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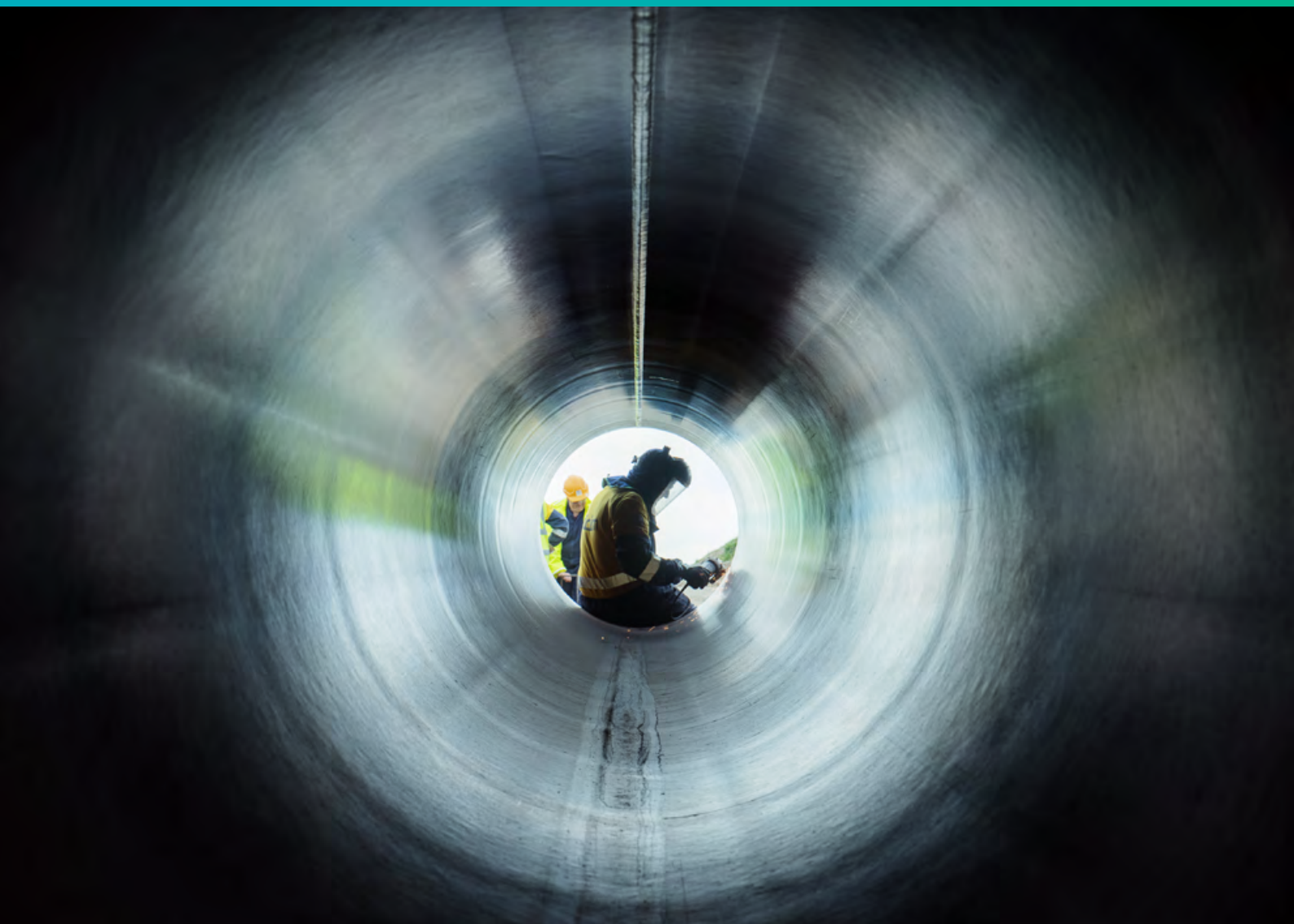
Gas Networks Ireland

Network Development Plan 2021



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 June 2021, 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.

Environmental Assessment
The NDP has been subject to Strategic Environmental Assessment (SEA) Screening to determine the requirement to carry out SEA on the same. In accordance with the EPA Report "Development of Strategic Environmental Assessment (SEA) Methodologies for Plans and Programmes in Ireland", the NDP was assessed using the 'pre screening' flowchart and criteria. This flowchart allows for rapid screening out of those plans and programmes that are not likely to have any environmental impact and screening in of those that definitely do require SEA.

