical interconnector projects involving Ireland, including the Celtic (France) and Greenlink (Great Britain) Interconnectors. Both Interconnectors have received Project of Common Interest status, with the Celtic Interconnector now having approved funding from the EU.

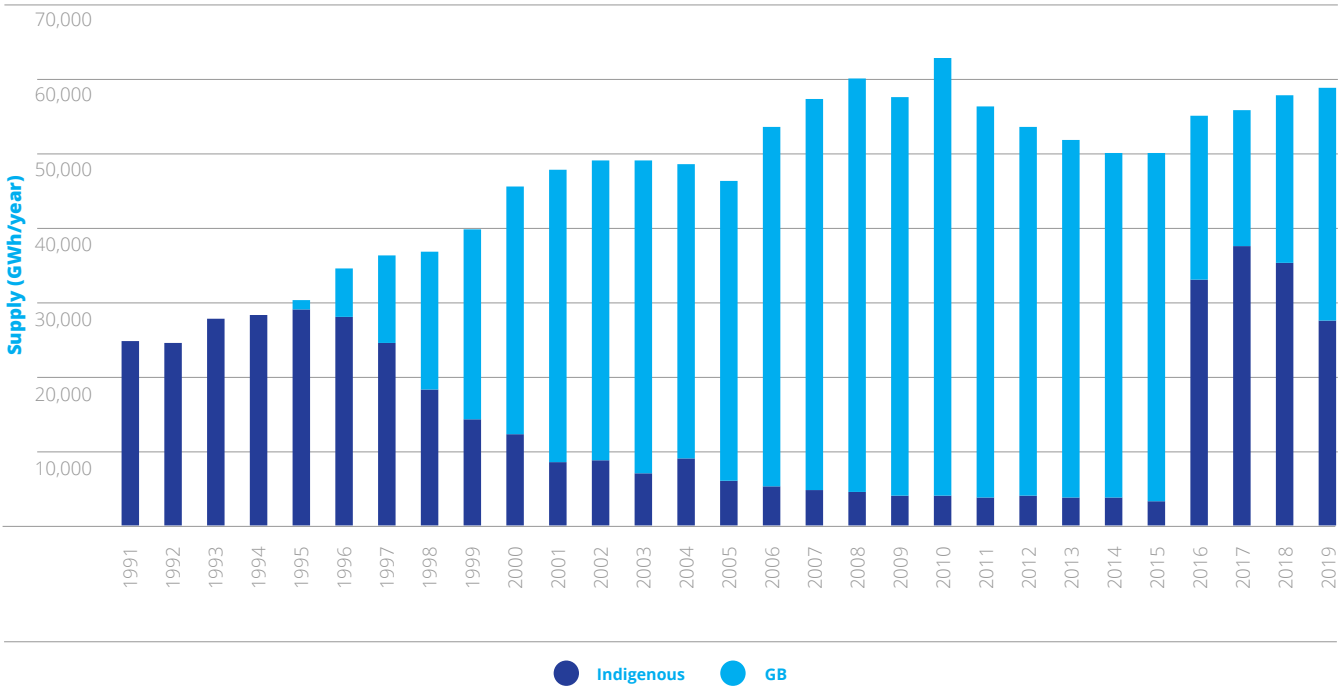
Gas Networks Ireland continue to engage with industry partners to further understand the interconnector dynamics that continue to have a major impact on the development of gas demand in the power generation sector.

5.8 Historic gas supply

In 2019 approximately 47% of Ireland's gas demand was supplied from indigenous sources (Corrib and Kinsale). The balance of supply, almost 53% came through the subsea interconnectors via the Moffat Entry Point in Scotland.

It is noted that 2019/20 marked the final year of commercial volumes of gas supply from the Kinsale gas fields onto the Gas Networks Ireland transmission system via the Inch Entry Point, as further outlined in Section 7.

Figure 5-4: Historic annual indigenous gas production and Great Britain (GB) imports



15 Gas Networks Ireland uses forecasts of carbon pricing from the International Energy Agency's World Energy Outlook document.

6.0 Gas demand forecasts

Key messages:

Gas Networks Ireland has developed Low, Best Estimate & High demand scenarios which forecast gas demand across the power generation, industrial & commercial, residential and transport sectors.

In the Best Estimate demand scenario annual ROI gas demand is expected to grow by 23% between 2019/20 and 2028/29.

The 1-in-50 peak day forecast is expected to grow by 19% between 2019/20 and 2028/29.

In defining the modelling assumptions for NDP 2020, Gas Networks Ireland have incorporated a view on the potential impact the COVID-19 pandemic may have on future gas demand. As a result, a high degree of uncertainty is associated with NDP 2020 modelling assumptions, given the evolving nature of the pandemic and the associated economic response.

This section presents an overview of the gas demand outlook for the period 2019/20 to 2018/29. The NDP forecasts future gas demands by examining the development of individual Power, Industrial & Commercial, Residential and Transport sector gas demands[16].

6.1 Gas demands

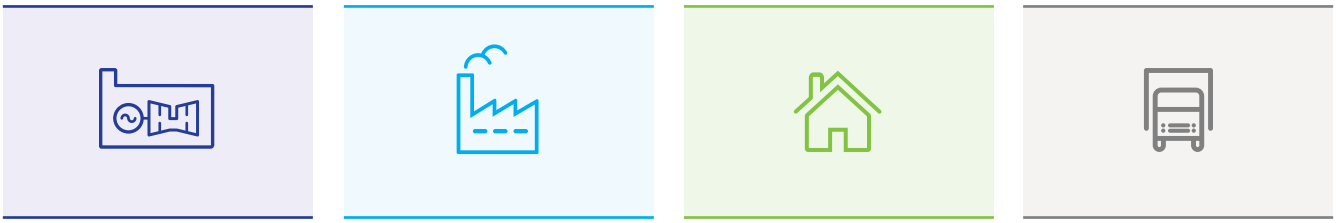
The demand forecasts presented in this section refer to ROI demand only, unless otherwise stated. Gas Networks Ireland system demand refers to the total demand transported through the Gas Networks Ireland system, i.e. the combined demands for ROI, NI and IOM. Gas Networks Ireland system demand forecasts are presented in Appendix 2.

Given the dynamic nature of the COVID-19 pandemic, the associated level of Government restrictions in place at any given time, and the uncertainty surrounding the potential short to medium-term economic impact, it is challenging to assess the potential impact on future gas demand. The demand assumptions set out in this section take into account the potential impact of COVID-19 on future gas demand by referencing best available information at the time of the modelling data freeze. It is noted that the modelling assumptions in this year's NDP therefore contain a high degree of uncertainty. These assumptions will be re-visited in next year's publication (NDP 2021) when more information will be available on the potential future impact of the pandemic on Ireland's economy.

6.2 Gas demand forecasting

The demand forecast modelling methodology used in producing the NDP generates a ten-year forecast for the power generation, Industrial & Commercial (I/C) Residential & Transport sectors, based on a series of assumptions[17] which affect demand for each of these sectors. The primary forecasting inputs by sector are summarised in Figure 6-1.

Figure 6-1: Key demand forecasting assumptions



Power generation	Industrial & commercial	Residential	Transport
Electricity demand	Gross domestic product	Annual quantity	Fast fill stations
Available generation capacity	New connections	New connections	Heavy goods vehicles & buses
Energy/fuel prices	Energy efficiency	Energy efficiency	Usage profiles

16 Gas Networks Ireland have developed a document outlining the Methodology for forecasting gas demand. This document is available for download via the following link: https://www.gasnetworks.ie/corporate/company/our-network/Methodology-for-forecasting-gas-demand.pdf

17 A number of external data sources are referenced when generating future gas demands along with additional sector specific assumptions. Details of these assumptions are set out in Appendix 2.

6.0 Gas demand forecasts (continued)

Table 6-1: 1-in-50 peak day forecasting assumptions

Year	Actual		Forecast		Variance
	(GWh/d)	(mscm/d)	(GWh/d)	(mscm/d)	(%)
2009/10	253	22.9	246	22.3	2.8
2010/11	251	22.7	249	22.5	0.8

The primary demand forecast outputs for each of the scenarios under review are as follows:

- 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)
- Annual demand forecasts i.e. the aggregate demand for each year of the forecast.

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 than 3% on each occasion, demonstrating that the demand forecasting methodology/process is reliable and robust.

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, as is the annual demand total.

6.3 Gas demand scenarios

In order to provide a comprehensive analysis Gas Networks Ireland has developed three gas demand scenarios for the period 2019/20 to 2028/29, namely Low, Best Estimate and High demand scenarios. These scenarios are designed to represent a broad range of likely outcomes and are informed by a range of external and internal factors.

Figure 6-2: Gas demand scenarios overview[18]

Low demand	Best estimate	High demand
EirGrid's low electricity demand scenario	EirGrid's median electricity demand scenario	EirGrid's high demand scenario
CO_2 – IEA's new policies scenario	CO_2 – IEA's new policies scenario	CO_2 – IEA's new policies scenario
Bloomberg futures fuel pricing	Bloomberg futures fuel pricing	Bloomberg futures fuel pricing
Blended short-term GDP projections plus ESRI's stagnation scenario	Blended short-term GDP projections plus ESRI's economic outlook 2016	Blended short-term GDP projections plus ESRI's economic outlook 2016
+ New connection low CNG low	**+ New connection best estimate CNG best estimate**	**+ New connections high CNG high**

18 Bloomberg futures fuel pricing as taken on 3rd August 2020

These scenarios represent a range of potential gas demands, to be used for network planning purposes to test the capability of the gas network. Gas demand is dependent on a number of external factors, including economic growth, electricity demand growth and other power generation sector developments. The Best Estimate scenario is designed to take the median view in terms of how these factors will develop over time.

6.4 Alignment of NDP scenarios with ENTSOG ten year Network Development Plan

ENTSOG and ENTSO-E are the European Network of Transmission System Operators for Gas and Electricity respectively. As well as developing Network Codes, ENTSOG and ENTSO-E are responsible for the delivery of Ten Year Network Development Plans (TYNDP) under EU Gas Regulation (EC) 715/2009 and EU electricity Regulation (EC) No 714/2009 respectively.

Regulation (EU) 347/2013 requires that the ENTSOG and ENTSO-E use scenarios to underpin their respective Ten Year[19] Network Development Plans. For the purposes of the 2020 TYNDPs, ENTSOG and ENTSO-E have jointly developed a set of credible scenarios that describe possible development paths for the European energy system out to 2050[20].

For the short and medium term, a 'Best Estimate' or (bottom-up) scenario is used, with no divergence in projected outcomes until after 2025. For the longer term, a number of scenarios have been developed. These include two top-down scenarios entitled the 'Global Ambition' and 'Distributed Energy' and a central bottom up scenario called the 'National Trends'. These scenarios are described as follows:

- **National trends** is the central scenario based on draft National Energy and Climate Plans (NECPs) developed in accordance with Regulation (EU) 2018/1999 on the governance of the energy union and climate action, as well as on other national policies already stated by EU member states. The National Trends scenario is compliant with the EU's long-term energy and climate ambitions.
- **Global ambition** considers a future that is led by development in centralised energy production and power generation. Economies of scale lead to significant cost reductions in emerging technologies such as offshore wind, but also imports of energy from competitive sources are considered as a viable option. The Global Ambition scenario is compliant with the EU's long-term energy and climate ambitions.
- **Distributed energy** takes a de-centralised approach to the energy transition. A key feature of the scenario is the role of the energy consumer who actively participates in the energy market and helps to drive the system's decarbonisation. Another key feature is distributed energy production e.g. Renewable Gas and Power to Gas technology and other small-scale solutions and circular approaches. The Distributed Energy scenario is compliant with the EU's long-term energy and climate ambitions.

Gas Networks Ireland fed directly into the central bottom up scenario i.e. 'Best Estimate' which covers the period up to 2025, and following on from that the 'National Trends' scenario. Gas Networks Ireland was also directly involved in the development of the assumptions which underpin the 'Global Ambition' and 'Distributed Energy' scenarios and would have agreed key assumptions with EirGrid in this regard and fed these assumptions into the joint ENTSOG / ENTSO-E scenario building work group.

Across the NDP forecasting horizon (2019/20 to 2028/29) there is no divergence in outcomes until 2025. Even from 2025 to 2029 in terms of gas demand there is only limited divergence in the outcomes across the three TYNDP scenarios.

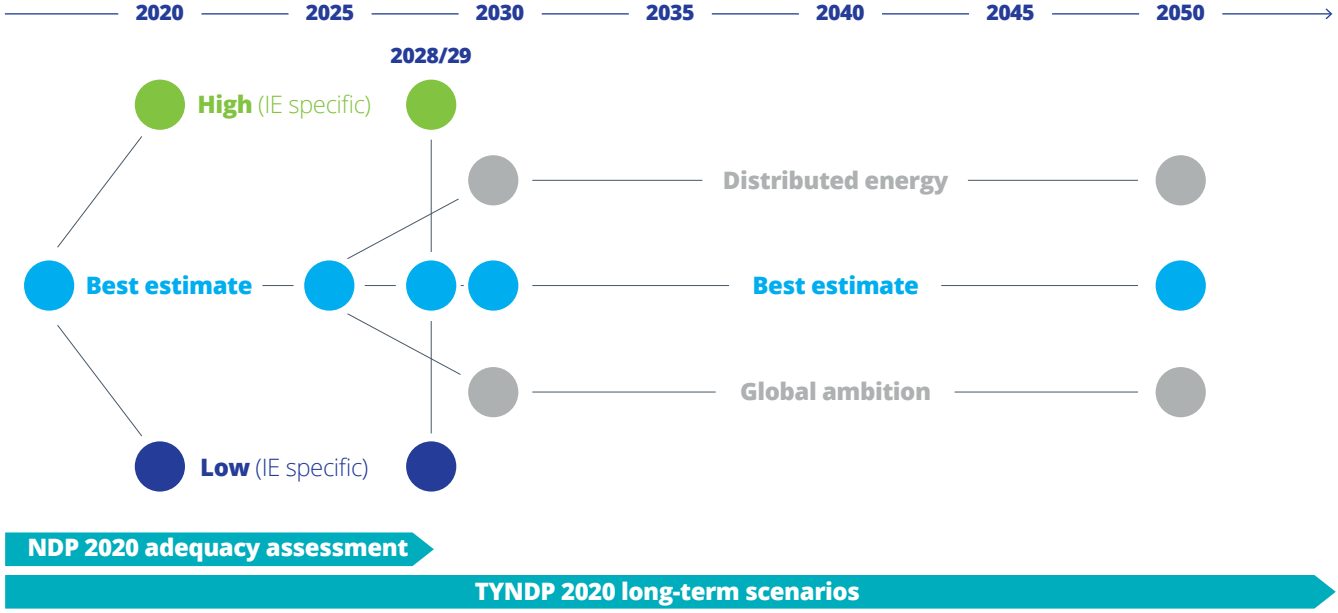
The NDP Best Estimate scenario is aligned to the TYNDP Best Estimate and National Trends scenarios. Because the primary purpose of the NDP is to assess and stretch the adequacy of the gas network over the 10 year period, Gas Networks Ireland develop Ireland-specific High and Low demand scenarios. The low level of divergence between the TYNDP scenarios to 2028/29 would not be sufficient to capture Ireland-specific scenario uncertainty. The Ireland-specific High and Low demand scenarios are closely aligned to the High and Low scenarios for electricity demand per the EirGrid / SONI All-Island Generation Capacity Statement 2020–2029[21].

Figure 6-3 below summarises the alignment between the NDP demand scenarios and the TYNDP scenarios.

19 Despite being called a Ten Year Network Development Plan the scenario horizon extends out to 2050
20 https://www.entsog.eu/sites/default/files/2019-11/TYNDP_2020_Joint_ScenarioReport_web.pdf
21 http://www.eirgridgroup.com/library/

6.0 Gas demand forecasts (continued)

Figure 6-3: Alignment between the NDP demand scenarios and the TYNDP scenarios



6.5 Demand forecast assumptions

This section presents an overview of the assumptions made for the gas demand outlook for the period 2019/20 to 2028/29.

6.5.1 Power generation sector

The Irish gas and electricity sectors are highly interdependent. Gas is a critical component of Ireland's electricity generation, producing 52%[22] of the country's annual electricity requirement in 2019. Gas fired generators are the largest customer sector in the gas market, accounting for approximately 57% of the total ROI demand in 2019.

The following summarises the main assumptions regarding the changes in the SEM generation portfolio, as per the EirGrid / SONI All-Island Generation Capacity Statement (GCS) 2020-2029:

- EirGrid has assumed the Moneypoint coal-fired power plant will not be available from 2025 as a result of the European Union Clean Energy Package decision to exclude generation emitting more than 550g/kWh from capacity markets such as SEM. Across our 3 scenarios, Moneypoint is therefore assumed unavailable from 2025. It is noted that ESB has not provided a closure notice for these units, and a decision on the future of the plant is a matter for ESB.
- The Kilroot[23] coal-fired power plant is assumed to restrict capacity from mid-2020, and close by the end of 2023 due to Industrial Emissions Directive (IED) restrictions on coal-firing.
- Plant closures are assumed in Tarbert (TB1, TB2, TB3, and TB4) and on Aghada unit AT1 by end of 2023.
- ESB peat units at Lough Ree and West Offaly are due to close at the end of 2020 due to planning constraints, and assumptions this has been reflected in all NDP scenarios.
- EirGrid in their GCS have assumed that the peat plant at Edenderry will close in 2023, based on current planning permission expiring at the end of 2023. Gas Networks Ireland have maintained this assumption in its Best Estimate and High scenarios. It is noted in the EirGrid / SONI All-Island Generation Capacity Statement (GCS) 2020–2029 that Bord na Mona have not provided a closure notice for the plant and are applying for a planning permission extension. In the NDP Low demand scenario, an assumption with Edenderry peat station remaining in operation beyond 2023 was used, and powered approximately 50% by biomass.
- Planning for the North-South Interconnector has been granted in Ireland. However, the project has encountered delays in Northern Ireland, and it is noted that SONI

22 System and Renewable Data Summary Report – EirGrid
23 While situated in Northern Ireland, closure of Kilroot would have an anticipated impact on ROI gas demand, as it would impact the behaviour of other generators operating in the single electricity market

are working to resolve planning challenges[24]. The North-South Interconnector is assumed not complete within the duration of the NDP forecast horizon. However, a sensitivity analysis has been carried out whereby the potential impact on gas demand in Ireland as a result of the North-South interconnector becoming available in 2024 has been examined.

- It is noted there are a number of proposed electrical interconnector projects involving Ireland, including the Celtic Interconnector. As these projects are at a preliminary stage, EirGrid have not included them in their adequacy assessments. These interconnector projects are assumed not complete within the duration of the NDP forecast horizon.
- We have included in our scenarios new entrant generation plant which were successful in the Capacity Year 2022/23 T-4 capacity auction from 2023[25], and plant which were successful in the Capacity Year 2023/24 T-4 capacity auction from 2024. It is noted that at the time of EirGrid / SONI All-Island Generation Capacity Statement (GCS) 2020–2029 publication, not all of these units had signed connections agreements in place. Therefore, Gas Networks Ireland has assumed these units to be available from 2023 only in the High and Best Estimate demand scenarios.
- Furthermore, to reflect the level of connection enquires received in Gas Network Ireland in the Power Generation sector, a further power station, equivalent in size and characteristics to a CCGT has been assumed in place from 2025 in the High scenario.

The Irish Government has a target of 40% of electricity to be generated from renewable sources by 2020[26]. Beyond 2020, assumptions on renewables integration targets in our scenarios have been informed by the National Energy and Climate Plan[27] (NECP) and the Government Climate Action Plan 2019[28]. It is noted that the EirGrid / SONI All-Island Generation Capacity Statement (GCS) 2020-2029 aligns to the ambition set out in the Climate Action Plan and NECP targets to inform assumed wind capacity development rates post-2020.

- Gas Networks Ireland has assumed the same wind capacity development rates in our Best Estimate and Low scenarios, thus targeting 70% of electricity to be generated from renewable sources by 2030 (the 'RES-E target').
- In these scenarios, wind generation is anticipated to increase to 8,605 MW and 1,516 MW in ROI and NI respectively, by 2029.
- In our High gas demand scenario, Gas Networks Ireland has assumed a scenario whereby the 70% RES-E target is not met. In this scenario, a target of 55% RES-E by 2030 is assumed, in line with the 2018 draft NECP[29].
- In this scenario, wind generation is anticipated to increase to 6,041 MW and 1,400 MW in ROI and NI respectively, by 2029.

In our Power Generation dispatch model, Gas Networks Ireland takes account of generator technical parameters (e.g. maximum and minimum generator limits), level of installed electrical interconnection between countries, and operational constraints in place on the transmission system (e.g. the maximum level of non-synchronous generation that can be accommodated on the system instantaneously).

- Technical parameters for generation plant have been modelled per the 2019-2025 SEM PLEXOS model validation[30].
- Electricity interconnection is modelled per the assumptions set out earlier in this section.
- Technical operational constraints on the EirGrid system have been modelled per the existing EirGrid operational constraints[31].