Following this assessment, it was concluded that the NDP does not fall within the requirements of the SEA Directive in that:

- The NDP is subject to preparation and adoption by a National Authority;
- The NDP is required by legislative, regulatory or administrative provisions;
- The sole purpose of the NDP is not to serve national defence or civil emergency nor is it a financial/budget Plan or co financed by the current Structural Funds/ Regional Development Funds Programme;
- The NDP is prepared for the energy sector; and
- NDP does not provide a framework for development consent for projects listed in the EIA Directive.

In accordance with the EPA methodology, the NDP was therefore not taken forward to 'Task 1.2' SEA Screening.

No requirement for SEA is therefore identified as a result of this SEA Screening assessment.

GNI have made an SEA Determination that the NDP 2021 will not give rise to likely significant environmental affects and does not require SEA.

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Foreword

Welcome to the 2021 ten-year Network Development Plan (NDP) published by Gas Networks Ireland.

This document provides a view of how the gas network may develop over the coming ten-year period. It is based on current supply and demand for gas, as well as on 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[1], and the Interim Climate Actions 2021[2]. Gas Networks Ireland continues 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 has implemented the recommendations and guidelines from the HSE and Irish Government to minimise the spread of the COVID-19 virus, and frequently updates relevant Government Departments on our activities. The COVID-19 pandemic has had a notable impact on gas demand in the Industrial and Commercial sector, with trends following the implementation, and later easing, of economic and societal restrictions. Gas demand in the Power Generation and Residential sectors has not been directly impacted. The potential withdrawal in Ireland of COVID-19 related economic restrictions is incorporated into our gas demand projections. The short-term economic outlook is more positive relative to that assumed in NDP 2020, and this is reflected in the forecasts. However, given the ongoing and dynamic nature of the pandemic and associated restrictions, certain modelling assumptions may evolve and be replaced relatively quickly – in this event, assumptions will be further calibrated in next year's NDP as necessary. Throughout 2020 and 2021, gas supplies have been available to customers at all times; this is testament to the underlying resilience of the gas network and the long-term investment strategies delivered and underpinned by the NDP.

Throughout 2020 and 2021, gas supplies have been available to customers at all times; this is testament to the underlying resilience of the gas network and the long-term investment strategies delivered and underpinned by the NDP.

Over the ten-year forecast horizon considered in this document, gas demand in Ireland is anticipated to increase, with growth of 15% 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

1 National Energy and Climate Plan 2021-2030 https://assets.gov.ie/94442/f3e50986-9fde-4d34-aa35-319af3bfac0c.pdf
2 Government of Ireland, 2021, Interim Climate Actions https://assets.gov.ie/127955/298d5c71-05d7-4ff9-b3f4-9da61bd17941.pdf

1. Foreword
(continued)

generators. Industrial and Commercial sector gas demand is also projected to grow, as is that of the Transport sector. The Residential sector is the only sector showing negative growth over the ten years, this trend reflects the current policy positions that are built into the modelling assumptions. The growth projection accounts for ambitious build-out targets for onshore and offshore wind generation over the forecast horizon. Should the associated projects not be delivered within the timeframe assumed, there would be a resulting increase in annual gas demand, relative to the growth figure outlined above. This is an important consideration given the challenging nature of the build-out targets assumed for wind generation.

Given the scope for growth, the current technical supply capacity at the Moffat Entry Point is projected to be exceeded in the latter seven years of the forecast horizon. Capacity on the interconnector pipelines is more than adequate to meet all gas demand projections over the ten-year horizon, the potential constraint would arise at the associated compressor station installations. Gas Networks Ireland have commenced analysis of potential long-term solutions to the Moffat constraint. In the short to medium-term, operational measures have been identified which will be sufficient to mitigate the constraint for the duration of the forecast horizon considered in the NDP.

Natural gas is the most important fuel in assisting Ireland's transition to a low carbon economy, as its flexibility means it is the optimal complementary energy source to intermittent renewable energy sources such as wind and solar. Natural gas continues in its key role in Ireland's energy system, providing approximately 32% of the country's primary energy needs[3]. Approximately 710,000 households and businesses in Ireland rely on natural gas for a secure and competitive source of heating. In 2020, 51% of Ireland's electricity was powered by natural gas[4].

Gas Networks Ireland welcomes the strength, ambition, urgency and clear governance set out in the Climate Action and Low Carbon Development (Amendment) Act 2021, the Programme for Government and the Interim Climate Actions 2021. Ireland has committed to and legislated for net-zero emissions by 2050 and utilising the national gas network is vital to achieving this target. Gas Networks Ireland is committed to proactively supporting this ambition through the delivery of a net-zero carbon gas network by 2050. By gradually replacing natural gas with renewable gases, such as biomethane and hydrogen, Gas Networks Ireland can deliver a net-zero carbon gas network and reduce emissions across a number of key sectors, including those that are traditionally difficult to decarbonise, such as Transport, Agriculture, Industry, Heating and Power Generation.