In order to achieve the stated RES-E target by 2030, it is recognised that in addition to the installed wind capacity development rates assumed in the NDP scenarios, additional measures will be required to address existing technical constraints on the power system. Measures will be required in order to reduce the wind curtailment rates that will otherwise transpire following development of the installed wind capacity build-out profiles per the assumed levels. Potential measures may include:

- Reduction of thermal generator minimum-generation thresholds, in

24 At the time of the NDP 2020 modelling data freeze, planning on the North-South interconnector remained outstanding. This planning was subsequently granted on 14th September 2020.
25 One of these units is assumed to be replacing the existing North Wall gas turbine, which is scheduled for a 3 year outage from end of 2019, returning in 2023 at a similar size.
26 White Paper: Ireland's Transition to a Low Carbon Energy Future 2015-2030
27 NECP https://www.gov.ie/en/publication/0015c-irelands-national-energy-climate-plan-2021-2030/
28 Climate Action Plan, https://www.gov.ie/en/publication/ccb2e0-the-climate-action-plan-2019/
29 https://www.gov.ie/en/publication/0015c-irelands-national-energy-climate-plan-2021-2030/
30 Commissioned by the CRU and UREGNI, an update and validated model of the SEM has been produced and published by Economic Consulting Associates (ECA): https://www.semcommittee.com/publications/sem-19-044-sem-plexos-validation-2019-2025-information-note
31 http://www.eirgridgroup.com/library/

6.0 Gas demand forecasts (continued)

order to create sufficient headroom for renewable generation on days of high wind

- Increasing the System Non-Synchronous Penetration (SNSP) level from existing 65%[32], in order to allow more penetration of wind instantaneously that would otherwise need to be curtailed
- Facilitation of wind export that may otherwise be curtailed on days of high wind, via electrical interconnection or alternative technologies.
- Further measures to increase future production rates from wind turbines may also be required:
- Increase wind capacity factor on onshore and offshore wind turbines in order to yield higher production rates from wind turbines.

The above changes cannot be modelled in our demand projections, as the details, and technical feasibility of the changes required are not verified at this point.

Consequentially, the RES-E targets associated with the NDP scenarios, are not actually met by the installed wind capacity development rates assumed. In the event the above technical constraints are addressed, future NDP scenarios will model revised technical assumptions, and this will result in a reduction in annual gas demand, against those levels projected in this document. Peak day gas demand will not be impacted significantly, as peak day gas demand in the power generation sector typically occurs on days of low wind.

The outlook to 2029/30 regarding the merit order in the SEM, as per Gas Networks Ireland's Power Generation gas demand forecasting model, is as follows:

- Renewables are assumed to be priority despatch.
- Peat fired generation is anticipated to significantly fall-off at the end of 2020 in-line with the anticipated closure of West Offaly and Lough Ree power stations.
- The electricity interconnectors, EWIC and Moyle, are anticipated to be net exporters of electricity to GB in the short term, due to the freezing of the carbon price floor at £18/ton CO_2 in GB to 2021-22[33]. In the medium term it is expected that the balance will shift towards imports to Ireland as CO_2 prices rise on the ETS, and UK carbon pricing after the Brexit transition period is anticipated to be based on a UK Emissions Trading System (UK ETS). It has been indicated that this UK ETS may be linked to the EU ETS[33].
- Over the course of the previous 2 years, coal fired plant has adopted a lower position in the merit order relative to previous years following increased carbon prices and reduced wholesale gas prices. This trend is anticipated to continue over the short to medium term, with coal fired generation anticipated to fall off completely in the longer term in line with the assumptions outlined previously.
- Gas fired plant is anticipated to meet the balance of electricity demand.

Figure 6-4 illustrates the anticipated level of generation by fuel for thermal plant in the SEM, based on the EirGrid / SONI All-Island Generation Capacity Statement 2020-2029. This is based on thermal plant capacities given for 2020 with anticipated commissioning/ decommissioning dates as set out in the GCS.

The EirGrid / SONI low, median and high electricity demand scenarios are illustrated in Figure 6-5. These electricity demand forecasts are used to differentiate Gas Networks Ireland's Low, Best Estimate and High gas demand scenarios for the power generation sector. While typically, Gas Networks Ireland takes the EirGrid / SONI electricity demand scenarios as direct input to the NDP, it is noted that the scenarios set out in the EirGrid / SONI All-Island Generation Capacity Statement (GCS) 2020-2029 were established at a stage when it was too early to incorporate and assessment on the potential impact associated with the COVID-19 pandemic and associated restrictions to our daily lives. Therefore, the NDP electricity demand scenarios are a blend of the EirGrid base scenarios, with an adjustment made to the short-term projections in line with observations to date on the impact of the COVID-19 pandemic on electricity demand in Ireland in 2020. The NDP electricity demand scenarios are shown super-imposed on the EirGrid / SONI low, median and high electricity demand scenarios in Figure 6-5.

The peak day electricity demand assumption for the average winter peak day projection is taken directly from the EirGrid / SONI All-Island Generation Capacity Statement (GCS) 2020-2029. For the 1-in-50 severe winter peak day projection, a calculated 1-in-50 year electricity demand is used, which considers the actual all-time electricity peak of 5,090 MW, which occurred in 2010, the intervening peak day electricity growth rates, and the projected peak day electricity growth rates.

The 1-in-50 year electricity demand is calculated by projecting forward the actual peak of 5,090 MW, which occurred in 2010 and growing this

32 http://www.eirgridgroup.com/library/
33 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/871799/Budget_2020_Web_Accessible_Complete.pdf

Figure 6-4: Forecast Single Electricity Market (SEM) thermal generation mix and interconnection capacity

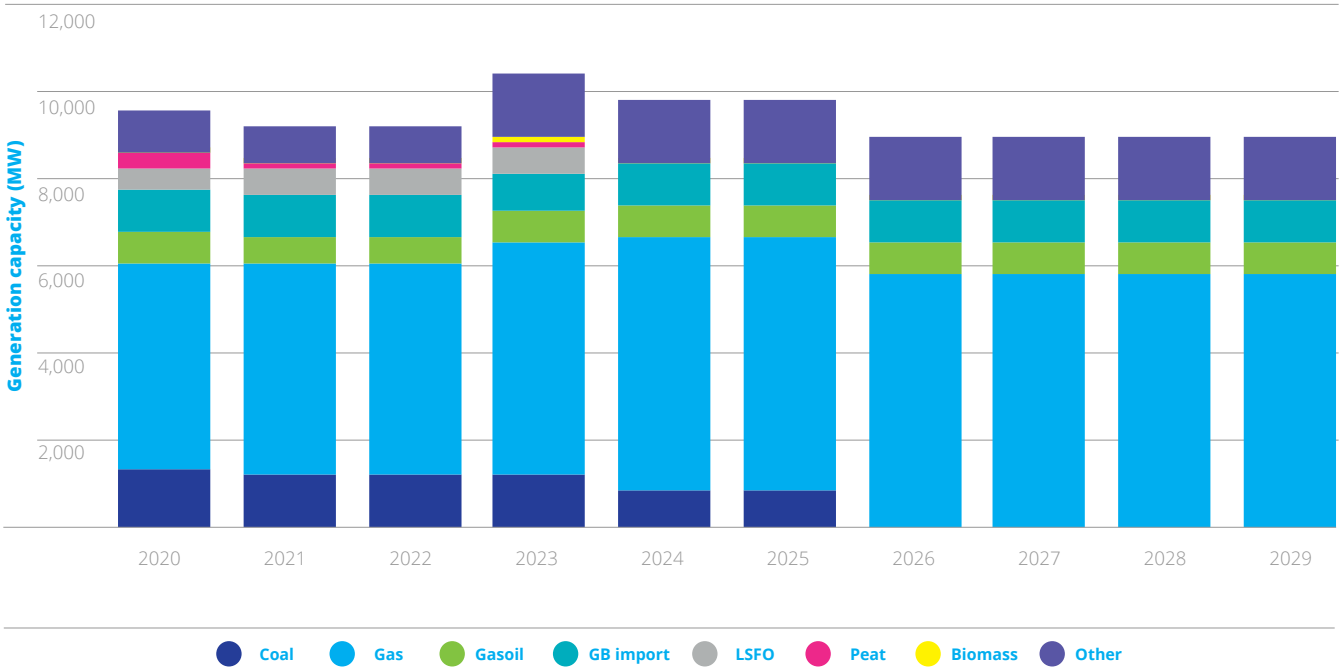
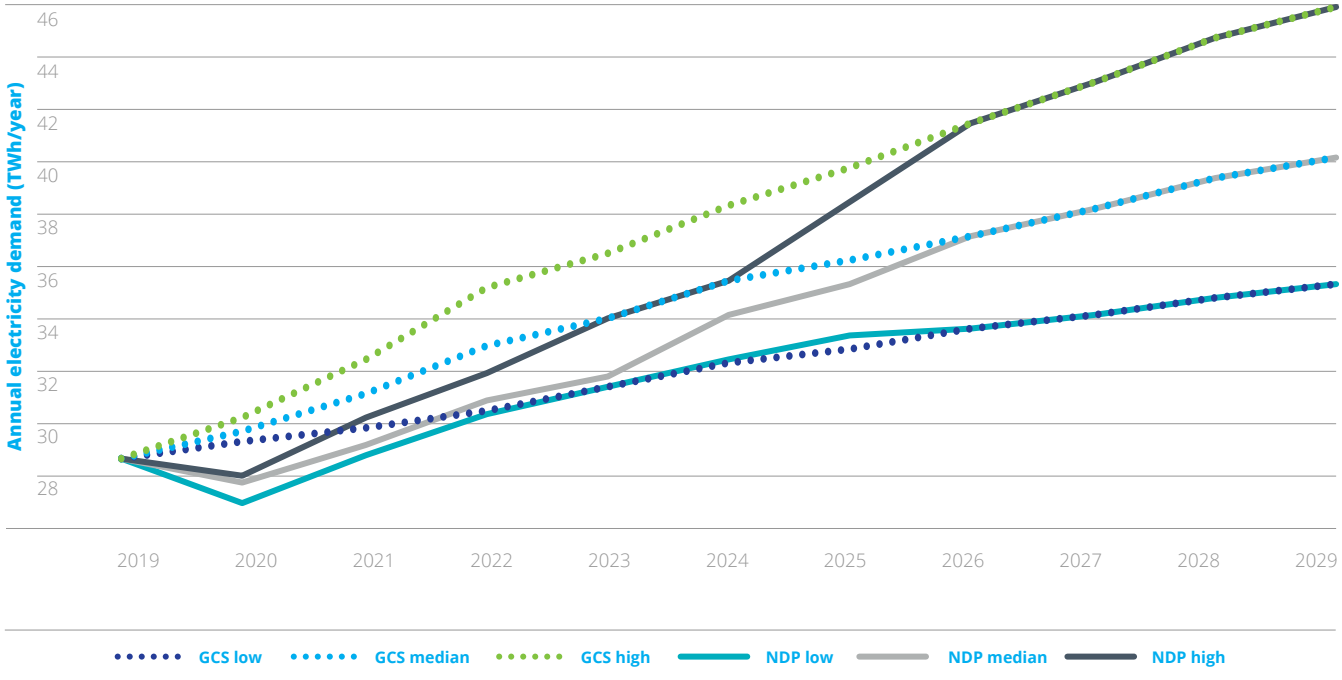


Figure 6-5: Electricity demand forecasts for ROI



6.0 Gas demand forecasts (continued)

figure forward in line with the electricity demand forecast growth rate.

An assessment of the first 2 years of the updated SEM operation has shown how the Gas Networks Ireland transmission system continues to supply gas to flexible gas-fired power generation, with gas contributing an average of c. 51% of Ireland's power generation fuel mix in the 2 years following commencement of the updated SEM. On days of low wind, gas has contributed towards 90% of the generation fuel mix.

6.5.2 Industrial and commercial sector

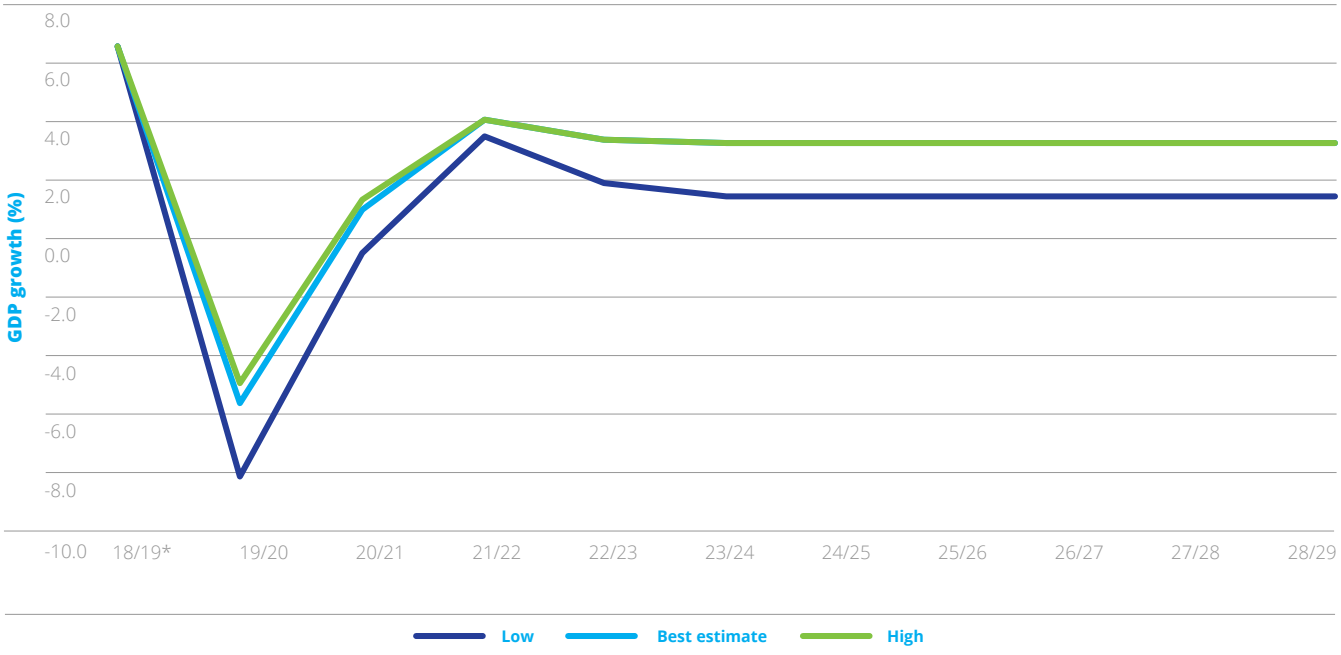
Industrial & Commercial (I/C) sector gas demand is assumed to continue to increase in line with anticipated new connection numbers and proportional to Gross Domestic Product (GDP)[34]. Figure 6-6 presents the GDP growth rate assumptions over the forecast period.

The short-term GDP forecasts are a composite of a number of short-term forecasts from the Economic & Social Research Institute (ESRI), Central Bank, the Organisation for Economic Co-operation and Development (OECD), the International Monetary Fund (IMF) and others. The impact of the COVID-19 pandemic and associated administrative restrictions is clearly reflected in the GDP growth assumptions for the short-term. All sources which fed into the short term blended GDP assumptions projected severe economic shock in the first year (2019/20), followed by a recovery period through the next 2 years. It should be noted that a significant degree of uncertainty is associated with the short term economic outlook, due to the fluid nature of the situation associated with living with the COVID-19 pandemic, and the associated restrictions imposed on the economy both domestically and worldwide.

In the medium term, GDP projections are based on the ESRI's 2013 Medium-Term Review (MTR) stagnation scenario for the Low demand scenario. In the cases of the Best Estimate and High demand scenarios GDP growth projections take account of the ESRI's Economic Outlook document published in December 2016.

While GDP is the primary driver of growth in the Industrial & Commercial sector, an additional incremental allowance is made for new connections in this sector for the Best Estimate and High demand scenarios in line with Gas Networks Ireland's I/C new connections growth strategy.

Figure 6-6: GDP growth assumptions



* 2018/19 actual GDP annual growth shown for context

34 Industrial & Commercial sector growth rate is assumed to be 80% of GDP based on observed historical trends.

6.5.3 Residential sector

The forecast for new residential connections is shown in Figure 6-7[35]. The Government's Climate Action Plan published in June 2019, proposed an effective ban on the installation of natural gas boilers in new homes from 2025, however retrofits to the mature housing stock are exempt from this ban. Gas Networks Ireland has already experienced a significant reduction in demand for natural gas connections for newly built homes. This is a natural reaction from builders, developers, architects and M&E (Mechanical and Electrical) consultants to a government paper recommending an effective ban on natural gas boilers, albeit 6 years in the future, with almost all new housing developments now being designed with electric heat pump heating solutions and without a natural gas supply. The expected reduction in demand is expected to be very significant in 2020 with new housing orders reducing by 70% of the 2019 run rate and remaining at a very low level through the NDP timeframe. Apartments may continue to be developed with natural gas central boiler solutions and potentially Combined Heat and Power (CHP) technology, however, this market is also challenged by the heat pump offerings (exhaust air heat pumps). Gas Networks Ireland will continue to support the building and developer community with natural gas solutions for new homes and will promote renewable gas as a pathway for new and existing homes to decarbonise.

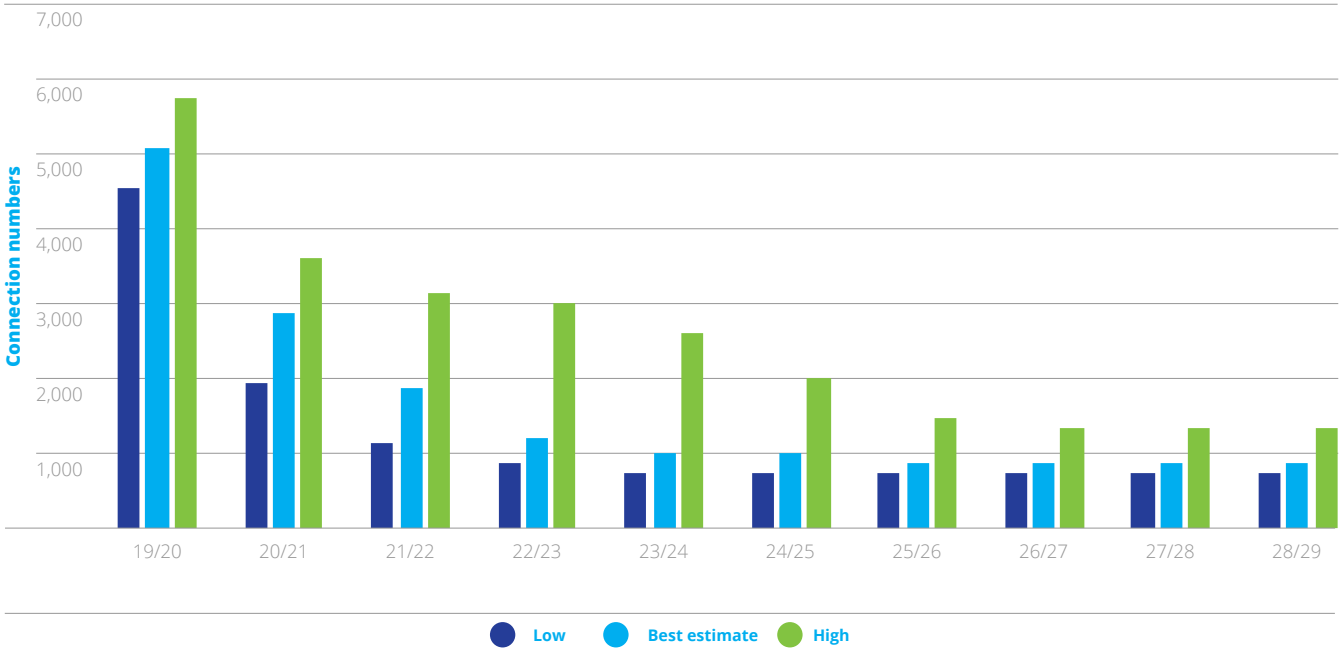
Energy efficiency

Energy efficiency savings impacting on Industrial & Commercial and residential gas demands are derived from the National Energy Efficiency Action Plan 2017[36] (NEEAP4). Assumptions relating to energy efficiency savings are further outlined in Appendix 3: Energy Efficiency Assumptions.

6.5.4 Transport sector

The transport sector gas demand is also included in the gas demand forecast. The transport forecast relates to the development of Compressed Natural Gas (CNG) within the transport industry through the promotion of Natural Gas Vehicles (NGVs). Gas Networks Ireland is conducting feasibility studies for a nationwide CNG fuelling network, co-located in existing forecourts, on major routes and/ or close to urban centres. This comprehensive refuelling station network will allow a transition to both natural gas and renewable gas as alternative fuels. This ambition will help meet Ireland's requirements under the EU's Alternative Fuels Infrastructure Directive. Gas Networks Ireland is

Figure 6-7: Residential new connection numbers



35 On average a central boiler will service 90 apartment units. The connection numbers shown in Figure 6-7 include new houses, mature houses and apartment units.
36 https://www.gov.ie/en/publication/93ee2-national-energy-efficiency-action-plan-neeap/

6.0 Gas demand forecasts (continued)

targeting the conversion of 24% of HGVs and 13% of buses to CNG by 2030.

Gas Networks Ireland is leading a project called the Causeway Study, which is funded by the Commission for Regulation of Utilities (CRU) and the Connecting Europe Facility (CEF) Transport Fund.

Two public access CNG stations are in operation, Circle K Dublin Port and Cashel. Two further stations are currently being constructed, in Limerick and Dublin.

See Section 8.4 for further details on Gas Network Ireland's plans regarding CNG and NGVs. Table 6-2 gives the projected transport sector demand for each scenario. The Best Estimate demand scenario assumes that 837.8 GWh/yr is in place by 2028/29, while the High demand scenario assumes a figure of 2,205.8 GWh/yr.

Table 6-2: Annual CNG demand forecasts

GWh/yr	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Low	10.3	35.8	98.7	198.8	335.9	475.2	541.4	543.4	543.4	543.4
Best estimate	12.1	37.5	98.8	198.8	335.9	492.6	632.1	737.1	803.4	837.8
High	12.1	43.4	141.3	330.2	570.6	852.6	1,201.0	1,549.4	1,901.4	2,205.8

6.6 The demand outlook

This section presents an overview of the gas demand outlook for the period 2019/20 to 2028/29.