Renewable gas will provide an indigenous and sustainable energy source, contributing significantly to the reduction of emissions from Irish agriculture, through capture of methane and waste emissions. The introduction of renewable gas onto the Irish gas network for the first time in 2019 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. Gas Networks Ireland now facilitates direct grid injection projects through a connection policy framework and is also supporting remote cluster developments with the development of 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 into a long-term competitive fuel. Gas Networks Ireland also recognises that the renewable gas industry needs to take steps to deliver long-term competitiveness and that this will require a coordinated approach across all stakeholders.

Ireland is facing a significant emissions challenge in the Transport sector which requires immediate action. Utilising Compressed Natural Gas (CNG) with renewable gas to power Heavy Goods Vehicles (HGVs), offers a real solution to decarbonising the HGV fleet. To deliver this, Gas Networks Ireland is developing a network of CNG re-fuelling stations for public and private network operators. This helps to establish the network of CNG refuelling facilities required by EU and National policy along Ireland's TEN-T Core Road Network, thus facilitating a transition

3 Based on SEAI Energy in Ireland 2020 - https://www.seai.ie/publications/Energy-in-Ireland-2020.pdf
4 System and Renewable Data Summary Report – EirGrid

Renewable gas will provide an indigenous and sustainable energy source, contributing significantly to the reduction of emissions from Irish agriculture, through capture of methane and waste emissions.

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 fuel with a similar operational performance to diesel. Public access stations have been constructed at Circle K Service Stations in Dublin Port, Cashel (on the M8 motorway), Clonshaugh in Dublin and Ballysimon Road in Limerick. 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 eight publicly accessible sites are contracted with forecourt operators, with project plans in place to deliver these stations over the next two years.

Gas Networks Ireland has commenced a range of work packages to ensure the gas network will be ready to support the transport of hydrogen when it arrives in blends and at scale. This work includes completion of a Hydrogen Innovation Centre at Brownsbarn, Co. Dublin, and development of a detailed hydrogen technical strategy which will ultimately provide a road map for the business to transition to hydrogen and to become an informed hydrogen transporter.

Gas Networks Ireland welcomed the European Commission's 'Green Deal' in 2020, in particular the ambition for a net-zero emissions EU economy by 2050. As a key next step in delivering on the Green Deal, the European Commission's 'Fit for 55 Package', delivered on 14th July 2021, put forward legislative proposals to ensure the EU reaches its updated 55% emissions reduction target for 2030 (compared to 1990 levels). Further legislative proposals around reducing methane emissions are anticipated. Gas Networks Ireland will continue to monitor these developments, in addition to the review of the EU gas legislative framework underway and will proactively engage with EU and national stakeholders in the context of considerations and implications for the Irish gas market.

Following Brexit, as anticipated, there has been no negative impacts on gas flows through the interconnectors and the focus now moves to monitoring any future market changes which may result in divergence between Great Britain (GB) and the European Union (EU). 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

2

Executive summary

The Network Development Plan (NDP) provides a view of how the gas network may develop over the coming 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.

By gradually replacing natural gas with renewable gases, such as biomethane and hydrogen, Gas Networks Ireland can deliver a net-zero carbon gas network and reduce emissions across a number of key sectors, including those that are traditionally difficult to decarbonise, such as Transport, Agriculture, Industry, Heating and Power Generation.

The assessment horizon covered in this report covers the ten-year period from 2020/21 to 2029/30 inclusive. The input data and assumptions used for modelling gas supply and demand scenarios over the ten-year period were finalised in June 2021, in line with the modelling 'Data Freeze' date. Further to this modelling Data Freeze, production of the report extended to August 2021, 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 31st August 2021, have been included in this report.

The COVID-19 pandemic continues to have an impact on gas demand, particularly in the Industrial and Commercial sector, where a reduction and subsequent recovery of gas demand has been seen to correlate with implementation and subsequent easing of the associated economic and societal restrictions. 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'. The anticipated negative economic impact of the COVID-19 pandemic and associated restrictions, as assumed in last year's NDP demand projections (and based on best available assumptions at the time) did not materialise, with GDP growing by 3.4% in 2020. Hence, the short-term economic outlook is more positive, relative to that assumed in NDP 2020, and this is reflected in the forecasts. However, given the fluid nature of the pandemic and the associated economic impact, the gas demand forecasting assumptions for NDP 2021 continue to carry a high degree of uncertainty. Next year's NDP (2022) 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.