6.6.1 Power generation sector gas demand

As described in Section 5.3, power generation sector gas demand has risen substantially since 2015 as a result of reduced electricity interconnector imports from Great Britain, growing electricity demand, and more recently carbon and fuel prices favouring gas-fired generation ahead of coal in the merit order for electricity generation. Following updates to the wholesale electricity market in October 2018 via the I-SEM project, electrical interconnector behaviour has generally displayed efficient behaviour in that the interconnectors are generally importing to Ireland when Irish electricity prices are higher than Great Britain markets, and exporting at times of high wind when prices in the SEM are lower than in Great Britain[37]. It is expected that this trend will continue in the short to medium term in all scenarios. However, the trend may gradually swing back towards imports from Great Britain to Ireland over the back end of the forecast horizon should carbon prices on the ETS continue to rise as forecasted[38]. This will depend on how carbon policy develops in the UK following the Brexit transition period. It has been indicated that the UK government will legislate to prepare for a UK ETS, which could be linked to the EU ETS35.

In the Best Estimate demand scenario, power generation sector gas demand is expected to continue to increase, despite the projected growth in installed wind capacities. Growth in the short to medium term is driven by continued favouring of base load gas plant in the merit order ahead of coal and the anticipated closure of 2 peat stations at the end of 2020. In the longer term, further growth in this sector is driven by the continued increase in electricity demand coupled with anticipated closure of coal-fired generation units, out-pacing the projected levels of renewable generation penetration. It is noted that while growth in installed wind capacities are modelled over the longer term, technical constraints on the power system and on generation plant minimum limits are modelled at existing levels. Should these constraints be reduced, an element of the gas demand growth projected in this sector will be reduced.

Over the forecast horizon, growth of 29% is predicted in the power generation sector in the Best Estimate scenario. This demand growth is reflective of the strong growth in electricity demand with EirGrid predicting growth of 30% in their median electricity demand scenario. The High demand scenario uses the similar inputs and assumptions, with the exception of a) taking the High electricity demand forecast, b) taking a stretched new-entrant assumption with regards to gas-fired power generation in the SEM, and c) taking a more prudent assumption on the target of electricity to be generated from renewable sources by 2030. The resultant narrative is similar to the Best Estimate scenario but leads Best Estimate in growth due to the higher electricity demand projected - growth of 61% is projected in the High demand scenario.

Similarly, the Low demand scenario uses the Low electricity demand forecasts as primary input. In addition, the Low demand scenario assumes prolonged operation of Edenderry peat station beyond 2023 (co-firing on biomass). Growth of 10% in the power generation sector is projected over the 10 year horizon in the Low demand scenario.

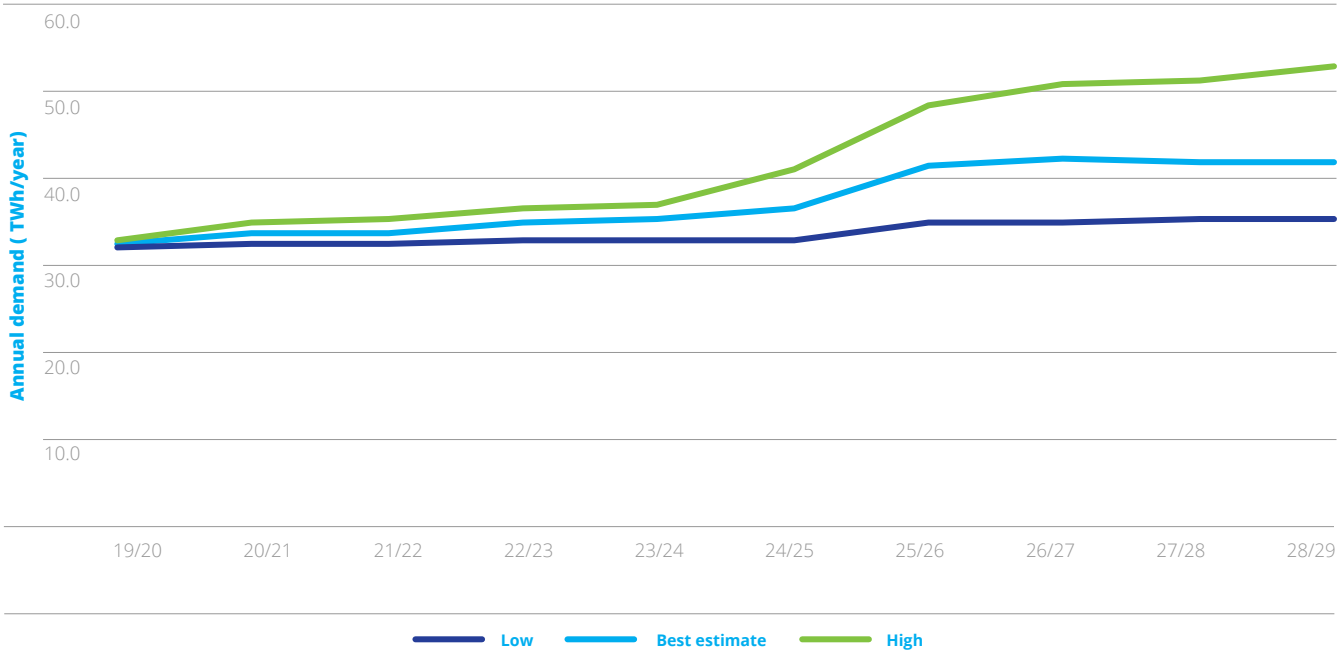
"Over the forecast horizon, growth of 29% is predicted in the power generation sector in the Best Estimate scenario. This demand growth is reflective of the strong growth in electricity demand with EirGrid predicting growth of 30% in their median electricity demand scenario."

Across all three demand scenarios a step change in demand is observed in 2025/26, resulting from the assumed closure of Moneypoint, and reinforced by the new entrant gas-fired power generation units assumed to connect in the middle of the forecast horizon as outlined in Section 6.5.1.

37 SEM committee Single Electricity Market Performance Quarterly Reports, available at https://www.semcommittee.com/publications
38 Gas Networks Ireland uses forecasts of carbon pricing from the International Energy Agency's World Energy Outlook document.

6.0 Gas demand forecasts
(continued)

Figure 6-8: Power generation sector gas demand



6.2.2 Industrial and commercial sector gas demand

In the industrial & commercial (I/C) sector, the Best Estimate demand scenario profile shows strong growth of 18% over the period of interest. I/C sector projections take account of NEEAP4 Energy Efficiency measures in the sector. A portion of anticipated growth in this sector is strongly linked to economic performance. As noted in Section 6.5.2, the short-term GDP growth assumptions are negative, associated primarily with the negative economic impact of the ongoing COVID-19 pandemic. In the short term, despite the negative GDP growth assumptions, the assumed additional growth in new I/C connections outstrips the negative impact of the short-term GDP regression. In the medium term, economic performance is assumed to recover to fall in line with previous year's NDP assumptions. In the Low and High demand scenarios, Industrial & Commercial sector gas demand is expected to grow by 2% and 23% respectively.

It is noted that a high degree of uncertainty is associated with the GDP growth assumptions input to this NDP, given the fluid and evolving nature of the COVID-19 pandemic and associated restrictions, and the resulting impact on our economy.

6.6.3 Residential sector gas demand

In the residential sector, taking account of the targets announced in the 2019 Climate Action Plan, negative growth is projected across all scenarios. This is as a result of reduced new connections assumptions, coupled with an anticipated increase in disconnection rates in this sector. The Best Estimate scenario projects a reduction of 5.6% in the residential gas demand sector across the forecast horizon. In the High and Low demand scenarios, 4.2% and 6.5% reduction in demand is predicted respectively.

6.4.4 Transport sector gas demand

In the transport sector, positive growth is projected across all scenarios. Gas Networks Ireland has successfully developed both public and private CNG stations on the distribution gas network with new connection expected to continue and increase of the 10 year NDP period. The Best Estimate demand scenario projects that 838 GWh/yr is in place by 2028/29, while the High and Low demand scenarios assume figures of 2,205 GWh/yr and 543 GWh/yr respectively.

Figure 6-9: Industrial & commercial sector gas demand

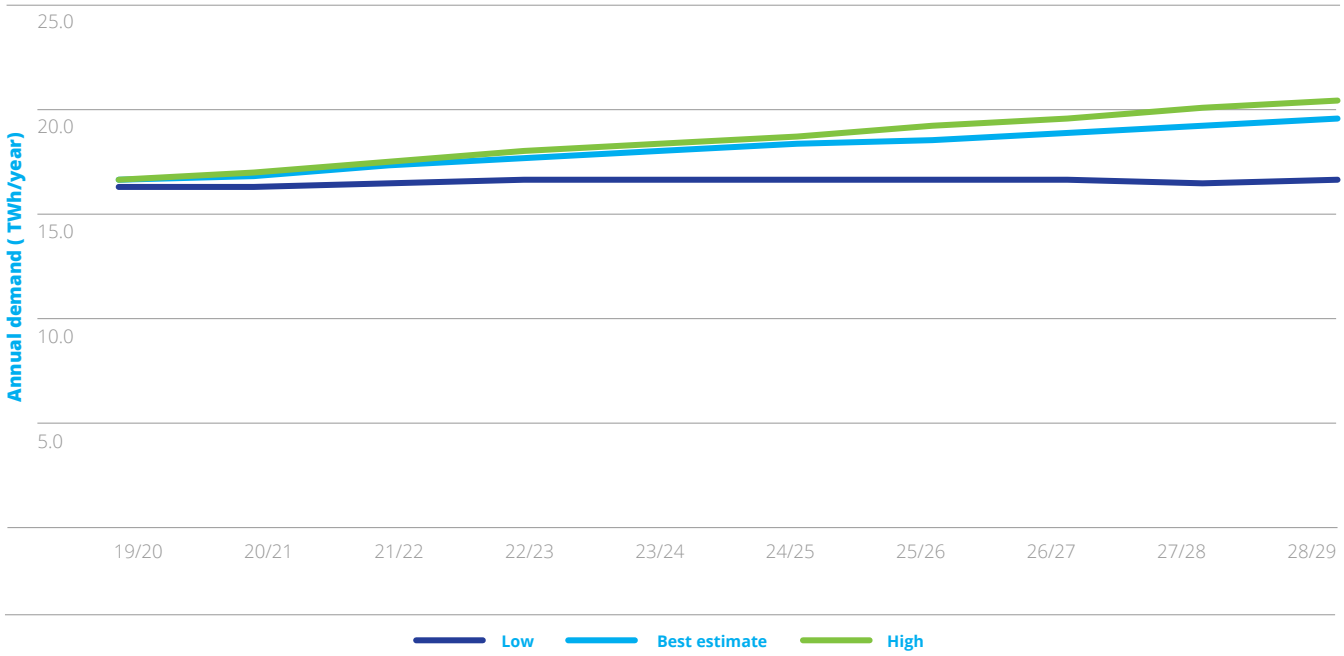
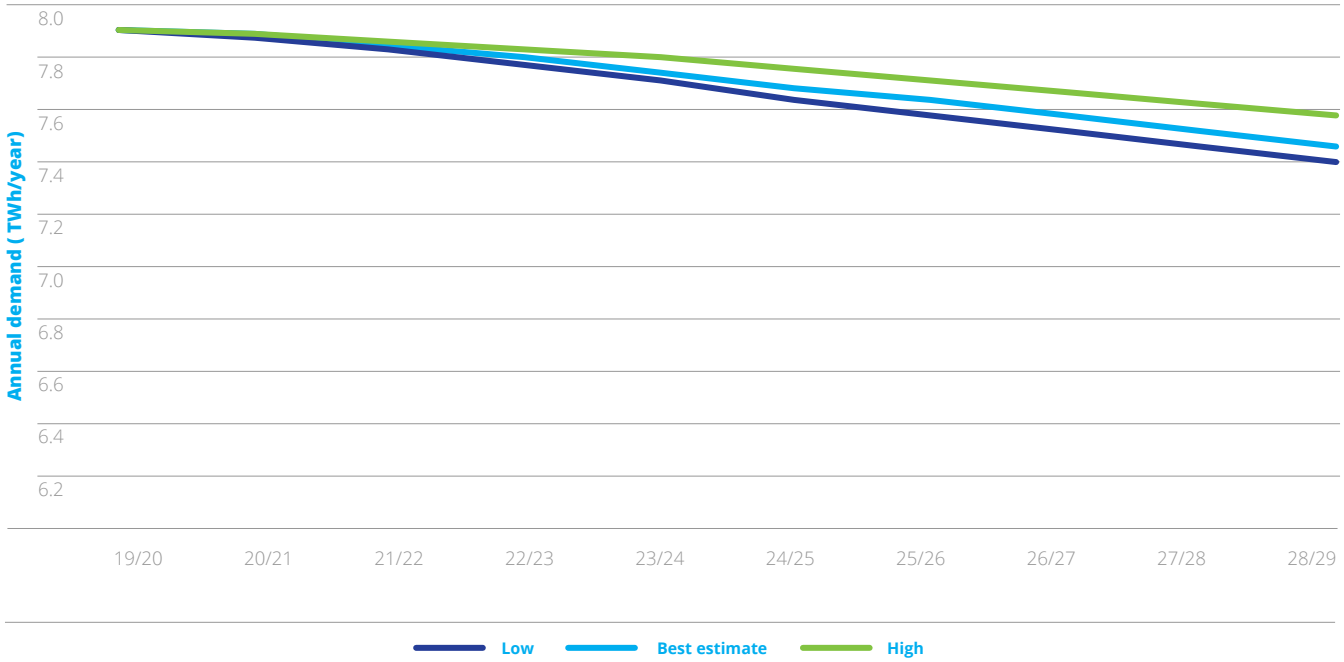


Figure 6-10: Residential sector gas demand



6.0 Gas demand forecasts
(continued)

Figure 6-11: Transport sector gas demand

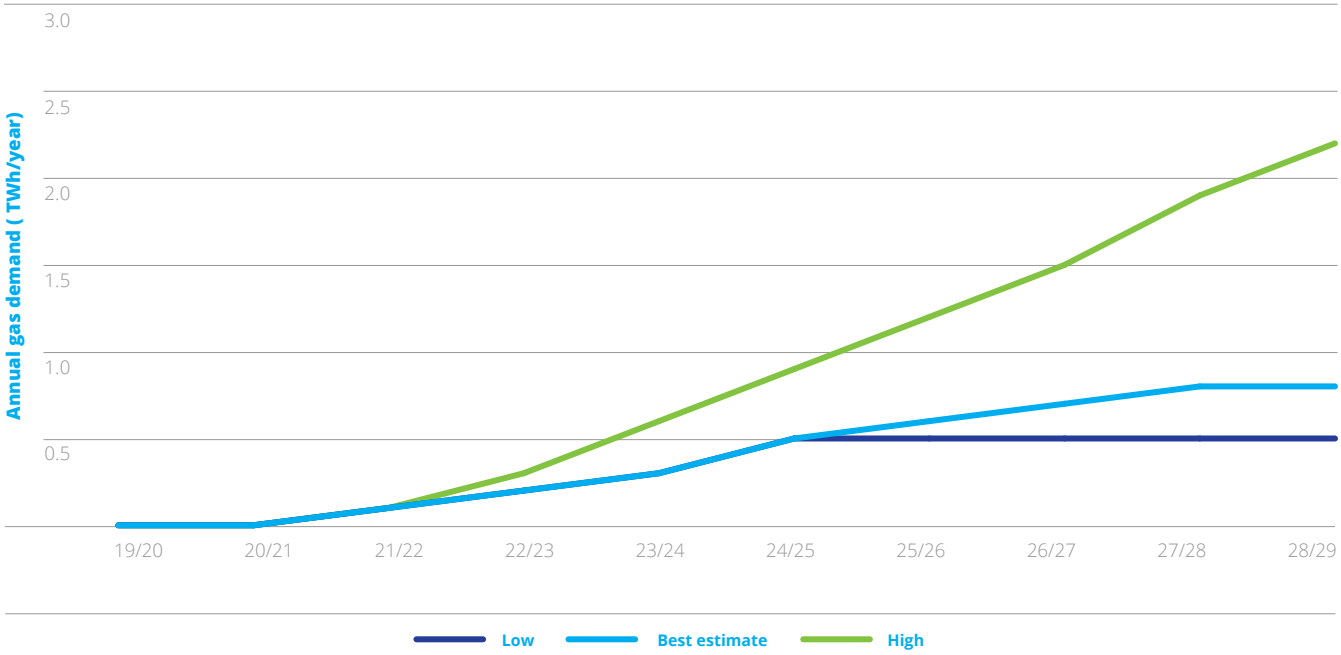


Figure 6-12: Total annual ROI gas demands

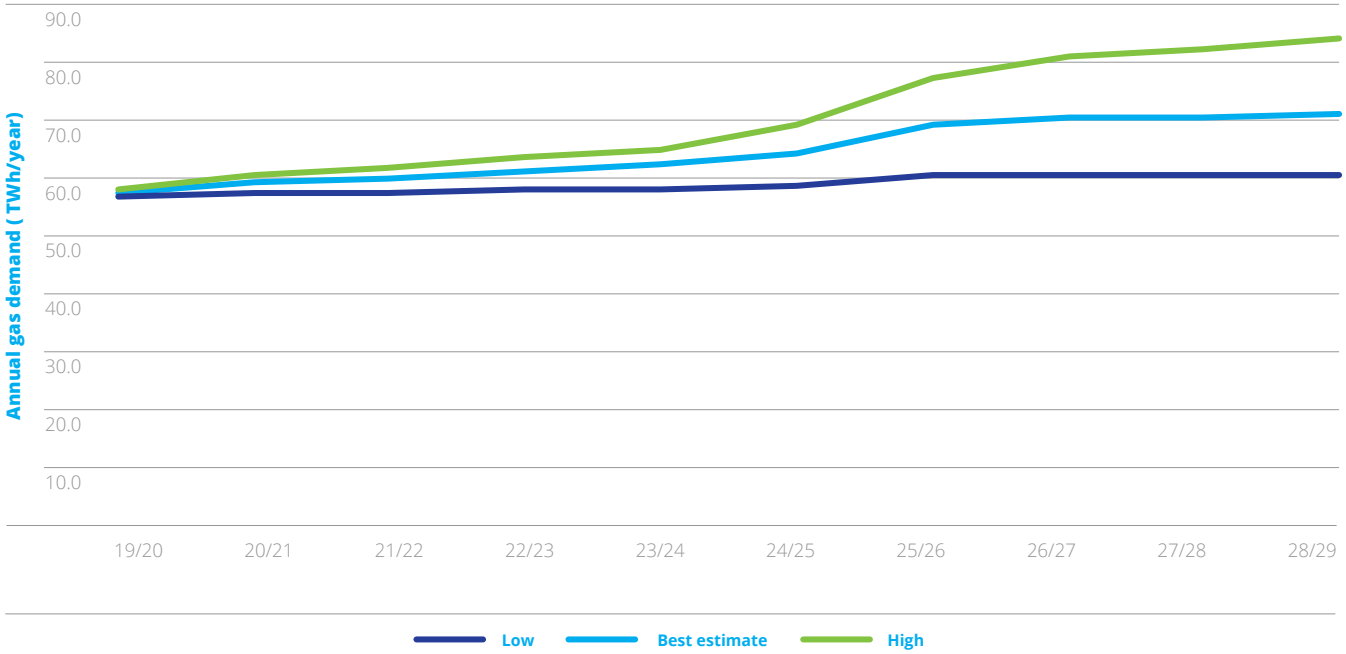
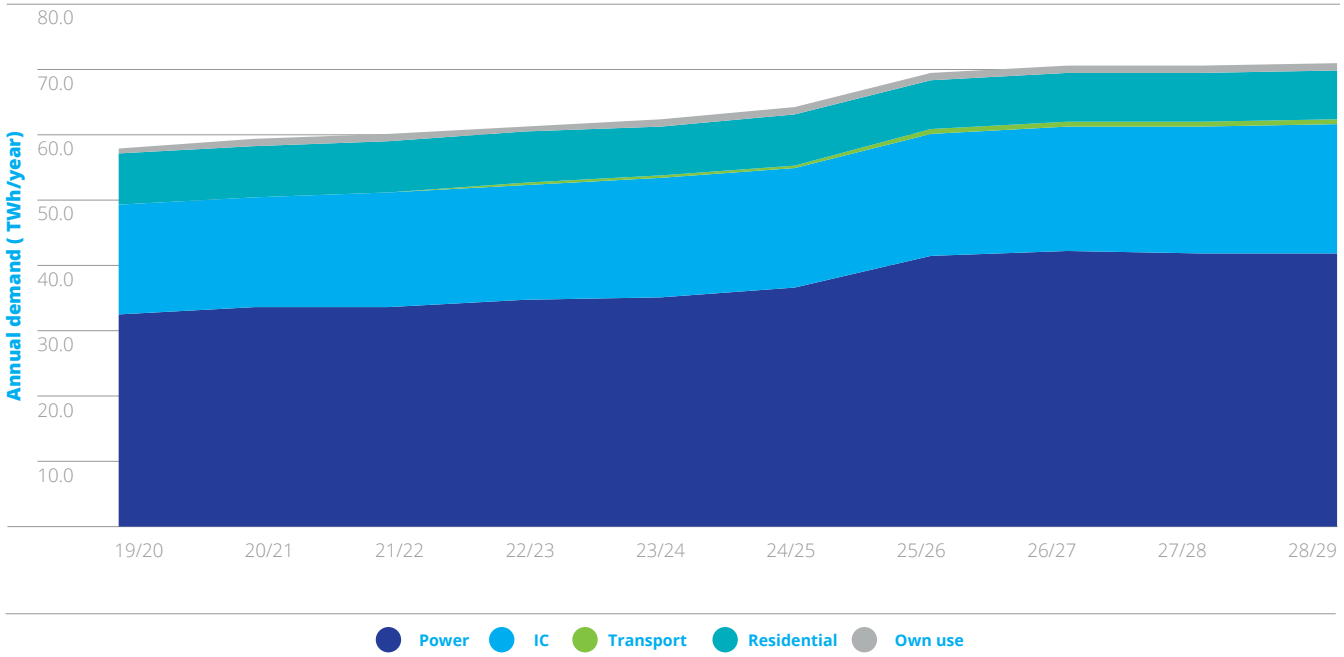


Figure 6-13: Best estimate scenario annual ROI demand by sector



6.6.5 Total annual gas demand

In the Best Estimate demand scenario, annual ROI gas demand is expected to grow by 23% between 2019/20 and 2028/29 with growth of 7% and 45% forecast in the Low and High demand scenarios respectively over the same horizon. The strong growth is primarily as a result of growth in power generation sector gas demand driven by growth in electricity demand, and anticipated closures of other thermal plant on the SEM. Assumed new entrants to the SEM from 2023 and 2024 contribute to the projected increase in the power generation sector. In comparison to previous years, the change in electricity interconnector flow towards exporting, following the market price differential between GB and IE is also expected to continue to have an impact in the short to medium term. This dynamic is expected to swing slowly back towards electricity imports towards the back-end of the forecast horizon. The industrial & commercial sector also contributes to the overall growth projection, with strong growth in additional (one-off) I/C connections out-stripping the negative short-term economic impact in this sector resulting from the COVID-19 pandemic.