The NDP Best Estimate scenario aligns to the existing policy measures in place at the time of the NDP modelling Data Freeze. While the key purpose of the NDP is to perform the ten-year gas network adequacy assessment, it is necessary to look beyond the ten-year adequacy assessment timeline to consider the role the gas network can play in decarbonising Ireland's energy system. Ireland has committed to and legislated for net-zero emissions by 2050 and utilising the national gas network is vital to achieving this. Gas Networks Ireland is committed to proactively supporting this ambition through the delivery of a net-zero carbon gas network by 2050. By gradually replacing natural gas with renewable gases, such as biomethane and hydrogen, Gas Networks Ireland can deliver a net-zero carbon gas network and reduce emissions across a number of key sectors, including those that are traditionally difficult to decarbonise, such as Transport, Agriculture, Industry, Heating and Power Generation. Gas Networks Ireland will continue to explore opportunities for greater energy system integration, building on the existing synergy which inherently exists between the gas and electricity transmission systems. An integrated energy system can help address some of the challenges that cannot be overcome through electrification alone.

2. Executive summary (continued)

Gas Networks Ireland has commenced a range of work packages to ensure the gas network is ready to transport hydrogen when it arrives in blends and at scale. This includes completion of a Hydrogen Innovation Centre at the Gas Networks Ireland Brownsbarn site in Co. Dublin with funding from the Gas Innovation Fund, and development of a detailed hydrogen technical strategy which will ultimately provide a road map for the business to transition to hydrogen and to become an informed hydrogen transporter.

In 2020 Gas Networks Ireland produced the 2020 Network Implementation Plan (NIP) 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 NIP sets out, in more detail, the manner in which projects identified in the NDP will be developed and the potential for cumulative effects on the environment that may arise from these projects. The NIP is publicly available on Gas Networks Ireland's website[5].

Annual Republic of Ireland (ROI) gas demands for 2020/21 are anticipated to be 1.6% lower than 2019/20 demands. This contrasts with increases of 1.5% in 2019/20 over 2018/19 and 2% in 2018/19 over 2017/18. It is notable that, in the context of the COVID-19 pandemic, gas demand in the Industrial and Commercial sector continued to track economic and societal restrictions, and removal of same. Industrial and Commercial gas demand experienced a 3.3% decrease in the first half of 2020/21, while a 4% increase is anticipated in the second half, when compared with the equivalent periods in 2019/20.

In the Power Generation sector, annual gas demand for 2020/21 is anticipated to show a decrease of 4% against 2019/20 levels. This decrease is predominantly related to enduring outages at several large gas-fired generators throughout the year which are due back online in late 2021.

Gas-fired power generation accounted for approximately 51% of Ireland's electricity generation in 2020, as the gas network continues to complement renewable generation. The partnership between flexible gas-fired power 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 National Energy and Climate Plan, and the Interim Climate Actions 2021.

In 2020, approximately 36% of Ireland's gas demand (ROI) was supplied from indigenous sources. The balance of supply, almost 64% 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 2020/21 to 2029/30, 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 European Network of Transmission System Operators for Gas (ENTSOG) / European Network of Transmission System Operators for Electricity (ENTSOE) Ten-Year Network Development Plan (TYNDP) Best Estimate and National Trends scenarios.

In the Best Estimate demand scenario, annual ROI gas demand is expected to grow by 15% between 2020/21 and 2029/30 with 4% growth forecast in the Low demand scenario and growth of 27% forecast in the High demand scenarios 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 electricity demand growth. It is notable that medium-term Best Estimate growth is projected at 28% over the first seven years of the horizon, where there is a more direct tracking of gas demand to electricity demand growth, ahead of projected build out of offshore wind generation. Towards the latter end of the horizon, a negative annual growth trend is observed.

5 Gas Networks Ireland Network Implementation Plan https://www.gasnetworks.ie/corporate/docs/network-implementation-plan-2020/GNI-NIP-2020.pdf

In the Best Estimate demand scenario, annual ROI gas demand is expected to grow by 15% between 2020/21 and 2029/30 with 4% growth forecast in the Low demand scenario and growth of 27% forecast in the High demand scenarios respectively over the same horizon.

This trend is linked to an ambitious build-out target assumed for offshore wind generation in Ireland. Assumptions for wind capacity development rates are based on the build-out profiles provided in the EirGrid / SONI All-Island Generation Capacity Statement (GCS) 2021 – 2030[6]. Should these challenging targets not be met as assumed in the NDP modelling, the result would be an increase in annual gas demand growth in all scenarios, relative to the growth projections presented above.

The development of peak day demands across the various scenarios follows similar trends as those in 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 (i.e. a severe winter peak day that is statistically likely to occur once every fifty years) peak day demand is predicted to grow by 18%, and by 20% for the average (i.e. a winter peak day that would occur in a typical winter) peak day in the Best Estimate demand scenario.

Given the scope for growth, the current technical supply capacity at the Moffat Entry Point is projected to be exceeded in the latter seven years of the forecast horizon. Capacity on the interconnector pipelines is more than adequate to meet all gas demand projections over the ten-year horizon; the potential constraint would arise at the associated compressor station installations. Gas Networks Ireland have commenced analysis of potential long-term solutions to the Moffat constraint. In the short to medium-term, operational measures have been identified which will be sufficient to mitigate the constraint for the duration of the forecast horizon considered in the NDP.

6 https://www.eirgridgroup.com/site-files/library/EirGrid/208281-All-Island-Generation-Capacity-Statement-LR13A.pdf

2. Executive summary
(continued)

National policy targets a 70% renewable energy share in electricity generation (RES-E), such as from wind and solar, by 2030. While annual gas demand in the medium to long-term will be inversely related to the delivered level of RES-E on the Single Electricity Market, peak day gas demand will not be impacted as gas-fired power generation will be required to meet almost all of Ireland's electricity requirements on days of low wind. While electricity interconnectors may operate in the net import direction on such days, equally they may operate as net exporters of electricity on such high demand / low wind days. This will depend on the wider electricity market dynamics, such as those experienced on the most recent winter peak day for gas demand in 2020/21, when the electricity interconnectors operated as net exporters to GB.

The Corrib gas field is expected to meet approximately 25% of annual Gas Networks Ireland system demands (33% of ROI demand) in 2020/21, with the Moffat Entry Point providing the remaining 75%.

There is 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 are located in close

The Corrib gas field is expected to meet approximately 25% of annual Gas Networks Ireland system demands (33% of ROI demand) in 2020/21, with the Moffat Entry Point providing the remaining 75%.

proximity to the gas network and could be readily connected to gas resulting in significant benefits from an environmental perspective; natural gas emits 22% less CO_2 and negligible levels of nitrogen dioxide (NOx) and sulphur dioxide (SOx) in contrast to 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 as possible. 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. This would reduce CO_2 emissions while also preparing these homes for renewable gas as it becomes available in greater quantities on the network.

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 support. 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 which require 99.999% availability, flexible onsite generation capacity to complement flexible grid power connections, and back-up generation to cater for grid power outages. A connection to the gas network will offer data centres the potential to transition to a reliable and constant zero-carbon energy source in the longer-term, as the integration of renewable gases such as biomethane and hydrogen increases on the network. Gas Networks Ireland expects the penetration of gas connections in this sector to increase in the coming years.

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 Core Road Network. The initial phase of the network rollout is conducted through the Causeway Study which has begun to deliver this essential infrastructure. Public access stations have been constructed at Circle K Service Stations in Dublin Port, Cashel (on the M8 motorway), Clonshaugh in Dublin and Ballysimon Road in Limerick. 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 eight publicly accessible sites are contracted with forecourt operators, with project plans in place to deliver these stations over the next two years. By the end of the current NDP period (2029/30), Gas Networks Ireland is expecting to see annual CNG demand of circa 600 GWh/yr, equivalent to meeting the annual fuel requirement of approximately 1,200 HGVs. Utilising Compressed Natural Gas (CNG) with renewable gas, to power HGVs, offers a real solution to decarbonising the HGV fleet.

Gas Networks Ireland commissioned the first renewable gas grid injection facility in 2019, 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 the development of 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 an appropriate support mechanism, 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 1.6 TWh/yr of renewable gas in the supply mix by the end of the current NDP period (2029/30), but further scope remains for renewable gas production beyond the NECP indicative target.

2. Executive summary
(continued)

Following Brexit, as anticipated there has been no negative impacts on gas flows through the interconnectors and the focus now moves to monitoring any future market changes which may result in divergence between GB and the EU.