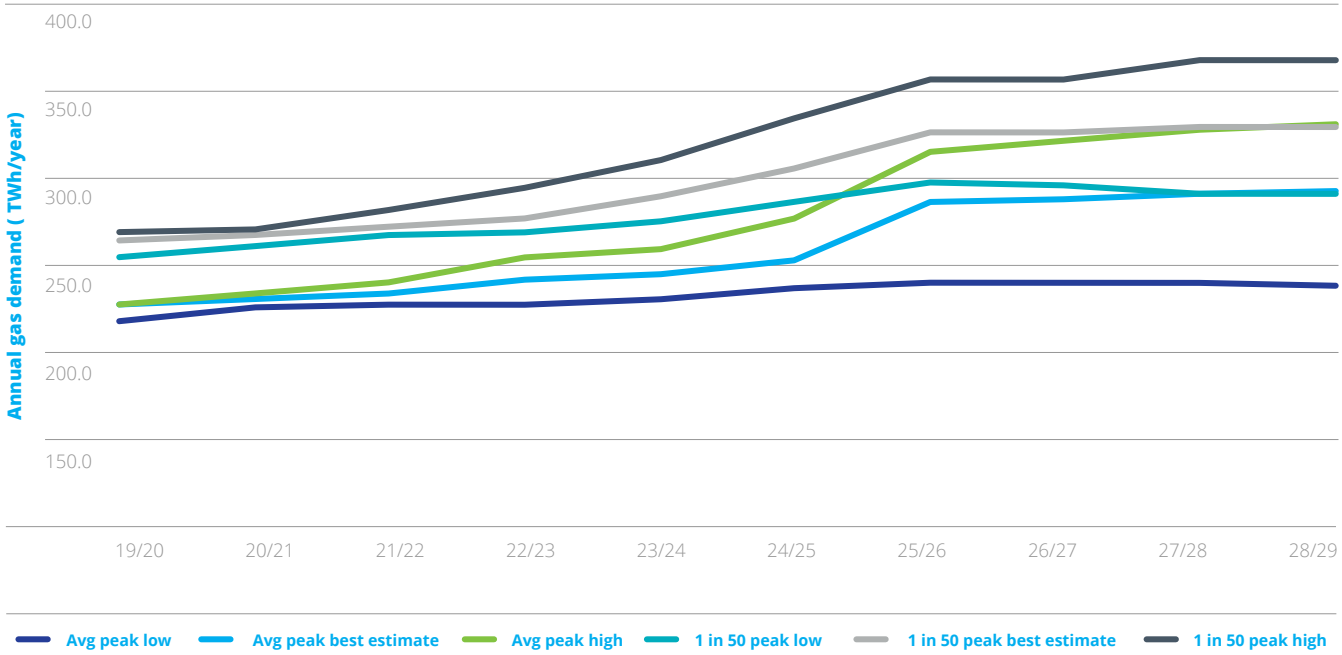
The aggregate ROI system demands for the Best Estimate scenario are presented in Figure 6-12. Figure 6-13 gives the relative weightings of each sector over the forecast period for the Best Estimate demand scenario.

6.6.6 Peak day gas demand

The 1-in-50 and average year peak day gas demands for ROI are given in Figure 6-14. The 1-in-50 peak is expected to grow by 19.1% in the Best Estimate scenario and between 10.7% and 28.9% for the Low and High demand scenarios over the duration of the analysis. Average year peaks are expected to grow by 21.5% in the Best Estimate scenario and by between 7.2% and 33.9% in the Low and High demand scenarios. The development of peak day demands across the various scenarios shows the same broad trends as the annual demand forecasts.

6.0 Gas demand forecasts (continued)

Figure 6-14: Peak day gas demand forecast



There is some decoupling of peak day and annual gas demand in the power generation as a result of wind generation's impact on the operation of gas fired plant in the SEM. Annual power generation gas demand is impacted by increasing wind generation capacity, which is displacing gas fired generation or at least offsetting growth in demand. However, wind generation is assumed to have little impact on the winter peak day. Although this is not always the case, there is often limited wind generation available during cold weather peak demand periods. Consequently, there is a high dependency on thermal generation, particularly gas fired generation, to meet the high levels of electricity demand which occur during such cold weather periods.

6.6.7 Role of gas in power generation

Ireland's portfolio of CCGT power plants are amongst the most efficient in the world and provide the responsiveness and flexibility required to support wind generation and other renewables. Gas fired power plants produce substantially lower emissions than coal, peat or oil fired plant (see Table 6-3) and when coupled with Carbon Capture and Storage (see Section 4.3) there is a long-term potential to provide practically zero carbon electricity to the Irish economy.

Table 6-3: Indicative carbon emissions by fuel type[39]

Generator type	Plant efficiency	tCO_2/MWh generated
Gas Fired	55%	0.37
Coal Fired	36%	0.94
Peat Fired	38%	1.10
Oil Fired	29%	0.96

39 Based on carbon emission factors published in the SEM Plexos validation model.

Gas fired generation accounted for approximately 52% of Ireland's electricity generation in 2019[40]. The construction of gas fired plants was an important factor in making it more economical to extend the gas network across Ireland, bringing gas to approximately 700,000 customers in Ireland, including some of Ireland's largest multinational and indigenous industries.

The strong relationship between gas and electricity has already proven to be very beneficial to Ireland; providing and maintaining competitive energy prices and a secure and reliable supply of energy. Figure 6-15 demonstrates the contribution of natural gas fired generation to the ROI electricity fuel mix for the 12 months up to June 2020. This figure demonstrates how the gas network continues to complement renewable generation. The partnership between flexible gas-fired power generation and intermittent renewable generation is key to enabling Ireland's renewable integration ambition into the future.

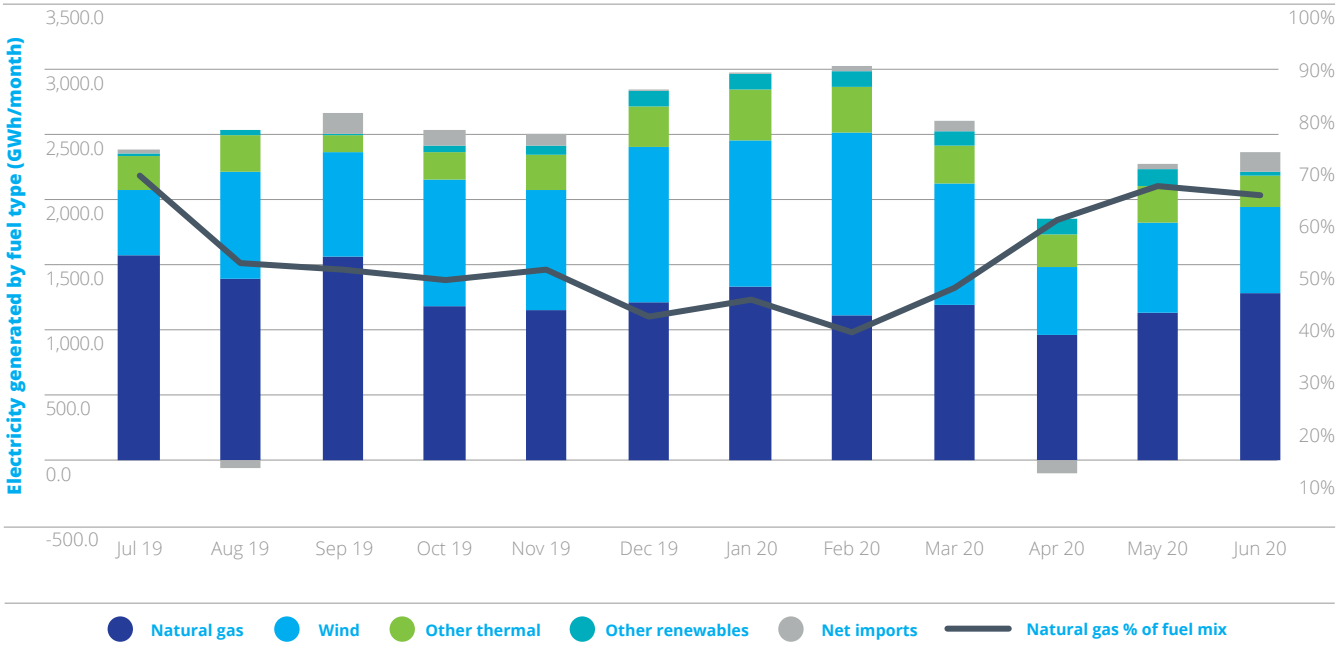
As noted in Section 6.5.1, the dynamics which influence gas demand in the power generation sector continue to evolve. In addition to future electricity demand growth, among the key factors set to influence the trajectory for gas demand in the medium term are:

- Potential change to the operation of Moneypoint power station beyond 2025
- Potential change to the future operation of Edenderry peat-fired power station beyond 2023 following the anticipated closure of West Offaly and Lough Ree power stations at the end of 2020
- Continued build-out of Wind Generation towards 70% by the 2030 RES-E target
- New generator entrants to the SEM (both gas-fired and other energy sources), coming online in 2023/24 aligning to the T-4 capacity auction results
- Potential additional future electricity interconnection, including the North-South interconnector

Gas Networks Ireland welcomes the opportunity to examine the future role of gas and of the gas network in contributing towards Ireland's transition to a low carbon energy future.

All the above considerations have been factored into NDP 2020 modelling assumptions to varying extents. In September 2020, planning approval for the North-South interconnector was approved in Northern Ireland. While this announcement followed the modelling data freeze date for NDP 2020, a sensitivity analysis was undertaken to assess the potential

Figure 6-15: Natural gas in the electricity fuel mix[41]



40 System and Renewable Data Summary Report – EirGrid
41 Based on SEAI Monthly Electricity Data https://www.seai.ie/data-and-insights/seai-statistics/monthly-energy-data/electricity/

6.0 Gas demand forecasts (continued)

impact of this project on gas demand in Ireland.

North-South electricity interconnector

While both ROI and NI electricity generators operate within the all-island Single Electricity Market (SEM), currently there is limited transmission capacity transfer between the two regions.

The proposed North-South Interconnector has now attained planning permission in both the ROI and NI. Completion of the project is anticipated to remove the capacity constraint between the two regions, thereby removing the existing flow restrictions between ROI and NI. As noted in Section 6.5.1, the North-South Interconnector is not assumed complete within the timeframe of the NDP 2020 and any of the 3 demand scenarios. However, a sensitivity analysis has been completed whereby the potential impact on ROI gas demand following completion of the project has been assessed.

The completion of the North-South Interconnector is anticipated to result in an increase in the net annual electricity transferred from ROI to NI. Depending on the prevailing electricity market dynamics between Ireland and GB, this increase will be provided by:

- Higher CCGT dispatch in ROI and/or
- Increased EWIC import from GB

Both of the above sources are anticipated to displace, to some extent, some of the less efficient power generation otherwise (and currently) constrained in NI as a result of the North-South constraint.

The anticipated impact of the North-South Interconnector on power generation sector gas demand in ROI is therefore estimated as a potential range, given the interdependency with the GB market dynamics. Gas Networks Ireland anticipate this range to of the order of 0 to 3% for annual gas demand, and 0 to 2% for peak day gas demand.

7.0 Gas supply

Key messages:

The final commercial flow of gas into the Inch Entry Point from the Kinsale gas fields took place on the 4th July 2020

The Corrib gas field is expected to meet up to 27% of annual Gas Networks Ireland system demands (35% of ROI demand) in 2020/21, with the Moffat Entry Point providing the remaining 73%.

The Moffat Entry Point in Scotland will remain key in terms of energy security as Corrib production declines in the medium term.

This section presents an overview of the gas supply outlook for the period 2019/20 to 2028/29.

As noted in the 2019 NDP, the reduction in Corrib and Inch gas supplies re-established the Moffat Entry Point in Scotland as the dominant supply point in 2018/19. In 2019/20 the Corrib gas field accounted for 36% of ROI supply, with the Inch Entry Point accounting for a further 3% of gas supplies. Gas imports via the Moffat Entry Point accounted for balance of gas supplies (61%).

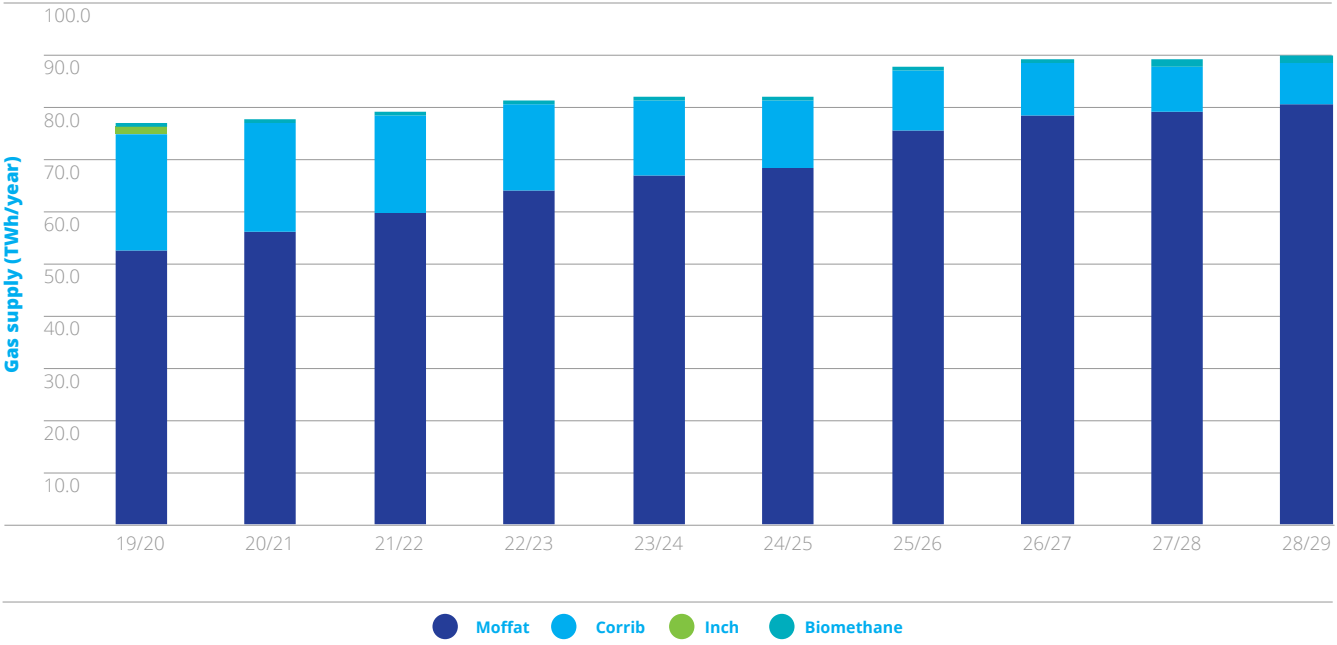
Looking forward, the above trend continues to the end of the forecast horizon. In 2020/21 Corrib is anticipated to meet up to 27% of annual Gas Networks Ireland system[42] demands (35% of ROI demand), with the Moffat Entry Point providing the remaining 73%. By 2028/29 Corrib gas supplies will have declined to less than 25% of initial peak production levels. By the end of the forecast horizon Moffat will account for approximately 90% of annual Gas Networks Ireland system demands (approximately 87% of ROI demand).

Figure 7-1 presents the forecast Gas Networks Ireland system annual gas supply for the period to 2028/29 for the Best Estimate demand scenario.

The Gas Networks Ireland system 1-in-50 peak day gas supply profile for the Best Estimate scenario is presented in Figure 7-2. The Corrib gas field would be expected to supply approximately 15% of Gas Networks Ireland system demand and 19% of ROI peak day gas demand in 2020/21 in the event of a 1-in-50 winter peak day. The Moffat Entry Point would be expected to meet nearly 85% and 81% of Gas Networks Ireland system demand and ROI demand respectively in 2020/21, in such circumstances. Moffat is anticipated to meet 94% and 92% of Gas Networks Ireland and ROI system peak day demands respectively in 2028/29.

The gas supply outlook highlights the continued critical role of the Moffat Entry Point throughout the forecast period. It is noted that based on the Best Estimate projection, the technical entry capacity at the Moffat Entry Point (see Section 7.1) would be exceeded on a 1-in-50 peak day in the last 5 years of the forecast horizon. While the capacity on the interconnector pipeline infrastructure is more than sufficient to

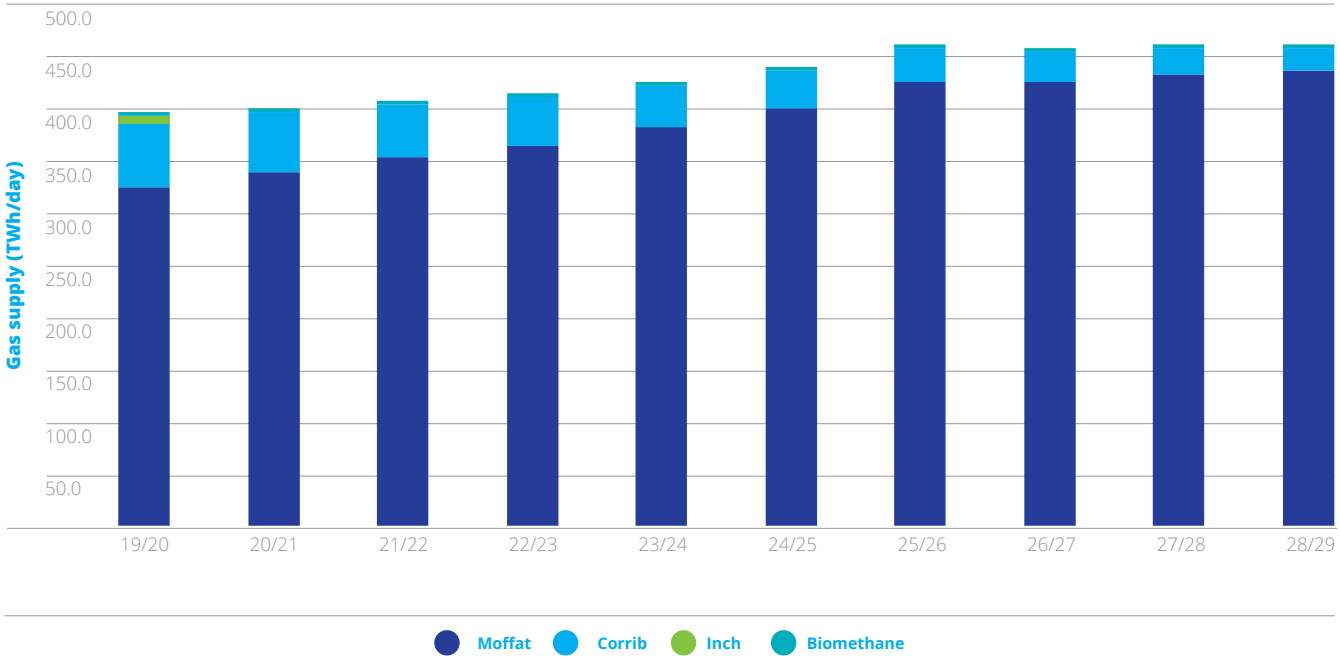
Figure 7-1: Annual Gas Networks Ireland system gas supply forecasts – best estimate scenario



42 Gas Networks Ireland 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.

7.0 Gas supply (continued)

Figure 7-2: 1-in-50 peak day gas supply forecast – best estimate scenario



safeguard gas supply requirements via Moffat Entry Point into the longer term, the potential constraint arises at the onshore Scotland compressor stations. Gas Networks Ireland will continue to monitor supply and demand developments in the interim period and take prudent steps to ensure sufficient capacity will be available on the transmission system into the longer term. Interim operational measures which might be available to relieve this constraint in the medium term are being explored.

7.1 Moffat Entry Point

The Moffat Entry point in south west Scotland supplies gas to ROI, NI and IOM. The Moffat Entry Point has reliably met the systems energy demand requirements for Ireland since the construction and commissioning of IC1 in 1993. This connection to the GB National Transmission System (NTS) facilitates Ireland's participation in an integrated European energy market. Shippers active in the wholesale gas market in ROI are also typically active in the GB market or have access via contractual arrangements upstream counterparties. The UK wholesale gas market is extremely liquid with diverse supply sources from the UK, Norway, mainland Europe and further afield. Wholesale supply contracts into the ROI market are typically of 1 year in duration and for variable volumes as much of the demand in ROI is related to the Power Generation Market. The technical capacity at the Moffat Entry Point is 35 mscm/d (386.9 GWh/d)[43].