The EU Green Deal (published in December 2019) presented a high-level roadmap of key policies and measures to guide energy and decarbonisation policy. It has resulted in more ambitious targets and increased pressure to decarbonise, at both EU and national levels. As a key next step in delivering on the Green Deal, the European Commission's 'Fit for 55 Package', delivered on 14th July 2021, put forward legislative proposals to ensure the EU reaches its updated 55% emissions reduction target for 2030 (compared to 1990 levels). This series of 13 cross-cutting legislative proposals includes eight revisions of existing legislation and five brand new proposals. The proposed amendments most relevant to Gas Networks Ireland relate to the EU Emissions Trading System (ETS), Renewable Energy Directive, Energy Efficiency Directive, and Alternative Fuels Infrastructure Directive. Further legislative proposals around reducing methane emissions are anticipated. 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. As part of PC4, the Commission for Regulation of Utilities (CRU) has given a capital allowance of €554m for investment in the distribution and transmission networks. Gas Networks Ireland is currently preparing a business plan for the next price control period (PC5) which will be submitted to the CRU in 2021.

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 2020, three such projects were completed including one Above Ground Installation (AGI) capacity upgrade and two reinforcements of the Distribution Network. 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 its capacity. 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 NIP.

Gas Networks Ireland will continue to ensure that a resilient, robust and safe gas network is maintained for customers through appropriate and efficient investment. Following Brexit, as anticipated there has been no negative impacts on gas flows through the interconnectors and the focus now moves to monitoring any future market changes which may result in divergence between GB and the EU.


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3

Introduction

Key messages:

The gas network currently consists of 2,477 km of high-pressure steel transmission pipelines and 12,140 km of lower pressure polyethylene distribution pipelines.

Natural gas is available in 21 counties and there are over 710,000 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 CRU in accordance with Article 22 of EU Directive 2009/73/EC and Article 11 of the EC[7] (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 TSO and Distribution System Operator (DSO) 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 and 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 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.

7 European Commission

3 Introduction
(continued)

In 2020 Gas Networks Ireland produced the 2020 NIP 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 NIP sets out in more detail 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. The NIP is publicly available on Gas Networks Ireland's website[8].

3.3 Overview of the Gas Networks Ireland system

Gas Networks Ireland builds, develops and operates Ireland's world-class gas infrastructure, maintaining over 14,617 km of gas pipelines and two sub-sea interconnectors.

The Gas Networks Ireland transmission network includes onshore Scotland, the interconnectors and the onshore ROI network. The interconnector sub-system is comprised of two subsea interconnectors between ROI and Scotland; and two compressor stations in Scotland at Beattock and Brighouse Bay. The interconnector system connects to GB's 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 12,140 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.

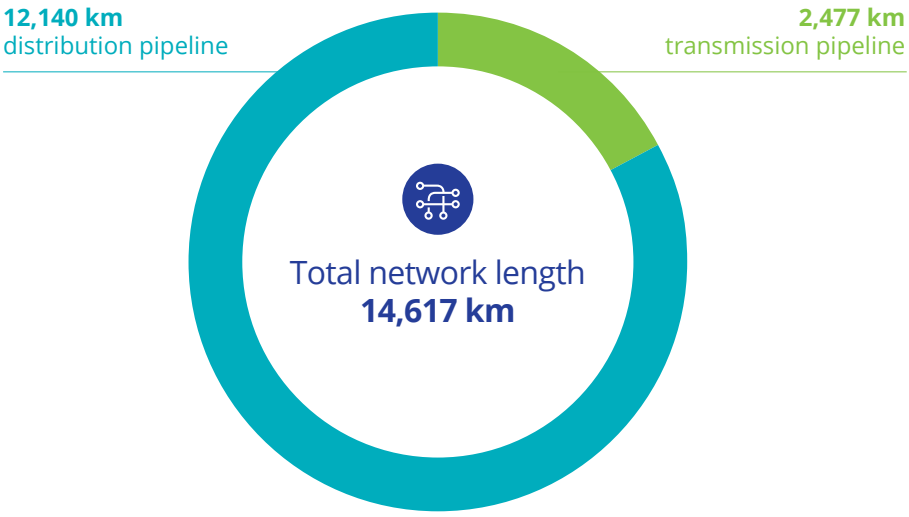
The gas infrastructure is differentiated by the following pressure regimes:

- 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 2010 and December 2010 when 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 over 710,000 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



8 Gas Networks Ireland Network Implementation Plan https://www.gasnetworks.ie/corporate/docs/network-implementation-plan-2020/GNI-NIP-2020.pdf

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

4 The role of the gas network in decarbonising Ireland's energy system

Key messages:

Gas Networks Ireland welcomes the strength, urgency, ambition and the clear associated governance set out in the Climate Action and Low Carbon Development (Amendment) Act 2021, the Programme for Government and the Interim Climate Actions 2021.