7.2 Corrib gas

The Corrib gas field, following commencement of production in December 2015 and a subsequent period operating at full capacity, reached a production plateau at the beginning of 2018. A steady decline in production has been observed at Corrib since then, in line with supply profile projections as detailed in previous Network Development Plans. Table 7-1 shows the forecast maximum daily supplies from Corrib.

Table 7-1: Corrib forecasts maximum daily supply

	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Daily supply (mscm/d)	6.21	5.78	5.12	4.54	4.02	3.55	3.18	2.81	2.49	2.20
Daily supply (GWh/d)	65.0	60.5	53.6	47.5	42.1	37.1	33.3	29.4	26.1	23.0

43 This technical capacity has been enabled through completion of the twinning of South West Scotland Onshore system (PCI 5.2) in 2018

Table 7-2: Inch forecasts maximum daily supply

	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Daily supply (mscm/d)	0.66	0	0	0	0	0	0	0	0	0
Daily supply (GWh/d)	6.9	0	0	0	0	0	0	0	0	0

7.3 Kinsale gas

The Kinsale storage facility has been operated by PSE Kinsale Energy Limited (KEL) using the depleted Southwest Kinsale gas field. In 2018, KEL announced that due to reserves at the Kinsale Gas Field depleting, all necessary measures would be undertaken to safely decommission the site. In July 2020, the KEL facility ceased production, and the final commercial volumes of gas from the Kinsale fields flowed onto the Gas Networks Ireland transmission system via the Inch Entry Point. Table 7-2 shows the forecast maximum daily supplies from Kinsale, where gas year 2019/20 represents the final year of production, with cease of production in July 2020 as outlined above.

Gas Networks Ireland acknowledge the key role the Kinsale Gas Fields have played in the supply of natural gas to Ireland since 1978, delivering all of Ireland's natural gas from 1978 to 1995. KEL has been producing natural gas from its facilities off the Old Head of Kinsale since 1978, with Ballycotton (1991), Southwest Kinsale (1999) and Seven Heads (2003) coming into production later. The South West Kinsale reservoir was repurposed to act as a storage facility from 2006 to 2017 allowing gas to be taken from the onshore network in periods of low gas demand and price, and delivered back to the onshore network in periods of high gas demand and price. The facility was Ireland's only indigenous source of natural gas until 2015, when Corrib was connected to the network.

7.4 Renewable gas

Energy from biomethane or 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 renewables (RES-T). In addition to being a potentially carbon neutral fuel, renewable gas production can also deliver significant greenhouse gas mitigations for the Agriculture sector, with elimination of Green House Gas (GHG) emissions from current slurry storage, slurry land spreading practices, and crop residue emissions.

As with other renewable energy technologies, renewable gas requires state policy and incentive supports to allow this industry to develop and grow to a long-term competitive fuel. With the pending implementation of the support scheme for the production and grid injection of biomethane, Gas Networks Ireland has produced three renewable gas production scenarios (Low, Best Estimate and High). The NECP has proposed an indicative target of 1.6 TWh/yr which will be reviewed in 2023 as part of the review process for the National Energy and Climate Plan, and the Gas Networks Ireland Low renewable gas scenario is aligned to this indicative target. In order to maintain alignment between the Best Estimate scenario and current policy measures, the 1.6 TWh/yr indicative target for biomethane has also been assumed in the Best Estimate scenario. Gas Networks Ireland anticipate the Best Estimate assumption to be revised upwards as policy is reviewed in 2023, given that there remains further scope for renewable gas production beyond the NECP indicative target, as expanded below:

- Article 23 of the most recent Renewable Energy Directive (RED II) states that *each Member State shall endeavour to increase the share of renewable energy in that sector by an indicative 1.3% as an annual average calculated for the periods 2021 to 2025 and 2026 to 2030, starting from the share of renewable energy in the heating and cooling sector in 2020 expressed in terms of national share of final energy consumption*, therefore this will drive a mandatory minimum of 1.3% annual increments of Biomethane which would oblige a minimum of 1.6 TWh/yr by 2030.
- Since RED II was published the European Commission has published the Green Deal which includes a Farm to Fork strategy and increased focus on the circular economy and sustainability. The EU is intent on decarbonising the agri-food sector and the objectives of the Farm to Fork strategy are likely to drive increased anaerobic digestion and therefore biomethane production. This has informed Gas Networks Ireland's assumption with regard to the NDP High scenario in relation to biomethane supply.
- In addition, KPMG is working with the Renewable Gas Forum Ireland (RGFI) and leading agri-food companies in Ireland to develop an initiative (Project Clover) that would see


KH ALPHA
KINSALE ENERGY
Kinsale A - East

7.0 Gas supply (continued)

increased anaerobic digestion in the agri-food sector. There is significant scope for biomethane production above the 1.6TWh/yr that is set out in Ireland's NECP.

Table 7-3 gives Gas Networks Ireland's medium national renewable gas production forecast. Renewable gas is discussed further in Section 8.5.

7.5 Other supply developments

Gas Networks Ireland welcomes new sources of gas supply and is willing to fully engage with both prospective onshore and offshore sources. Gas Networks Ireland has an excellent track record in delivering infrastructure projects.

Gas Networks Ireland has recently started to receive connection enquiries from prospective renewable hydrogen producers and are actively engaging with these producers in answering enquiries. Gas Networks Ireland will continue to engage with renewable energy developers to explore the opportunities and challenges presented by future injection of hydrogen into the gas network.

Table 7-3: Renewable gas supply forecast

TWh/yr	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Low	< 0.1	< 0.1	< 0.1	0.1	0.3	0.5	0.7	0.9	1.1	1.4
Best estimate	< 0.1	< 0.1	< 0.1	0.1	0.3	0.5	0.7	0.9	1.1	1.4
High	< 0.1	< 0.1	0.1	0.3	0.6	1.1	1.5	2.0	2.6	3.2

8.0 Gas growth

Key messages:

The gas network in Ireland is critically important and strategic infrastructure providing a natural gas supply to over 700,000 customers across the country.

The gas network remains key to Ireland's economic growth, with thousands of businesses and homes connecting to natural gas every year.

Gas Networks Ireland estimate that there are up to 300,000 households in Ireland, located on or close to the gas network, that are using oil for central heating, which could be readily connected to natural gas resulting in a more convenient cost effective heating solution for the consumer and significant benefits from an environmental perspective.

Public access CNG stations have been constructed at the Circle K Service Station in Dublin Port, and at Circle K Service Station at Cashel on the M8 Motorway. Both stations are fully operational.

The Causeway Project currently has a further nine publicly accessible sites contracted with forecourt operators and aims to complete the roll out of the Causeway infrastructure by 2022.

Clean Ireland Recycling are successfully operating the first private fast-fill CNG station at their premises in Smithstown Industrial Estate, Shannon, Co. Clare.

The first renewable gas injection facility in Ireland was commissioned in Cush Co. Kildare in 2019 with the first renewable gas flowing in 2019. Cush was declared a gas entry point in May 2020.

Gas Networks Ireland currently transports natural gas to its over 700,000 customers and the introduction of renewable gas gives customers access to an indigenous source of renewable energy to help them decarbonise their energy usage while providing environmental benefits to Ireland as a whole. The ESRI carried out research on 'access to and consumption of natural gas: spatial and socio-demographic drivers' and the resultant report recognises that increasing the number of dwellings connected to the gas network has the potential to reduce emissions where dwellings are switching from e.g. oil or coal. It is evident that gas, both natural and renewable, has an essential role in Ireland's transition to a low carbon economy. The advent of renewable gas has a profound impact on the challenge of decarbonising domestic heating. Once a sufficient level of renewable gas is on the network there is an opportunity that close to 1 million homes (those on, or within easy access of, the gas network) could be decarbonised via the gas network.

Gas can now also be used in transport. This is a relatively new area of focus for Gas Networks Ireland, it provides an alternative low carbon fuel to the transport sector and increases demand on the gas network. As more people use the gas transportation system this helps to reduce network tariffs for all customers which is important for the competitiveness of gas and it benefits all gas customers. As set out in further detail in Section 10, Gas Networks Ireland's design and planning teams assist in the development of transmission system projects and key infrastructural projects which are vital for the socio-economic development of the State. A key focus in the development of such projects is on matters of proper planning and sustainable development having due regard for the environment as set out in further detail in Section 10.1.

8.1 Residential new connections growth

Gas Networks Ireland currently provides a safe, reliable and secure supply of natural gas to over 680,000 residential customers throughout Ireland. This represents around one third of all homes in Ireland. Between 2013 and 2019, Gas Networks Ireland connected almost 30,000 newly built homes to the natural gas network with an average completion of approximately 4,000 per annum. All of these homes were built to stringent energy rating designs and met or exceeded the required A3 Building Energy Rating (BER) standards. This was made possible using high efficiency condensing gas boilers and temperature controls, high performance insulation and solar technology (PV or thermal).

Despite an increase in homes being built in Ireland to meet the housing shortages, there was a drop of circa 11% in the number of new homes connecting to the gas network during 2019. On top of this, a significantly higher reduction in connections is evident so far in 2020. This is mainly due to much more stringent Building Regulations (Near Zero Energy Buildings/NZEB) introduced at the end of 2018 making it more difficult for natural gas homes to meet these standards, plus increased competition from renewable technologies such as electric heat pumps. The Government's Climate Action Plan published in June 2019 also resulted in significant uncertainty in both the New Housing and the Mature Domestic sectors as, among other things, the document contained a proposed effective ban on natural gas boilers in new homes from 2025 onwards.

Gas Networks Ireland continues to actively promote natural gas heating systems, in combination with solar technology, to builders and developers. This is done by outlining through CPD presentations that natural gas in conjunction with solar PV or thermal can economically and technically meet A-Rating requirements for new-build homes. Although the Government's policy is for the electrification of home heating to achieve decarbonisation, Gas Networks Ireland believes that as the gas network decarbonises with renewable gas in the short to medium

8.0 Gas growth (continued)

term and hydrogen in the medium to long term, gas will also deliver decarbonisation in the heat sector. Gas Networks Ireland's vision for a decarbonised gas network is set out in its 'Vision 2050: A Net Zero Carbon Gas Network for Ireland'[44] which was published in October 2019.

In relation to the built environment, between 2013 and 2019 Gas Networks Ireland connected almost 32,000 mature/existing homes to the natural gas network, on average approximately 4,500 every year. These were all existing homes converting from other fuel sources, mainly oil. The conversion from oil to gas generally formed part of energy efficiency measures carried out on the home (including, for example, electronic zone controls, attic and cavity wall insulation, hot water cylinder insulation and often the installation of solar technologies). This approach enabled homeowners to improve their Building Energy Rating (BER) from poor performing homes at D, E, F or even G ratings up to a highly efficient B2 BER at an extremely competitive cost (compared to deep retrofit).

Gas Networks Ireland estimates that there are a large number of properties located close to the gas network which are not connected to natural gas. It is estimated that there are over 700,000 households in Ireland using oil for central heating and up to 300,000 of those have a natural gas network nearby and could be readily connected to gas[45]. This would result in significant benefits from an environmental perspective, considering natural gas emits 22% less CO_2 and negligible levels of NO_x and SO_x versus oil. Gas Networks Ireland also provides pre-payment gas meters that can help customers to manage their energy usage and costs. Natural gas is a more convenient cost effective solution for homeowners nationwide.

The targets contained in the Climate Action Plan for existing housing stock focus almost entirely on deep retrofits and the installation of electric heat pumps to improve energy efficiency and reduce energy usage in existing homes across the country. The plan sets out a target to deep retrofit 500,000 existing homes to a B2 BER and install 400,000 heat pumps by 2030. The cost of deep retrofitting existing homes to enable them to switch from oil home heating to electric heat pump technology is estimated to be in the region of €30,000 or more for bigger or older homes[46]. There are some estimates that highlight that the typical cost of a full scale deep retrofit to BER B2 or A3 standard would be between €40,000 and €60,000[47]. The high cost is due to the scale of works required to prepare the homes for the lower grade heat output from electric heat pumps and include the cost of a heat pump as well as wall and attic insulation and external doors. The levels of disruption associated with deep retrofits can be very high, with residents potentially being required to move out for a period of time while the works are being carried out.

Where there is no natural gas network available, Gas Networks Ireland supports deep retrofit investment to bring as many of Ireland's homes to a B2 energy rating standard. However, where homes using oil (to provide heating and hot water) are located on or close to the natural gas network, Gas Networks Ireland recommends upgrading these homes to a B2 BER by carrying out basic insulation (attic, walls and hot water tank), switching to

44 https://www.gasnetworks.ie/vision-2050/future-of-gas/GNI_Vision_2050_Report_Final.pdf.
45 'The Future of Oil and Gas in Ireland', Policy Advisory by the Irish Academy of Engineering, February 2013.
46 https://www.irishtimes.com/news/health/500-000-homes-to-be-retrofitted-for-energy-efficiency-1.3929819.
47 https://superhomes.ie/ - SuperHomes Cost of Works.

high efficiency condensing gas boilers and controls, replacing lighting with LED equivalents and installing solar PV panels. This work can be carried out at up to one third of the cost[48] of the deep retrofit works, and with significantly less disruption. This proposal means that up to 300,000 homes could be upgraded to a B2 BER at one third of the cost of the alternative deep retrofit costs, reducing CO_2 emissions while also future proofing these homes for renewable gas as it becomes available in greater quantities on the network.

8.2 Industrial & commercial sector development

Gas Networks Ireland currently provides a safe, reliable and secure supply of natural gas to circa 30,000 Industrial and Commercial customers throughout Ireland. Between 2013 and 2019, Gas Networks Ireland connected almost 4,500 new Industrial and Commercial customers to the natural gas network. These were made up of a high number of Small and Medium Enterprise (SME) low energy consumers and a smaller number of higher energy consuming customers. Natural gas, where available, is the fuel of choice for most businesses due to the many benefits this fuel source brings to their operations. In particular, natural gas is an excellent partner for the hospitality sector, providing heating, hot water, cooking, laundry and even onsite electricity generation to businesses like hotels, restaurants, bars and clubs. The public sector also relies heavily on natural gas to provide heating and hot water to operations involved with Education, Health, Civil Services, Justice and Defence, Local Authorities and Water Services. Natural Gas is also used to generate onsite electricity in many hospitals across the country providing significant security of supply and cost savings to the health system.

Larger industry is almost fully reliant on natural gas as a means of providing heat, hot water and/or steam and even electricity to their manufacturing or production processes. These range from agri-food operations like grain drying, dairy processing and food processing facilities to breweries and distilleries, pharmaceutical and biomedical operations and metal/cement production. Second only to power generation, these are the largest consumers of natural gas in the country and Gas Networks Ireland continues to connect new customers in this category every year.

In addition, many I/C customers, including those in the Public Sector responsible for energy procurement, are now actively looking to renewable gas as a means of further decarbonising their processes into the future. Natural gas is viewed as providing a reliable, convenient, flexible, cost effective, environmentally friendly fuel source; while renewable gas now has the potential to offer the additional benefit of carbon neutral emissions, without the need for costly equipment upgrades (the same equipment can be used to burn renewable gas as natural gas). Further information about renewable gas can be found in Section 8.5.

"Between 2013 and 2019, Gas Networks Ireland connected almost 4,500 new Industrial and Commercial customers to the natural gas network."

Some of the other key areas of focus for the I/C sector are detailed in the following sections.

8.2.1 Data centres

There are a number of key sectors which could potentially influence capacity with their growth demand over the coming years. Data centres have emerged as a potential growth sector in Ireland due to its global connectivity to Europe and the Americas, combined with excellent utility infrastructure, moderate climate, stable economic policies and IDA[49] support. Data centres are inherently large users of electricity with their annual usage varying from 12 GWhe/yr for a small data centre to a 520 GWhe/yr for a very large data centre. There are now an estimated 60 data centres[50] currently operating in Ireland with

48 This is based on analysis carried out by Gas Networks Ireland.
49 The IDA (Industrial Development Agency) is a semi state body whose main objective is to encourage investment into Ireland by foreign-owned companies
50 Ireland's Data Hosting Industry Q2 2018 Update http://www.bitpower.ie/images/RDDSTUDY/Bitpower_2018_Q2_Update_V4.pdf

8.0 Gas growth
(continued)

"In 2017 the installed CHP technology in Ireland avoided an estimated 423 $ktCO_2$ emissions (up 16% from 2016) and provided for an estimated 1,887 GWh in primary energy savings."

substantial future growth predicted in this sector subject to planning.

Gas Networks Ireland has developed a combined offering of natural gas, renewable gas and dark fibre services (through its subsidiary Aurora Telecom) to provide the data centre sector with a reliable and flexible source of energy and fibre connectivity. Natural gas can be used for onsite energy generation leveraging the existing reliable and versatile gas network infrastructure, offering data centre operators a primary source of power for data centres requiring 99.999% availability, flexible on-site generation capacity to complement flexible grid power connections or back up generation to cater for grid power outages, and as such Gas Networks Ireland expects the penetration of gas connections in this sector to increase in the coming years.

8.2.2 Combined heat & power (CHP)

Growth in the Combined Heat & Power (CHP) sector is another area which could potentially influence capacity in the coming years. The CHP technology combines the generation of electricity at a local level with the use of heat for process use and/or space heating. CHP technology provides distributed power generation, reducing the reliance on the national electricity grid, while providing significant carbon and energy savings versus utilising grid electricity. In 2017 the installed CHP technology in Ireland avoided an estimated 423 $ktCO_2$ emissions (up 16% from 2016) and provided for an estimated 1,887 GWh in primary energy savings. Applications of CHP technology range from smaller users such as nursing homes, hospitals and hotels up to large industrial applications such as data centres, dairy processing plants and the pharmaceutical sector. In 2017 there was a 2.1% increase in the CHP capacity in Ireland. Natural gas remains the fuel of choice for CHP plants throughout Ireland and accounts for over 90% of the installed operational capacity. The reliability, combined with the high efficiency of natural gas CHP, also offers substantial savings when compared to grid electricity. Gas Networks Ireland has been promoting the increased utilisation of CHP technology for a number of years now, including three CHP Conferences held during the last 4 years promoting the use of this highly efficient, low emissions solution. Forecasts show that the number of CHP installations in Ireland will continue to increase as large industrial users and hotel/leisure centres seek to leverage the commercial and environmental benefits of investing in this technology in both retrofits of existing sites and new developments to assist in meeting stringent energy ratings.

8.2.3 Other developments

The electricity market in Ireland is experiencing significant growth in demand due to economic growth and the prevalence of the growth of the data centre market. In their annual All-Island Generation Capacity Statement, EirGrid and SONI outline the expected electricity demand and the level of generation capacity that will be required on the island over the coming 10 year horizon. Generation adequacy studies assess the balance between supply and demand. The SEM Capacity Market is designed to procure enough generation capacity to meet the EirGrid/SONI adequacy requirement. These auctions have resulted in capacity contracts being awarded to a number of technology types, including both intermittent renewables and flexible thermal peaking power generation plants. The requirements for additional flexible peaking power plants is anticipated to continue to complement Ireland's additional

renewable electricity sources which will assist in meeting Ireland's renewable electricity share of the 2030 targets as set out in the Government's Climate Action Plan.

Other sectors of note include new Foreign Direct Investment (FDI) developments in the pharmaceutical and bio-medical sector. Gas Networks Ireland is focused on developing further gas demand growth in this key sector of the economy, and ensuring that existing customers utilise the most up-to-date and sustainable technologies, including CHP and renewable gas.

The project to bring natural gas to the newly-built Center Parcs holiday village development in Longford was completed at the end of 2018. Gas Networks Ireland worked closely with this UK company to bring the gas network from Athlone to this new development over a distance of circa 25km, illustrating the importance of the gas network to the hospitality sector. Center Parcs also constructed circa 25km of low pressure downstream network within the site to bring natural gas to all 400 lodges, commercial units and their 3 CHP engines for onsite electricity generation. The project was delivered on time and on budget by Gas Networks Ireland and enabled an on-time opening of the facility during the summer of 2019. Since then the new holiday village has been operating for almost 12 months without any outages or supply issues and the operator's decision to opt for a natural gas solution for their development has provided heating, hot water, laundry facilities and electricity to this significant operation.

The Center Parcs project also facilitated further extension of the natural gas network to the Ballymahon town centre. Gas Networks Ireland worked closely with Longford County Council to gain the required approvals to extend the network to the centre of the town to provide gas connections to homes and businesses located along the main street. The network extension was completed in 2019 and will be commissioned in 2020. This provided an additional benefit to the residents and businesses of Ballymahon on top of the Center Parcs benefits.

8.3 New towns and suburbs policy

The towns of Nenagh, Wexford and Listowel have recently been connected to the gas network along with a new connection to Center Parcs in Longford. Gas Networks Ireland facilitate further new town connections to increase the penetration of the gas network in Ireland and allow additional population centres to benefit from the many economic and environmental benefits of gas infrastructure. These extensions occur where demand is sufficient to meet the requirements of the new towns section of the Gas Networks Ireland Connections Policy.

Gas Networks Ireland will also expand the gas network through the suburb projects policy which is outlined in the connections policy. This approach allows the gas network to be extended to industrial zones or streets/regions that are close to the existing gas network but not connected. These areas can be connected as long as they are commercially feasible and represent minimal increases to the existing network. Gas Networks Ireland is progressing a number of suburb project proposals and the

8.0 Gas growth (continued)

"The CNG Stations will be strategically located to deliver the required outputs of the Causeway Study and to maximise utilisation of the assets."

first of these projects to advance to construction was a natural gas network extension for the Suburb Infill project in Galway, centred on the West-End area of Dominick Street. This project is progressing will provide natural gas to over 20 restaurants and fast food outlets, 11 of which have already contracted for natural gas connections in advance of construction kick-off (as a prerequisite for commencing).

As set out in Section 3.2, Gas Networks Ireland applies a bespoke environmental planning and assessment tool used by Gas Networks Ireland's design and planning teams in consultation with the Gas Networks Ireland environmental team to assess the environmental impact of such projects.

8.4 Transport

Ireland is facing an emissions challenge in transport which requires immediate action. Using Compressed Natural Gas (CNG) to power trucks and buses offers a real solution to reducing emissions from diesel-fuelled heavy vehicles. This is important considering that heavy goods vehicles (HGV) account for 20% of all energy related carbon dioxide (CO_2) emissions in the road transport sector, despite accounting for only 3% of the total number of road vehicles[51].

In order to provide an affordable low carbon alternative fuel to diesel in the Irish market, Gas Networks Ireland is conducting a project for a nationwide CNG fuelling network, co-located in existing forecourts, on major routes and/or close to urban centres. This will help satisfy the requirements of the EU's Alternative Fuels Directive which aims to establish CNG refuelling facilities along the TEN-T[52] Road Core Network. It is also in line with the National Policy Framework for Alternative Fuels Infrastructure as published by the Department of Transport on the 31st May 2017. This refuelling station network will allow a transition to both natural gas and renewable gas as alternative fuels. The existing natural gas network can be utilised as a national vehicle refuelling network, giving the commercial transport sector access to a cleaner, cheaper fuel with a similar operational performance to diesel. For areas not connected to the natural gas network, CNG can be supplied in a similar way as diesel is supplied to service stations, by transporting it by road.

As a commercial proposition CNG is also much cheaper than diesel and operators of CNG vehicles can avail of substantial fuel costs savings. Furthermore, the government has committed to a fixed excise duty rate for natural gas and renewable gas until at least 2023, helping to ensure a low and stable price. Gas Networks Ireland is targeting the conversion of 24% of HGVs and 13% of buses to CNG or Bio-CNG by 2030. By the end of the current NDP period, Gas Networks Ireland is expecting to see annual CNG demand of circa 837.8 GWh/yr. Please see Section 6.6.4 for more information on the projected transport sector gas demand.

Gas Networks Ireland is utilising high capacity fast fill technology which provides quick, efficient and safe

Figure 8-1: Dublin Port CNG station

refuelling which is very similar in nature to that of diesel refuelling. The normal fill time for a natural gas HGV is 3-5 minutes from empty. This is essential to recognise that these are commercial vehicles and are required to be in consistent use on a reliable basis to generate income.

The initial phase of the network rollout is through the Causeway Study which has begun to deliver this essential infrastructure. The Causeway Study consists of 6 activities such as Programme Management, Pilot CNG Network, CNG Vehicles and Supports, Renewable Gas Injection Facility, System Operation & Data Analysis and Communication & Dissemination. The CNG Stations will be strategically located to deliver the required outputs of the Causeway Study and to maximise utilisation of the assets. The second phase of rolling out CNG infrastructure across the country is the Green Connect project which includes the installation of 21 high capacity fast fill CNG stations, 4 renewable gas injection facilities, 4 CNG mobile refuelling units which will act as a backup solution to the CNG stations and the launch of a CNG Vehicle Grant

51 SEAI Energy in Transport 2014 report.
52 TEN-T – Trans-European Transport Network. https://ec.europa.eu/transport/themes/infrastructure/ten-t_en

Scheme which will be set up to support the purchase of circa 400 CNG vehicles across Ireland.

Public access stations have been constructed at the Circle K Service Station in Dublin Port, and at Circle K Cashel on the M8 motorway. The stations are fully operational and have been integrated with Circle K's systems and as such CNG is now sold through the forecourt in a similar fashion to diesel and petrol. Currently, Gas Networks Ireland has 9 additional contracts for publicly available stations with forecourt operators on the core motorway network. Project plans are in place to deliver these stations over the next 2 years. These developments will significantly bolster the completion of the Causeway Project.

A CNG compressor and private refuelling station have been installed at Clean Ireland Recycling's Shannon operation, and the company, a leader in environmentally friendly waste management services since its establishment in the early 1990s, has also received delivery of dedicated CNG waste collection vehicles, the first of their kind in Ireland. The specially commissioned, lower-emission CNG trucks have replaced a portion of Clean Ireland Recycling's diesel powered fleet, with the rest of the fleet also transitioning to CNG in the coming years. The Shannon site is part of Gas Networks Ireland's wider strategy to develop a market for natural gas as a lower-emission transport fuel.

In 2017, Gas Networks Ireland launched its Compressed Natural Gas Vehicle Fund making up to €20,000 available to businesses towards the purchase of a new Natural Gas Vehicle (NGV). The Vehicle Fund has made a total of €700,000 of funding available to transport operators, supporting the purchase of a range of commercial vehicles including trucks, buses and vans powered by CNG, and is part of a process to promote natural gas as a transport fuel in Ireland. The Vehicle Fund is supported by the Commission for Regulation of Utilities (CRU) and is co-financed by the European Union's TEN-T Programme under the Connecting Europe Facility as part of the Causeway Project. This has successfully allocated support to 39 dedicated natural gas vehicles in the market. These vehicles alone are expected to utilise up to 20GWh/yr of CNG, reducing CO_2 emissions by approximately 4,600 tonnes per year.

Figure 8-2: Clean Ireland Recycling fast-fill CNG station

8.0 Gas growth (continued)

"The Green Renewable Agricultural Zero Emissions (GRAZE) Gas project aims to develop the first large CGI facility located near Mitchelstown County Cork. The CGI facility is being designed to support over 20 remote agriculture based anaerobic digestion projects within 60 km of the site, which is currently in the planning process."

The Green Connect CNG Vehicle Grant Scheme is set to launch in Q1 2021. This grant scheme will make a maximum of €5,000 available to vehicle operators for the purchase of a new CNG vehicle. The size of the grant available will depend on the size of the vehicle applying for example, different funding rates will be available for different types of CNG vehicles such as the HGV Road Freight (>12t unladen) – Artic and the LGV Road Freight (<3.5t unladen) – Small Van. The application process for this scheme will be highlighted on the Green Connect website which is also set to go live in Q1 2021.

As part of the Green Connect project, Gas Networks Ireland is purchasing four CNG mobile refuelling units which will act as backup solutions to the CNG fast-fill stations that are located around the country. As infrastructure is limited in the early stages, reliability is key to confidence and adoption. The provision of mobile CNG refuelling units will ensure that if there are any technical issues with a CNG station then the market can still be serviced successfully until the station is back online. The mobile refuelling units can also be used for transporting renewable gas.

8.5 Renewable gas

Biogas, which is a form of renewable gas, can be produced through the digestion of wet organic biomass, purified to biomethane and then injected directly into the gas network without modification to the network or end user equipment. This can provide benefits to the agriculture, heat and transport sectors while contributing significantly to meeting Ireland's current and future climate change targets.

Gas Networks Ireland commissioned the first renewable gas grid injection facility in Cush, County Kildare and it was officially declared an Entry Point in May 2020. Gas Networks Ireland now facilitates direct grid injection projects through a connection policy framework and is also supporting remote cluster developments with Central Grid Injection (CGI) infrastructure. The Green Renewable Agricultural Zero Emissions (GRAZE) Gas project aims to develop the first large CGI facility located near Mitchelstown County Cork. The CGI facility is being designed to support over 20 remote agriculture based anaerobic digestion projects within 60 km of the site, which is currently in the planning process.

Gas Networks Ireland envisages that up to 8 regional CGI facilities will be required to facilitate the agriculture sector requirements for ~200

anaerobic digestion facilities remote from the gas grid. Direct injection anaerobic digestion facilities are envisaged to exceed 100 also. As of July 2020, over 130 expressions of interest were received from potential developers. All enquiries can be sent to renewablegas@gasnetworks.ie.

The EU Green Deal, which defines the EU strategy for implementing the Paris Agreement, sets out a roadmap to a low carbon economy across Europe. The Green Deal[53] covers a range of topics such as energy production (renewable gas and hydrogen) and the focus on agriculture and food production (the Farm to Fork Strategy)

53 Note on EU Green deal targets: The EU Green Deal sets out the key policies, strategies and targets by which EU Member States must meet the obligations of the Paris Agreement. GHG (Greenhouse Gas) emissions across the Union are to be reduced by 50-55% by 2030. There is also a requirement for 50% reduction in chemical pesticides, 25% of all farming to be organic, reduction of nutrient loss in soils by 50%, reduction in the use of chemical fertiliser application by 20% - all to occur whilst ensuring soil fertility is retained and improved, and lands (primarily grassland and cropland) are to be used to sequester soil carbon.

Figure 8-3: Green Generation, Nurney, Co. Kildare

presents a significant opportunity for renewable gas and its by-product digestate which is the key ingredient for organic soil improvers. The focus of the Farm to Fork strategy is on sustainable, low carbon, local and organic food production requiring 25% of farming to become organic. There is requirement for a significant reduction (20%) in chemical fertilisers, which will drive organic fertiliser alternatives, while recognising the massive potential for carbon sequestration by improving soil quality (50% reduced nutrient loss). Anaerobic Digestion, which produces renewable gas, is also one of the most sustainable ways of producing organic soil-enhancing fertiliser which reduces the GHG (Greenhouse Gas) emissions from agriculture and increases the capacity of soil to capture carbon. The emission reduction opportunity associated with soil enhancement can provide three times the GHG emission savings associated with carbon-neutral renewable gas.

The sustainability criteria for production and supply of renewable gas are an important aspect of the process. In line with the expanded objectives of the Paris Agreement, the EU Renewable Energy Directive has been recast and strengthened to impose mandatory obligations on renewable fuel production to ensure that renewable fuels such as biomethane can only be produced sustainably and in adherence to a full GHG Lifecycle Assessment from source to end-use that can demonstrate minimum net GHG savings. Only biomethane that is produced in line with these strict sustainability criteria can be accepted and recognised as renewable gas, and all facilities must demonstrate compliance annually through independent auditing by an EU/UNFCCC (United Nations Framework Convention on Climate Change) approved body (ISCC-system.org or REDcert.org).

Green Gas Certification and Guarantees of Origin

The re-cast of the EU Renewable Energy Directive (RED II) requires Member States to issue certificates (Guarantees of Origin) for each MWh of renewable gas injected into gas grid systems. A key requirement that comes with this recognition is for a robust Green Gas Certification scheme and service. To that end, the International Energy Research Centre, Gas Networks Ireland and the Renewable Gas Forum of Ireland jointly funded a project with Deutsche Biomasseforschungszentrum (DBFZ) and the German Energy Agency, to develop the blueprint for a certification scheme for renewable gas in Ireland. This project was completed in September 2018 and Gas Networks Ireland has implemented the blueprint that was produced. This has resulted in the system becoming operational in 2020. Green Gas Certificates will allow end users to purchase renewable gas in confidence and give government and regulators certainty that the sales of renewable gas are transparent and accounted for. Independent auditing by certification bodies approved by the EC will ensure compliance with RED II requirements.

9.0 Commercial market arrangements

Key messages:

Gas Networks Ireland supports the development of new entrants to both the retail and wholesale markets.

At EU level, full implementation by Gas Networks Ireland of the EU Network Codes is nearing completion.

The focus will now move to the European 'Green Deal' and the signalled review of the gas legislative framework in 2021 in order to design a gas market for renewable gases.

In the context of Brexit, Gas Networks Ireland is confident that gas will continue to flow through its interconnectors and that supply will not be negatively impacted following completion of the transition period.

9.1 Republic of Ireland gas market

Gas Networks Ireland in providing transportation services to shippers and suppliers operating in the wholesale and retail markets interacts regularly with regulatory authorities and gas market participants. Gas Networks Ireland 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 Gas Networks Ireland's responsibilities:

- Develop and maintain strategies for the Irish natural gas wholesale and retail markets;
- Establish market rules which are include in the Code of Operations;
- Support initiatives from various industry bodies;
- Deliver compliance with EU and National legislation as well as playing a driving role in the development of market arrangements to achieve 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 on an all-island basis; and
- Manage the contracts of the companies licensed to ship gas through the transportation system.

Gas Networks Ireland plays a pivotal role in fostering relations with neighbouring transporters, regulators and government departments to further the aim of European gas market integration. Gas Networks Ireland will continue to ensure that a resilient, robust and safe gas network is maintained to customers through appropriate and efficient investment. Following on from Brexit, Gas Networks Ireland is fully committed to ensuring that gas will continue to flow through its interconnectors and that gas supply will not be negatively impacted. In this regard Gas Networks Ireland is working closely with key stakeholders including Department of the Environment, Climate and Communications (DECC), Commission for Regulation of Utilities (CRU) and neighbouring Transmission System Operators (TSOs) to ensure that all Brexit related considerations are addressed in the context of minimising changes to Ireland's daily interaction with the UK in the transportation of gas. Depending on the final outcome of the trade negotiations, there may be a knock-on effect for Ireland, whereby Ireland will continue to implement EU regulations and legislation and the UK may decide not to as they will no longer be obliged to. The UK have however committed to continuing gas market operations that pertain today and Gas Networks Ireland are confident that there will be no negative impact on gas flows following completion of the Brexit transition period.

9.2 European developments

In order to deliver full compliance with the EU Network Codes, a project team was established in Gas Networks Ireland to oversee this process.

The objective of the project team was to deliver the necessary work packages to implement the EU Network Code requirements which are described in the sections below and is now complete.

Gas Networks Ireland is continuing to actively participate in various EU gas association work groups across ENTSOG, Eurogas and Gas Infrastructure Europe (GIE), which are focused on the upcoming review of the gas legislative framework, inputting into and monitoring technical and regulatory studies feeding into this review.

9.2.1 Capacity allocation mechanism

The objective of the Capacity Allocation Mechanism (CAM) is to enable further development of European cross-border competition and market integration. The CAM Regulation (EU) 984/2013 was implemented from 1st November 2015.

A revised code, Regulation (EU) 2017/459, amended the Network Code on Capacity Allocation Mechanisms (CAM NC), became applicable on the 6th April 2017. The amended CAM NC consists of a number of changes including the annual auction of capacity at Interconnection Points (IPs), which now take place in July and introduced new quarterly auctions throughout the gas year.

It also includes rules relating to incremental capacity at Interconnection Points. The harmonised rules outline the process to be followed for the development of incremental capacity.

The first phase of the incremental capacity process requires transmission system operators to undertake a demand assessment. This assessment is required to be undertaken every two years. In 2019 Gas Networks Ireland completed this assessment which revealed no firm signals from the market to increase gas capacity at the interconnection points. A similar exercise will take place in 2021.

Gas Networks Ireland actively monitors the results of all auctions and hence the availability of capacity to shippers at all entry points.

9.0 Commercial market arrangements (continued)

9.2.2 Balancing

The fundamental objective of the Balancing Network Code (Regulation (EU) 312/2014) is to introduce market mechanisms into the balancing regime. Primary responsibility for balancing gas flows on the system resides with network users, with the TSO having a residual role. This included changes to the timings for the submission of nominations and also allowed for a TSO to submit a nomination to another TSO at an Interconnection Point and to have that automatically be passed through to the adjacent TSO – a Single Sided Nomination.

In mid-2018, Gas Networks Ireland commenced participation in a designated trading platform to meet its gas balancing requirements. In April 2019, Gas Networks Ireland, following consultation with gas market participants and the CRU, introduced changes to the cash-out regime and removed/amended certain tolerances. As a result of the above, full compliance with the Balancing Network Code has been achieved.

9.2.3 Tariffs

The Network Code on harmonised transmission tariff structures for gas came into force on the 6th April 2017, with full implementation required by May 2019. The Code sets out the Union-wide rules for transmission tariffs which have the objective to contribute to market integration, to enhance security of supply, to promote competition and cross-border trade, to ensure non-discriminatory and cost-reflective transmission tariffs, and to avoid cross-subsidisation between network users.

In June 2019, following extensive engagement with gas market participants including a public consultation process, the CRU published its decision affirming the continued use of the Matrix Methodology. The other elements of their decision were to introduce a tariff for the virtual reverse flow product at Moffat and that Shrinkage costs will now be recovered as part of the tariff (rather than the Disbursements Account). The multipliers for short-term capacity products were adjusted slightly to align with the EU Network Code (e.g. cumulative monthly multipliers were reduced to 1.5 from 1.55). Quarterly products have been reduced to 1.35 to incentivise the use of the products. Following publication of the Commission's decision, full compliance with the Tariff Network Code has been achieved, notwithstanding that the shrinkage costs inclusion in the Tariff will be delivered for 1 October 2020. Related to this decision, Gas Networks Ireland will procure Shrinkage gas requirements via the Marex Spectron Trading Platform going forward. In June 2020, Gas Networks Ireland secured the first ever volumes traded on the forward curve at the Irish Balancing Point (IBP) for delivery in Gas Year 2020 indexed to UK prices but at a discount to the equivalent annual transportation charges.

9.2.4 Transparency

Under the 3rd European Energy Directive and the resultant Network Codes, a number of transparency requirements have ensued for transmission system operators in relation to the publication of data items, such as capacities, flows and tariffs. The ENTSOG Transparency Platform went live in October 2014, including the implementation of a new data warehouse. Gas Networks Ireland launched a new transparency platform in May 2018 which meets the transparency requirements of the Network Code and also provides the market with additional extensive data on entry and exit flows etc.

9.2.5 European Green Deal

The landmark European 'Green Deal' was announced by the European Commission in December 2019, with the intention of transforming the European Union into a "fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050". In the interim, however, much has changed with a global pandemic affecting plans and distorting timelines. The European Commission has responded by re-framing the 'Green Deal', and placing it and its associated strategies, at the heart of the 'EU Recovery Plan'.

Despite the disruption caused by COVID-19, the EU has delivered on several important components of the 'Green Deal', including the 'European Industrial Strategy', 'Circular Economy Action Plan', 'Farm to fork strategy', and the 'EU Biodiversity Strategy'. Of keen interest to Gas Networks Ireland and the European energy industry was the adoption of the EU strategies for Energy System Integration and Hydrogen announced on the 8th of July 2020. These strategies are designed to pave the way towards a "fully decarbonised, more efficient and interconnected energy sector".

The Strategy for Energy System Integration is one of the most ambitious and all-encompassing elements of the 'Green Deal'. This strategy sets out to establish the basis for "the coordinated planning and operation of the energy system as a whole, across multiple energy carriers, infrastructures, and consumption sectors". It envisages an integrated energy system which delivers decarbonisation "at the least cost across sectors while promoting growth and technological innovation". One of the key concepts in this strategy

"The landmark European 'Green Deal' was announced by the European Commission in December 2019, with the intention of transforming the European Union into a "fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050"."

centres on the use of "renewable and low-carbon fuels, including hydrogen". This strategy also highlights the potential of biomethane and carbon capture technology in decarbonising energy systems.

In parallel, the European Commission's Hydrogen Strategy sets out an ambitious roadmap for the development of a European hydrogen economy by 2030. According to the EC, hydrogen "offers a solution to decarbonise industrial processes and economic sectors where reducing carbon emissions is both urgent and hard to achieve", making it an essential part of the European 'Green Deal'.

Both the Energy System Integration Strategy and the Hydrogen Strategy have signalled a "review of the legislative framework to design a competitive decarbonised gas market, fit for renewable gases", by 2021. They also highlight the ongoing revision of 'The Regulation on Trans-European Networks in Energy' (TEN-E) which governs the Project of Common Interest (PCI) process, in order to ensure consistency with the ambition set out in the Green Deal.

Gas Networks Ireland will continue to monitor these developments and to proactively engage with our European and national stakeholders in the context of considerations and implications of these developments for our business and for the Irish gas market.

10.0

Gas network capacity

Key messages:

As part of the forecast modelling, Gas Networks Ireland compares the forecasted demands in Section 6 and the forecasted supplies in Section 7. The 2020 NDP highlights that the forecasted 1-in-50 peak demand may surpass the combined system entry capacity towards the end of the NDP period in the Best Estimate and High demand scenarios.

Gas Networks Ireland will keep this potential constraint under review in subsequent Network Development Plans. Measures are being explored to relieve this constraint in the medium and long term.

Gas Networks Ireland is in the third year of its fourth regulatory Price Control Period (PC4) which concludes in September 2022.

Future investment may be required to improve network capability in response to changing flow requirements or increased system flexibility.

As part of the forecast modelling, Gas Networks Ireland compares the forecasted demands in Section 6 and the forecasted supplies in Section 7. The 2020 NDP highlights that the forecasted 1-in-50 peak demand may surpass the combined system entry capacity towards the end of the NDP period in the Best Estimate and High demand scenarios.

In order to ensure adequate future capacity Gas Networks Ireland is continually investing in the network. The key capital investments are outlined in Section 10.1 below.

10.1 Capital investment

This section provides information on planned capital investment and future investments proposals for transmission system projects in order to comply with statutory and regulatory requirements.

10.1.1 Investment planning

Gas Networks Ireland's planning and design team assist in the development of transmission system projects and key infrastructural projects which are vital for the socio-economic development of the state. A key focus in the development of projects is on matters of proper planning and sustainable development having due regard for the environment. This process has been outlined in Section 3, which involves the application of a bespoke environmental planning and assessment tool used by the Gas Networks Ireland design and planning teams in consultation with the Gas Networks Ireland environmental team.

The NDP sets out the projects required to ensure the continuity of supply in the gas transmission system and associated investment requirements. Future investment proposals are subject to approval from the Commission for Regulation of Utilities (CRU) and the relevant consents and permissions as set out above and in Section 3. System operator requirements continue to evolve and both environmental and European legislative requirements will impact on future system operation.