Ireland has committed to and legislated for net-zero emissions by 2050 and utilising the national gas network is vital to achieving this. Gas Networks Ireland is committed to proactively supporting this ambition through the delivery of a net-zero carbon gas network.

By gradually replacing natural gas with renewable gases, such as biomethane and hydrogen, Gas Networks Ireland can deliver a net-zero carbon gas network and reduce emissions across a number of key sectors, including those that are traditionally difficult to decarbonise, such as Transport, Agriculture, Industry, Heating and Power Generation.

The continued rollout-out of Renewable Gas and CNG technologies will deliver immediate emissions reductions.

Gas Networks Ireland will continue to explore opportunities for greater energy system integration, building on the existing synergy which inherently exists between the gas and electricity transmission systems. An integrated energy system can help address some of the challenges that cannot be overcome through electrification alone.

Gas Networks Ireland has commenced a range of work packages to ensure the gas network will be ready to support the transport of hydrogen when it arrives in blends and at scale.

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 ten-year 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 the 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 (CAP) 2019[9], the Interim Climate Actions[10] (March 2021), and the National Energy and Climate Plan (NECP)[11] for 2021 – 2030.

Further to the above energy policy publications, Ireland's Programme for Government (PfG)[12] 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 recently signed Climate Action and Low Carbon Development (Amendment) Bill 2021 also sets a commitment to net-zero emissions by 2050. These are significantly higher targets than set out in the CAP 2019 and NECP respectively and are set to shape the Irish energy landscape into the coming decades.

Gas Networks Ireland continues to monitor ongoing energy policy development and will incorporate all further policy measures and ambitions into the NDP Best Estimate scenario as these measures and ambitions become known. In this section, we look beyond the ten-year network adequacy assessment timeline, to consider the role the gas network will play in decarbonising Ireland's energy system.

Gas Networks Ireland continues to monitor ongoing energy policy development and will incorporate all further policy measures and ambitions into the NDP Best Estimate scenario as these measures and ambitions become known.

9 Government of Ireland, 2019, Climate Action Plan, https://assets.gov.ie/25419/c97cdecddf8c49ab976e773d4e11e515.pdf
10 Government of Ireland, 2021, Interim Climate Actions https://assets.gov.ie/127955/298d5c71-05d7-4ff9-b3f4-9da61bd17941.pdf
11 National Energy and Climate Plan 2021-2030 https://assets.gov.ie/94442/f3e50986-9fde-4d34-aa35-319af3bfac0c.pdf
12 Programme for Government https://assets.gov.ie/130911/fe93e24e-dfe0-40ff-9934-def2b44b7b52.pdf

4. The role of the gas network in decarbonising Ireland's energy system (continued)

4.1 Policy background

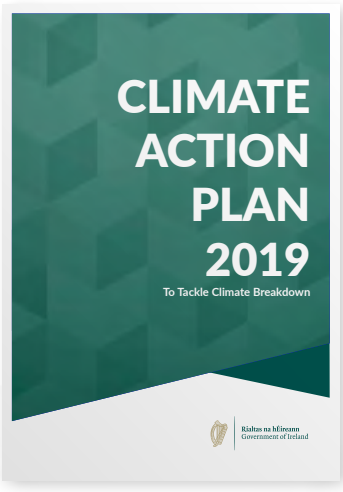
Climate change is one of the greatest and most urgent global challenges, affecting communities, human health and the environment. Significant growth in population and economic activity continues to increase the demands on energy. Policy developments at National and European level continue to evolve at pace, and Ireland is now committed to achieving net-zero emissions of greenhouse gases by 2050 at the latest. Relevant National and European policy developments are summarised in Figure 4.1.

Figure 4-1: National and European energy policy developments

National Policy Developments	European Policy Developments
Climate Action and Low Carbon Development Act (July 2021)	EU Green Deal (December 2019)
Climate Action Plan 2019 (June 2019)	EU Hydrogen Strategy (July 2020)
Programme for Government (June 2020)	EU Energy System Integration Strategy (July 2020)
National Energy and Climate Plan 2021 – 2030 (August 2020)	EU Gas Legislative Review (Ongoing for delivery end of 2021)
Interim Climate Actions 2021 (March 2021)	
Climate Action Plan 2021 (anticipated Q3 2021)	

Climate Action Plan

In 2019, the Irish Government published their first Climate Action Plan (CAP), with the aim of tackling climate change by setting out sectoral targets, actions and timelines. The plan contained over 180 actions focused on setting out a pathway to 2030, consistent with achieving a net-zero target by 2050. The CAP also set out clear governance arrangements which will significantly enhance accountability and purpose in implementing the proposals. Gas Networks Ireland welcomes the strength and urgency of the ambition and the associated governance set out in the CAP.