Gas Networks Irelands continuously maintains the gas network to ensure a safe, efficient and reliable gas networks for the benefit of the communities it serves. In keeping with Gas Networks Irelands ISO55000 accreditation, information is gathered during maintenance interventions to inform future maintenance programmes and to shape and drive refurbishment and renewal decisions. Gas Networks Ireland has a comprehensive suite of asset lifecycle policy documents aligned to industry standards that describe in detail the approach to maintaining Gas Networks Irelands network assets. These Functional Specification and Requirements (FSR) documents provide detail on the various asset systems including key sections such as:

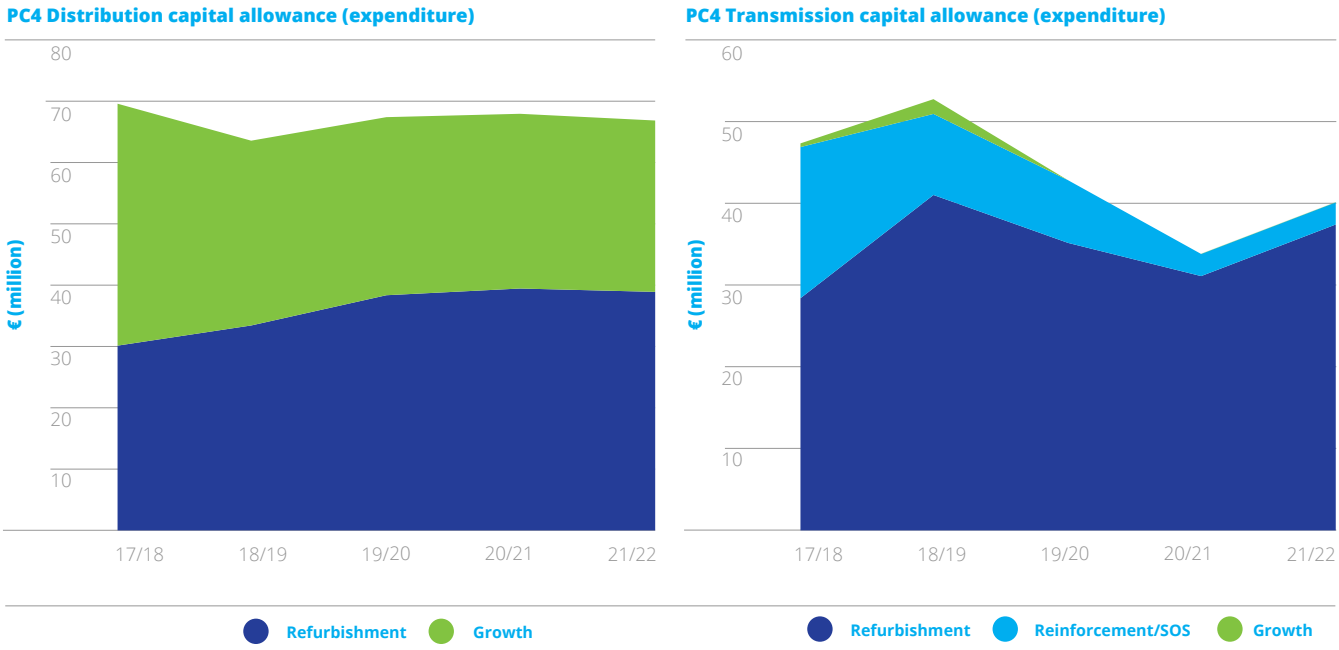
- Scope: this provides an overview of the assets and provides comprehensive technical detail on the relevant asset system and its anatomy, i.e. each of its primary parts/components.
- Asset Risk: these details how asset risk is assessed for, and how an asset risk score is assigned to, the assets, including Asset Health (probability-of-failure), Asset Criticality (consequence-of-failure) and failure modes (for each of the primary components).
- Asset Lifecycle: this details the interventions, and associated requirements and criteria, which are applied to the management of the assets across all four stages of the asset lifecycle, including the asset information requirements.

10.1.2 Regulatory capital allowance

Gas Networks Ireland is in the third year of its fourth regulatory Price Control period (PC4) which concludes in September 2022. The CRU has given a capital allowance of €554m for future investment in the distribution and transmission network for the duration of PC4 as illustrated in Figure 10-1 (excluding non-pipe and work in progress).

10.0 Gas network capacity (continued)

Figure 10-1: Capital allowance excluding non-pipe and work in progress



Capacity constraints projects, refurbishments and new connections are funded by the Price Control Capital Allowance and form part of the Regulated Asset Base (RAB). A portion of the cost of new connections and capacity upgrades related to large new connections may be funded directly by the customer in accordance with the New Connections Policy.

Future investment proposals are subject to approval from the CRU and the relevant consents and permissions. System operator requirements continue to evolve and both environmental and European legislative requirements will impact on future system operations.

In addition to RAB-funded regulated investments, the Causeway Project is a regulated project funded by a combination of regulatory opex allowances (Innovation fund), co-funded from a grant from the CEF Transport Fund and upfront customer contributions. The current Compressed Natural Gas (CNG) projects outlined in the Network Investment Plan are funded by the Causeway Project. The Causeway project represents a significant step forward in delivering a sustainable alternative fuel for Irish transport.

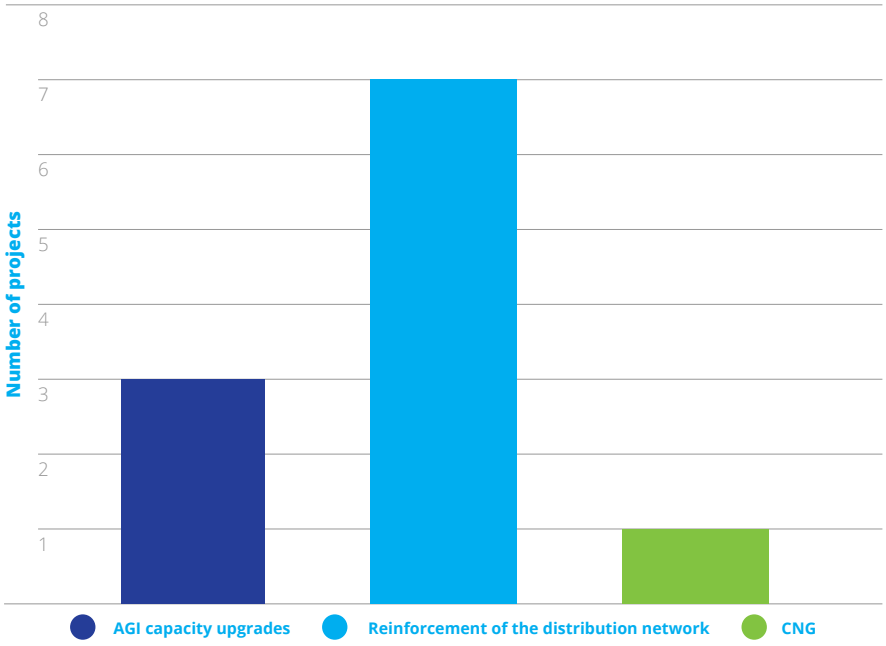
10.1.3 Unregulated projects

Projects that are not funded by regulated capex and opex allowances are referred to as unregulated projects. These are funded by a combination of Gas Networks Ireland investing their own resources in commercial projects together with customer contributions and third party grants. The assets from an unregulated project will not be included in the RAB. Any unregulated project must be approved by the Ervia Board and capital commitments must be approved by Gas Networks Ireland's shareholder.

The Green Connect project is a follow-on project to the Causeway project which has the scope to allow for the construction of an additional 21 CNG stations, four renewable gas injection facilities, four CNG mobile refuelling units and a CNG vehicle grant scheme to provide support to fleet operators to convert to CNG vehicles. The location and scope of each of these individual projects is yet to be determined. The Green Connect project has been approved for a grant from the CEF Transport Fund with the balance being funded by Gas Networks Ireland on an unregulated basis.

The new Centralised Gas Injection (CGI) Facility project at Mitchelstown Co. Cork, aims to build the first transmission connected CGI in Ireland. The GRAZE Gas project, of

Figure 10-2: Capital projects completed since 2019



which the CGI is an integral part, has been shortlisted for funding from the Climate Action Fund and once formally approved will be an unregulated project. In addition to the CGI, the project will also include a renewable gas logistics operation, two additional CNG stations and a CNG vehicle grant scheme. This project will inject large volumes of renewable natural gas onto the natural gas grid and will be a major step in achieving Gas Networks Ireland's targets.

10.4.1 Completed capital programmes

Capacity limitations are identified on the network and addressed through appropriate capital investment programmes in order to ensure continuity of supply to all customers. These projects were subject to the appropriate consenting and planning regimes as set out in Section 3. The following are significant capacity programmes completed since 2019, in addition to maintaining a rolling planned maintenance programme. These capital capacity programmes include:

- Above Ground Installation (AGI) Capacity Upgrades
- Reinforcement of the Distribution Network
- CNG

In 2019, 11 projects were completed including 3 AGI Capacity Upgrades, 7 Reinforcements of the Distribution Network and 1 CNG station located in Cashel. These projects were subject to the appropriate consenting and planning regimes as set out in Section 3.

10.1.5 Future system capacity

Gas Networks Ireland continuously undertakes detailed system modelling of the network in order to assess the capacity of the network. The Best Estimate demand scenario identified in Section 6 is modelled to identify any potential capacity constraints. Gas Networks Ireland will mitigate against these modelled system constraints to maintain system resilience and security of supply. Any such mitigating works are identified as part of the Network Implementation Plan which Gas Networks Ireland is currently preparing and will set out in more detail the manner in which projects identified in this section will be developed and will assess the potential for cumulative effects on the environment that may arise from these projects. It will also consider significant projects which are listed in table 10.1 below as "Other" projects.

Short-term requirements

In the short term, Gas Networks Ireland has a number of ongoing projects which are expected to be built within the next 3 years in order to reinforce and increase capacity in the network. These projects consist of AGI capacity upgrades and new AGIs and are spread across the network. Table 10-1 outlines the type and the region of project required in the short term.

"In 2019, 11 projects were completed including 3 AGI Capacity Upgrades, 7 Reinforcements of the Distribution Network and 1 CNG station located in Cashel. "

10.0 Gas network capacity
(continued)

Table 10-1: Short-term requirements

	Northern & Western	Eastern & Midlands	Southern	Total
Upgrade – AGI	1	3	1	5
New – AGI	0	1	0	1
Other – new CNG	1	8	2	11
Other – new CGI	0	0	1	1
Total	**2**	**12**	**4**	**18**

Table 10-2: Long-term requirements

	Northern & Western	Eastern & Midlands	Southern	Total
Upgrade – AGI	0	6	1	7
New – AGI	0	2	0	2
Total	**0**	**8**	**1**	**9**

Gas Networks Ireland is focused on the delivery of new CNG stations throughout Ireland. These will be located along core urban and regional road networks. The table above includes CNG stations that are expected to be built in the next 3 years and are classed under "Other – New CNG" projects. The table above also includes CGI facilities. Gas Networks Ireland, in conjunction with other industry stakeholders, intends to invest in CGI facilities located on the gas transmission network where Renewable Gas quality will be verified, and the grid injection process will be managed and metered. These projects are classed under "Other – New CGI" projects. Sections 8.4 and 8.5 outline CNG and Renewable Gas further.

Long-term requirements

In the long term, Gas Networks Ireland has identified projects which may be required within the next 10 years in order to reinforce and increase capacity in the network. These projects consist of AGI capacity upgrades and new AGIs and are spread across the network. Table 10-2 outlines the type and the region of project required in the long term.

10

CRU commentary

The CRU's mission is to regulate water, energy and energy safety in the public interest. The CRU is committed to protecting the short and long run interest of the public by ensuring, amongst other things, that energy and gas are supplied safely, the lights stay on and the gas continues to flow. Our aim is to protect the interest of the energy customers, promote competition and maintain security of supply.

CRU commentary

The CRU notes that the gas system in Ireland is evolving as Ireland moves to a decarbonised economy. There are also changes to the supply scenario with the reduction of indigenous gas supply from Corrib. Corrib is expected to supply up to 35% of Ireland's system demand in 2020/21. Moffat remains the dominant supply point with its contribution only expected to increase over TYNDP period (87% by 2028/29). With increased reliance on gas imported from Great Britain, the CRU is working closely with Department of the Environment, Climate and Communications (DECC), Gas Networks Ireland (GNI), Department for Business, Energy and Industrial Strategy-UK (BEIS) and the European Commission to ensure Ireland's energy security is maintained.

The CRU acknowledges GNI's approach to aligning the Best Estimate scenario with ENTSOG's National Trends while also having two Ireland-specific High and Low demand scenarios. Gas demand is expected to grow by 7% in the low demand scenario and grow between 23% and 45% based on the Best Estimate and High demand scenarios. The CRU notes that these figures are higher (for Low demand and High demand scenario) than projections made in previous TYNDPs and can be attributed to GNI's assumptions around new gas-fired generation coming online. These demand figures are also underpinned by sources such as ESRI's GDP growth forecasts and are designed to represent a broad range of possible outcomes. The CRU further notes that these are possible outcomes rather than likely outcomes; with the high and low scenarios designed to further test the capability of the gas network. The TYNDP also outlines GNI's growth initiatives which aim to promote sustainable development and increase usage of Ireland's gas network in a cost-effective manner. The CRU will continue to work with GNI on the progression of such initiatives and ultimately ensure that they bring benefits to the customer.

The CRU realises the critical role of gas in electricity generation which accounted for 52% of electricity generated in 2019. As Ireland transitions to a low carbon economy, renewable electricity generation will require greater flexibility from the Irish gas network, as gas is increasingly used as a backup fuel for intermittent renewable generation. This may have an impact on gas flow profiles and network operations.

The CRU welcomes GNI's commentary on the 'Future Role of the Gas Network' as Ireland moves to a decarbonised economy. The CRU notes GNI and its parent company Ervia's focus on the following with regard to the future use of the gas network:

- Compressed Natural Gas;
- Renewable Gas;
- Carbon capture and storage;
- Hydrogen;

The CRU is of the view that the role played by GNI will be important as Ireland transitions itself to a low carbon economy; and that the gas network will play a critical role. Therefore, the CRU supports initiatives undertaken by GNI to ensure system integrity and minimum pressures are maintained. Readers should note that this TYNDP process is separate to the approval of revenues for GNI; which is carried out under the Price Control process. Under that process, separate submissions are made by GNI as to its revenue needs over a 5-year price control period. The CRU reviews these submissions to ensure that any revenues requested are necessary, appropriate and efficient. The CRU is currently working towards Price Control 5 which would cover the period from 2022 to 2027.

Finally, the CRU would like to take this opportunity to thank Gas Networks Ireland for producing the TYNDP 2020, while acknowledging the work done maintaining Ireland's security of supply.

Appendices

Appendix 1: Historic demand

Historic daily demand by metering type

The historic demand data in Section 5 is presented by sector (i.e. residential, industrial and commercial (I/C) and power generation), 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.
- 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).
- 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. 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 Gas Networks Ireland annual gas demands (actual)[54]

GWh/yr	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
ROI	55,726	50,435	50,072	47,582	47,136	51,478	55,070	56,348	57,481	58,344
NI & IOM	17,852	15,142	15,031	15,132	16,970	16,992	18,168	16,984	17,005	17,693
Total	**73,578**	**65,577**	**65,103**	**62,714**	**64,106**	**68,470**	**73,237**	**73,332**	**74,485**	**76,036**

Table A1-2: Historic Gas Networks Ireland peak day gas demands (actual)[54]

GWh/d	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
ROI	244.1	211.7	213.2	187.0	203.8	199.4	221.8	215.9	218.5	225.4
NI & IOM	79.3	74.1	62.7	68.2	72.8	69.9	70.1	63.1	75.9	70.6
Total	**323.4**	**285.8**	**275.9**	**255.2**	**276.6**	**269.2**	**291.9**	**279.0**	**294.4**	**295.9**

Table A1-3: Historic ROI annual gas demands (actual)[54]

GWh/yr	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
Power[55]	35,365	29,864	28,156	26,910	24,708	29,061	32,181	31,936	33,050	33,772
I/C	12,021	13,244	13,700	13,682	15,013	15,581	15,835	16,485	17,149	16,879
Residential	8,340	7,326	8,216	6,991	7,414	6,835	7,054	7,927	7,282	7,693
Total	**55,726**	**50,435**	**50,072**	**47,582**	**47,136**	**51,478**	**55,070**	**56,348**	**57,481**	**58,344**

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

Appendix 1: Historic demand
(continued)

Table A1-4: Historic ROI peak day gas demands (actual)[54]

GWh/d	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
Power[55]	132.2	114.1	119.9	102.0	102.4	104.7	121.6	110.1	113.0	129.4
I/C	49.6	49.4	50.4	46.8	54.8	54.9	56.6	61.0	60.2	58.8
Residential	64.2	48.2	44.2	39.9	46.6	40.1	43.6	44.8	45.3	37.2
Total	**246.0**	**211.7**	**214.4**	**188.7**	**203.8**	**199.7**	**221.8**	**215.9**	**218.5**	**225.4**

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, as well as electricity demand and the penetration of renewables.

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 ROI daily demand of transmission connected sites

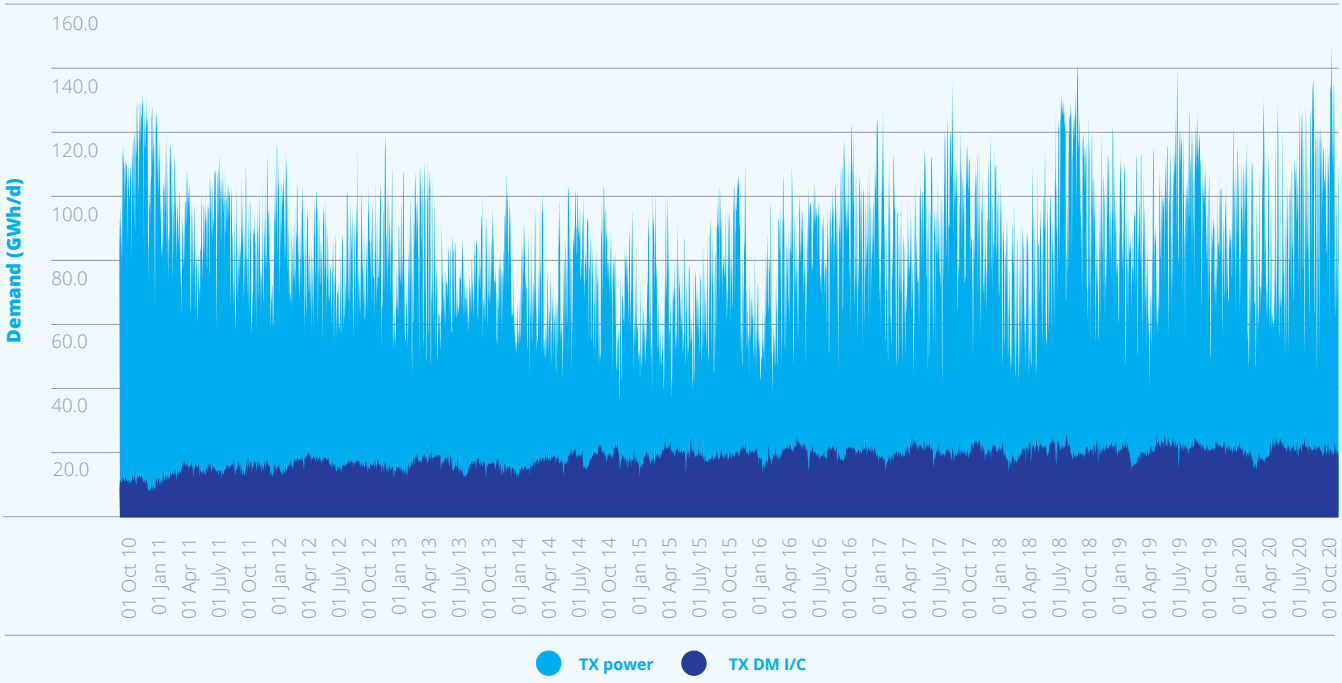


Figure A1-2: Historic ROI daily demand of distribution connected sites

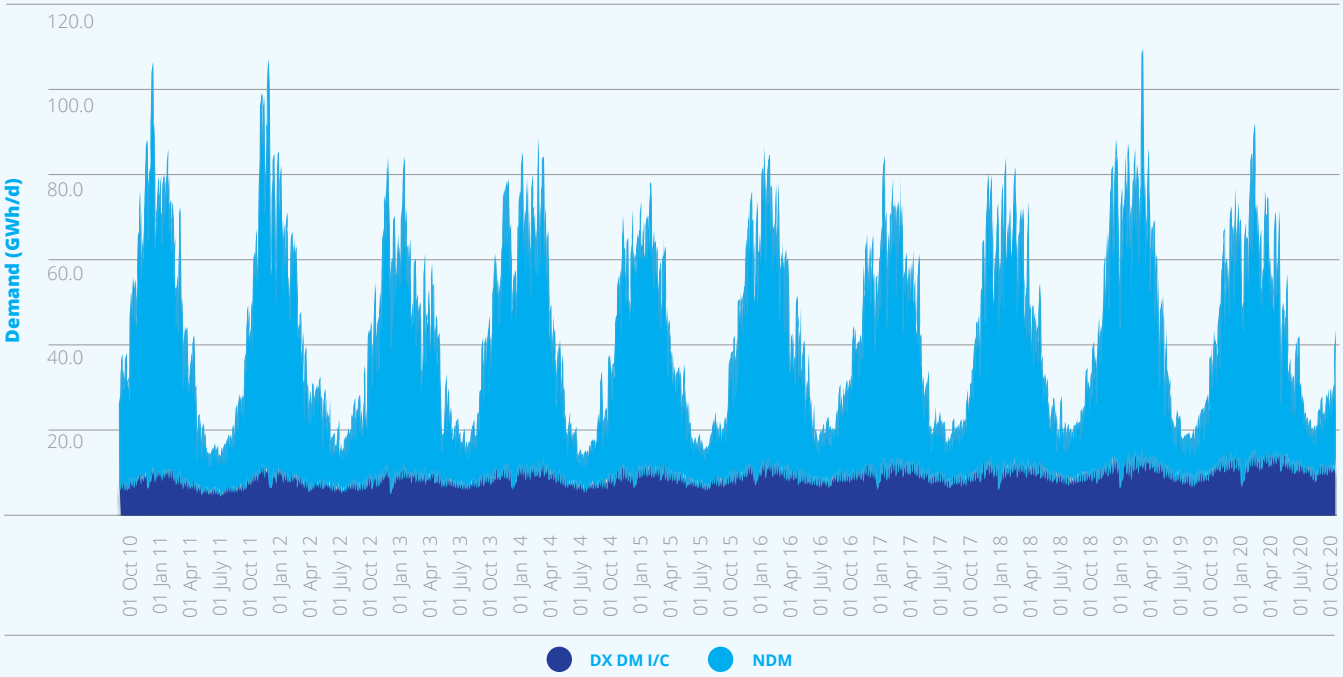


Table A1-5 and Table A1-6 present the historic annual and peak day gas supplies for the Gas Networks Ireland system.

Table A1-5: Historic annual supplies through Moffat, Inch and Corrib[56]

GWh/yr	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
Moffat[57]	72,320	64,103	64,148	62,549	63,132	45,731	35,494	39,060	46,544	54,216
Inch	3,765	3,952	4,014	3,339	3,724	3,674	3,872	3,696	2,784	1,571
Corrib	-	-	-	-	-	20,470	34,659	32,612	26,747	21,217
Total	**76,086**	**68,055**	**68,162**	**65,888**	**66,856**	**69,876**	**74,025**	**75,368**	**76,074**	**77,004**

Table A1-6: Historic peak day supplies through Moffat, Inch and Corrib[56]

GWh/d	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
Moffat[57]	303.9	255.7	251.2	232.7	248.3	189.5	172.9	171.4	213.2	233.9
Inch	33.7	32.0	26.7	26.4	28.0	19.6	16.8	11.2	9.7	5.7
Corrib	-	-	-	-	-	60.1	103.7	97.1	78.5	61.9
Total	**337.6**	**287.6**	**277.9**	**259.1**	**276.3**	**269.3**	**293.4**	**279.7**	**301.4**	**301.4**

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

56 Daily gas supply taken from Gas Transportation Management System (GTMS)
57 Table shows total Moffat supplies including ROI, NI and IOM

Appendix 1: Historic demand
(continued)

Table A1-7: Historic coincident peak day and annual ROI demands

GWh/d Peak day	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
TX power	132.2	114.1	119.9	102.0	102.4	104.7	123.8	106.1	113.0	129.4
TX DM I/C	12.0	17.7	17.8	16.1	18.8	21.1	20.0	21.7	20.3	23.1
DX DM I/C	12.3	11.9	12.2	12.6	13.3	13.5	13.6	14.0	15.5	15.5
DX NDM	89.5	68.0	64.6	57.9	69.4	60.4	61.2	68.4	69.7	57.4
Total ROI	**246.0**	**211.7**	**214.4**	**188.7**	**203.8**	**199.7**	**218.6**	**210.1**	**218.5**	**225.4**
Annual										
TX Power	35,365	29,864	28,156	26,910	24,708	29,061	32,181	31,936	33,050	33,772
TX DM I/C	4,978	6,147	6,088	6,439	7,085	7,455	7,562	7,642	7,888	7,659
DX DM I/C	3,020	3,235	3,419	3,432	3,593	3,776	3,842	4,038	4,494	4,570
DX NDM	12,363	11,188	12,409	10,802	11,749	11,184	11,485	12,733	12,049	12,343
Total ROI	**55,726**	**50,435**	**50,072**	**47,582**	**47,136**	**51,478**	**55,070**	**56,348**	**57,481**	**58,344**

Table A1-8: Historic non-coincident peak ROI demand by sector

GWh/d Peak day	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
TX power	133.0	117.4	119.9	108.7	103.2	123.2	127.3	142.2	141.5	148.4
TX DM I/C	18.4	20.4	22.9	23.1	25.1	25.4	26.3	26.4	26.0	25.2
DX DM I/C	12.3	12.7	13.7	12.8	13.8	14.1	14.0	15.8	15.9	18.7
DX NDM	94.9	73.0	75.5	65.8	73.5	71.5	71.0	97.2	76.4	74.8
Total ROI	**258.5**	**223.5**	**231.9**	**210.4**	**215.6**	**234.1**	**238.6**	**281.7**	**259.8**	**267.1**
Power	133.0	117.4	119.9	108.7	103.2	123.2	127.3	142.2	141.5	148.4
I/C	57.5	53.7	59.1	56.5	62.7	63.4	64.3	74.4	68.6	69.2
Residential	68.0	52.4	52.9	45.2	49.7	47.6	47.0	65.0	49.6	49.5
Total ROI	**258.5**	**223.5**	**231.9**	**210.4**	**215.6**	**234.1**	**238.6**	**281.7**	**259.8**	**267.1**

Appendix 2: Demand forecasts

Assumptions

As outlined in Section 6 assumptions are made regarding a number of key demand drivers. These are summarised in Table A2-1 and Table A2-2.

Table A2-1: Future GDP annual growth

GDP growth (%)	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Low	-8.08	-0.44	3.47	1.90	1.40	1.40	1.40	1.40	1.40	1.40
Best estimate	-5.63	1.03	4.02	3.36	3.20	3.20	3.20	3.20	3.20	3.20
High	-4.88	1.28	4.02	3.36	3.20	3.20	3.20	3.20	3.20	3.20

Table A2-2: Residential new connections

	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Low	4553	1950	1193	883	748	788	878	900	900	900
Best estimate	5138	2880	1880	1255	1048	1013	928	900	900	900
High	5798	3610	3153	3025	2625	2050	1525	1400	1400	1400

Forecast

The demand forecasts are summarised in Tables A2-3 to A2-11. Table A2-12 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:

- Tables A2-3, A2-4 & A2-5: Peak-day gas demand under severe 1-in-50 weather conditions, i.e. weather so severe that it only occurs once every 50 years;
- Tables A2-6, A2-7 & A2-8: Peak-day gas demand under 'average year' weather conditions, i.e. the weather conditions that typically occur each year; and
- Tables A2-9, A2-10 & A2-11: 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 in the Northern Ireland Gas Capacity Statement. The IOM peak-day is based on information provided by the Manx Electricity Authority (MEA).

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.

The power generation 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.

Appendix 2: Demand forecasts
(continued)

Table A2-3: 1-in-50 peak day demand – low demand scenario

GWh/d	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Power	148.1	152.6	158.2	159.1	164.8	173.5	183.5	183.4	180.8	181.6
I/C	63.5	63.0	63.7	63.9	63.3	63.1	62.5	62.2	61.4	61.0
Residential	62.1	61.8	61.5	61.0	60.5	60.0	59.5	59.0	58.6	58.1
Transport	0.0	0.1	0.3	0.5	0.9	1.3	1.5	1.5	1.5	1.5
Own Use	5.6	5.9	6.2	6.3	6.6	6.9	7.1	7.1	7.1	7.1
Sub total	**279.2**	**283.4**	**289.8**	**290.9**	**296.1**	**304.8**	**314.1**	**313.1**	**309.3**	**309.2**
IOM	6.7	6.7	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
NI	97.6	101.5	103.4	105.7	107.7	109.1	111.5	112.2	112.8	113.2
Total	**383.6**	**391.6**	**400.0**	**403.4**	**410.7**	**420.8**	**432.4**	**432.2**	**428.9**	**429.3**

Table A2-4: 1-in-50 peak day demand – best estimate demand scenario

GWh/d	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Power	155.2	155.9	159.0	161.7	170.2	182.5	198.9	197.5	200.3	200.1
IC	64.6	65.2	67.2	68.4	69.5	70.5	71.5	72.4	73.3	74.2
Residential	61.6	61.4	61.1	60.7	60.3	59.9	59.4	59.0	58.6	58.1
Transport	0.0	0.1	0.3	0.5	0.9	1.3	1.7	2.0	2.2	2.3
Own Use	5.7	6.0	6.3	6.5	6.9	7.2	7.2	7.2	7.2	7.2
Sub total	**287.2**	**288.6**	**293.9**	**297.9**	**307.9**	**321.4**	**338.7**	**338.1**	**341.6**	**342.0**
IOM	6.7	6.7	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
NI	97.6	101.5	103.4	105.7	107.7	109.1	111.5	112.2	112.8	113.2
Total	**391.6**	**396.9**	**404.1**	**410.5**	**422.4**	**437.4**	**457.0**	**457.2**	**461.2**	**462.1**

Table A2-5: 1-in-50 peak day demand – high demand scenario

GWh/d	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Power	157.8	158.9	164.9	173.9	185.3	201.9	218.5	216.7	223.8	221.9
I/C	65.0	65.8	68.2	69.8	71.4	73.1	74.8	76.4	78.1	79.8
Residential	61.4	61.3	61.1	60.8	60.5	60.2	59.9	59.5	59.2	58.8
Transport	0.0	0.1	0.4	0.9	1.6	2.3	3.3	4.2	5.2	6.0
Own Use	5.8	6.1	6.4	6.9	7.2	7.2	7.3	7.3	7.3	7.3
Sub total	**290.0**	**292.2**	**301.0**	**312.2**	**326.1**	**344.8**	**363.7**	**364.2**	**373.6**	**373.9**
IOM	6.7	6.7	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
NI	97.6	101.5	103.4	105.7	107.7	109.1	111.5	112.2	112.8	113.2
Total	**394.4**	**400.4**	**411.2**	**424.8**	**440.6**	**460.9**	**482.1**	**483.3**	**493.3**	**494.0**

Table A2-6: Average year peak day demand – low demand scenario

GWh/d	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Power	136.4	143.0	143.7	144.7	147.0	152.3	155.3	156.9	156.8	156.5
I/C	56.3	56.0	56.7	56.9	56.5	56.4	55.8	55.7	55.0	54.8
Residential	50.8	50.6	50.2	49.9	49.5	49.1	48.7	48.3	47.9	47.5
Transport	0.0	0.1	0.3	0.5	0.9	1.3	1.5	1.5	1.5	1.5
Own Use	4.0	4.2	4.3	4.4	4.5	4.7	4.8	4.8	4.8	4.9
Sub total	**247.4**	**253.9**	**255.2**	**256.4**	**258.4**	**263.7**	**266.0**	**267.1**	**266.0**	**265.1**
IOM	5.8	5.1	5.3	4.9	5.3	5.3	5.3	5.3	4.9	5.3
NI	80.6	83.8	85.3	87.6	89.0	84.2	86.5	88.0	89.1	90.2
Total	**333.8**	**342.8**	**345.9**	**348.9**	**352.7**	**353.1**	**357.8**	**360.4**	**360.0**	**360.7**

Table A2-7: Average year peak day demand – best estimate demand scenario

GWh/d	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Power	143.6	146.0	146.3	152.3	153.7	159.4	186.1	186.5	187.5	188.6
I/C	57.4	57.9	59.8	60.9	61.9	62.8	63.7	64.6	65.5	66.4
Residential	50.4	50.2	50.0	49.6	49.3	49.0	48.6	48.2	47.9	47.5
Transport	0.0	0.1	0.3	0.5	0.9	1.3	1.7	2.0	2.2	2.3
Own Use	4.1	4.3	4.5	4.7	4.8	4.9	5.4	5.5	5.5	5.6
Sub total	**255.4**	**258.5**	**260.8**	**268.0**	**270.6**	**277.5**	**305.6**	**306.9**	**308.6**	**310.4**
IOM	5.8	5.1	5.3	4.9	5.3	5.3	5.3	5.3	4.9	5.3
NI	80.6	83.8	85.3	87.6	89.0	84.2	86.5	88.0	89.1	90.2
Total	**341.8**	**347.4**	**351.4**	**360.4**	**364.9**	**367.0**	**397.4**	**400.2**	**402.6**	**406.0**

Table A2-8: Average year peak day demand – high demand scenario

GWh/d	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Power	143.8	147.8	150.4	160.4	162.9	175.8	204.3	208.1	210.9	211.5
I/C	57.7	58.5	60.6	62.1	63.5	65.0	66.5	68.0	69.5	71.0
Residential	50.2	50.1	49.9	49.7	49.5	49.2	49.0	48.7	48.4	48.1
Transport	0.0	0.1	0.4	0.9	1.6	2.3	3.3	4.2	5.2	6.0
Own Use	4.1	4.3	4.5	4.8	5.0	5.3	5.8	5.9	5.9	5.9
Sub total	**255.9**	**260.9**	**265.9**	**277.9**	**282.5**	**297.7**	**328.9**	**335.0**	**339.9**	**342.6**
IOM	5.8	5.1	5.3	4.9	5.3	5.3	5.3	5.3	4.9	5.3
NI	80.6	83.8	85.3	87.6	89.0	84.2	86.5	88.0	89.1	90.2
Total	**342.2**	**349.8**	**356.6**	**370.4**	**376.8**	**387.1**	**420.7**	**428.3**	**433.9**	**438.2**

Appendix 2: Demand forecasts
(continued)

Table A2-9: Annual demand – low demand scenario

TWh/yr	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Power	32.0	32.4	32.5	32.7	32.9	32.9	34.8	34.9	35.1	35.2
I/C	16.3	16.3	16.5	16.7	16.6	16.7	16.6	16.7	16.6	16.6
Residential	7.9	7.9	7.8	7.8	7.7	7.6	7.6	7.5	7.4	7.4
Transport	0.0	0.0	0.1	0.2	0.3	0.5	0.5	0.5	0.5	0.5
Own Use	0.8	0.8	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0
Sub total	**56.9**	**57.4**	**57.8**	**58.2**	**58.5**	**58.7**	**60.6**	**60.6**	**60.7**	**60.8**
IOM	1.6	1.4	1.5	1.3	1.5	1.5	1.5	1.5	1.3	1.4
NI	16.8	16.5	17.2	17.8	18.1	16.5	17.0	17.2	17.3	17.5
Total	**75.3**	**75.3**	**76.5**	**77.3**	**78.0**	**76.6**	**79.0**	**79.2**	**79.4**	**79.7**

Table A2-10: Annual demand – best estimate demand scenario

TWh/yr	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Power	32.5	33.6	33.8	34.7	35.2	36.5	41.5	42.2	41.8	41.9
I/C	16.6	16.9	17.4	17.7	18.1	18.4	18.7	19.0	19.3	19.7
Residential	7.9	7.9	7.8	7.8	7.7	7.7	7.6	7.6	7.5	7.5
Transport	0.0	0.0	0.1	0.2	0.3	0.5	0.6	0.7	0.8	0.8
Own Use	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.2	1.2	1.2
Sub total	**57.8**	**59.2**	**60.0**	**61.4**	**62.3**	**64.1**	**69.6**	**70.7**	**70.6**	**71.0**
IOM	1.6	1.4	1.5	1.3	1.5	1.5	1.5	1.5	1.3	1.4
NI	16.8	16.5	17.2	17.8	18.1	16.5	17.0	17.2	17.3	17.5
Total	**76.2**	**77.1**	**78.7**	**80.5**	**81.9**	**82.1**	**88.0**	**89.3**	**89.3**	**89.9**

Table A2-11: Annual demand – high demand scenario

TWh/yr	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Power	32.8	34.7	35.2	36.6	37.0	41.1	48.2	50.7	51.3	52.8
I/C	16.7	17.0	17.6	18.0	18.4	18.8	19.3	19.7	20.1	20.5
Residential	7.9	7.9	7.9	7.8	7.8	7.8	7.7	7.7	7.6	7.6
Transport	0.0	0.0	0.1	0.3	0.6	0.9	1.2	1.5	1.9	2.2
Own Use	0.8	0.9	0.9	1.0	1.0	1.1	1.3	1.3	1.4	1.4
Sub total	**58.3**	**60.5**	**61.7**	**63.8**	**64.8**	**69.6**	**77.6**	**81.0**	**82.3**	**84.5**
IOM	1.6	1.4	1.5	1.3	1.5	1.5	1.5	1.5	1.3	1.4
NI	16.8	16.5	17.2	17.8	18.1	16.5	17.0	17.2	17.3	17.5
Total	**76.6**	**78.4**	**80.4**	**82.9**	**84.4**	**87.6**	**96.1**	**99.6**	**100.9**	**103.4**

Table A2-12: Maximum daily supply volumes

GWh/d	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29
Corrib	65.0	60.5	53.6	47.5	42.1	37.1	33.3	29.4	26.1	23.0
Inch	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moffat	386.9	386.9	386.9	386.9	386.9	386.9	386.9	386.9	386.9	386.9

Appendix 3: Energy efficiency assumptions

National Energy Efficiency Action Plan 2017

The National Energy Efficiency Action Plan 2017 (NEEAP 4) sets out the Government's strategy for meeting the energy efficiency savings targets. In 2009, Ireland set a national target to improve its energy efficiency by 20% by 2020, meaning that energy savings of 31,925 GWh should be made. The fourth National Energy Efficiency Action Plan sets out progress towards that target and the measures to maximise progress to the target.

Table A3-1 outlines the NEEAP 4 energy efficiency targets over the period to 2020.

Table A3-1: National Energy Efficiency Action Plan 2017 (NEEAP 4) – energy savings

	2016 (achieved)	2020 (anticipated)
2002 Building regulations – dwellings	1,801	1,864
2008 Building regulations – dwellings	560	675
2011 Building regulations – dwellings	157	214
2019 (Proposed) building regulations – dwellings (NZEB)	0	8
2005/2008 Building regulations – other than dwellings	762	1,299
Greener Homes Scheme (GHS)	114	114
Energy efficient boiler regulation	320	480
Domestic lighting (eco-design directive)	170	268
Warmer Homes Scheme (WHS)	269	347
Warmth and wellbeing pilot	0	22
Deep retrofit pilot	0	18
Better energy communities	228	543
Better energy homes (formerly HES)	994	1,324
Major renovations (dwellings)	0	12
Public sector	1,784	2,303
Business	3,062	3,556

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 section 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[58] 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 day types were analysed for each supply scenario over a 10 year period to 2028/29;

- 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
Pressure (barg)	47.0[59]	30.0	Up to 85.0
Gross calorific value (MJ/scm)	39.8[60]	37.5	37.7
Max supply (mscm/day)	35	0.66[61]	6.21

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). This ANOP pressure has been used in the network modelling

58 NI transmission system is not included in the modelling. NI is treated as a demand at Twynholm, Scotland.
59 Anticipated Normal Off-take Pressure (ANOP).
60 Figure based on average historic values.
61 Up until July 2020, 0 mscm/day thereafter.

Glossary

AA	Appropriate Assessment
AD	Anaerobic Digester
AGI	Above Ground Installation
ANOP	Anticipated Normal Offtake Pressure
BETTA	British Electricity Trading and Transmission Arrangements
CAM	Capacity Allocation Mechanism
CAP	Climate Action Plan
CCGT	Combined cycle gas turbine
CCS	Carbon Capture & Storage
CCUS	Carbon Capture Utilisation& Storage
CEF	Connecting Europe Facility
CER	Commission for Energy Regulation
CGI	Central Gas Injection
CHP	Combined heat and power
CNG	Compressed Natural Gas
CO_2	Carbon dioxide
CRU	Commission for Regulation of Utilities
DD	Degree Day
DECC	Department of the Environment, Climate and Communications
DM	Daily Metered
DRI	District Regulating Installation
EC	European Commission
ENTSOG	European Network of Transmission System Operators for Gas
ENTSO-E	European Network of Transmission System Operators for Electricity
ESRI	The Economic & Social Research Institute
ESIPP	Energy Systems Integration Partnership Programme
ETS	European Emission Trading Scheme
EWIC	East West Interconnector
EU	European Union
GB	Great Britain
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GNI	Gas Networks Ireland
GRAZE	Green Renewable Agricultural & Zero Emissions
GTMS	Gas Transportation Management System
GWh	Gigawatt hour
GWhe	Gigawatt hour (electric energy)
GWh/d	Gigawatt hours per day
GWh/yr	Gigawatt hours per year
GWhe/yr	Gigawatt hours of electric energy per year
HGV	Heavy Goods Vehicle
HUGE	Hydrogen Utilisation Green Energy
I-SEM	Integrated Single Electricity Market Project
I/C	Industrial & Commercial
IC	Interconnector
IDA	Industrial Development Agency
IE	Ireland
IED	Industrial Emissions Directive
IMF	International Monetary Fund
IP	Interconnection Point
IOM	Isle of Man
ISCC	International Sustainability and Carbon Certification
KEL	Kinsale Energy Limited
KM	Kilometre
LDM	Large Daily Metered
LGV	Light Goods Vehicle
LNG	Liquefied Natural Gas
MEA	Manx Electricity Authority
MOP	Maximum operating pressure
Mscm/d	Million standard cubic metres per day
MW	Megawatt
MWh	Megawatt hour
NDM	Non-Daily Metered
NDP	Network Development Plan
NECP	National Energy & Climate Plan
NEEAP	National Energy Efficiency Action Plan
NGV	Natural Gas Vehicle
NI	Northern Ireland
NO_x	Nitrogen Dioxide
NTS	National Transmission System
NUIG	National University of Ireland Galway
OECD	The Organisation for Economic Co-operation and Development
PC4	Fourth Price Control
PCI	Projects of Common Interest
PMA	Pressure Maintenance Agreement
PSO	Public Service Obligation
RES	Renewable Energy Share
RGFI	Renewable Gas Forum Ireland
ROI	Republic of Ireland
SEA	Strategic Environmental Assessment
SEAI	Sustainable Energy Authority of Ireland
SEM	Single Electricity Market
SO_x	Sulphur Dioxide
TES	Tomorrow's Energy Scenarios
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
UK	United Kingdom
UCD	University College Dublin
UNFCCC	United Nations Framework Convention on Climate Change

Gas Networks Ireland