In March 2021, the Government published an Interim Climate Actions 2021 document which outlines the actions that are being worked on as the Government prepares the Climate Action Plan 2021. The Interim Climate Actions 2021 document contains an overarching action (Action 54) to decarbonise the natural gas grid.

Specific actions 54a, 54b and 54c relate to development of green hydrogen, and look at:

- assessing the potential for energy system integration between the electricity and gas networks including the production, storage and use of green hydrogen;
- developing a regulatory/policy roadmap for using the gas network to transport hydrogen;
- testing the feasibility of injecting green hydrogen blends into the gas network.

Specific actions 54d and 54e relate to further development of biomethane through:

- developing biomethane grid injection infrastructure;
- reviewing (in 2023) the indicative biomethane grid injection target for 2030.

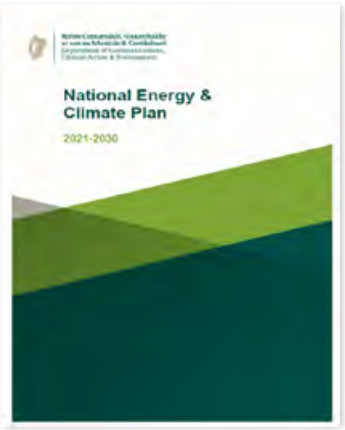
Further actions also relate to decarbonising the natural gas network.

- Action 55b calls for establishment of an official Renewable Gas certification scheme. In 2020, Gas Networks Ireland implemented a voluntary registration scheme for renewable gas. Draft secondary legislation is currently being progressed by the Department of the Environment, Climate and Communications (DECC) which will establish Gas Networks Ireland's registration scheme as the official certification scheme for Renewable Gas in the gas network.
- Action 57b proposes the introduction of a renewable energy obligation in the Heat Sector, with a consultation and decision required by Q4 2021. The purpose of this obligation would be to stimulate the demand for renewable energy in the Heat sector.
- Action 229b offers to continue support for the delivery of the GRAZE (Green Renewable Agricultural Zero Emissions) Gas Project which would be the first industrial scale biomethane Central Grid Injection (CGI) facility in Ireland.

The Government issued a public consultation on the CAP 2021 in March 2021. The consultation closed on the 18th of May and the CAP 2021 is currently being finalised, with publication anticipated in Q3 2021.

Programme for government
In 2020, the Programme for Government (PfG) committed Ireland to an average 7% per annum reduction in overall greenhouse gas (GHG) emissions from 2021 to 2030, and to achieving net-zero emissions by 2050 at the latest. This 51% reduction by 2030 is more than double the 23% emission reductions targeted in the 2019 Climate Action Plan. This increase in emission reductions from 23% to 51% means that Ireland may now need to consider all initiatives and technologies that would reduce emissions on a no regrets basis.

Climate Action and Low Carbon Development Act 2021
On the 23rd of March 2021, the Climate Action and Low Carbon Development (Amendment) Bill 2021 was published which makes the Government legally accountable for Ireland's target of net-zero emissions by 2050. The Bill amends the Climate Action and Low Carbon Development Act 2015 to significantly strengthen the framework for governance of climate action by the State in order to realise Ireland's national, EU and international climate goals and obligations. The Bill places Ireland's commitment to achieve a climate neutral economy no later than 2050 (known as the 'national climate objective') on a statutory basis. In addition, the Bill strengthens public participation and provides that, for each of the relevant plans, strategies, and carbon budgets, DECC will consult with the public. In July 2021, the Bill was signed into law by the President of Ireland, as the Climate Action and Low Carbon Development (Amendment) Act 2021.



National Energy and Climate Plan 2021–2030
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. The NECP has proposed an indicative target for biomethane of 1.6 TWh by 2030, which will be reviewed in 2023 as part of the review process for the National Energy and Climate Plan, and as outlined above under Action 54e of the Interim Climate Actions 2021. 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 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.

4. The role of the gas network in decarbonising Ireland's energy system (continued)

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 decarbonising the Transport sector and particularly with regard to HGVs, which are difficult to decarbonise.

European policy developments
The EU Green Deal (published in December 2019) presented a high-level roadmap of key policies and measures to guide future European energy and decarbonisation policy. EU strategies on individual components of the Green Deal have been published, including the EU's Hydrogen Strategy and the Energy System Integration Strategy, and in July 2021, the European Commission adopted the 'Fit for 55 Package' – a set of legislative proposals to ensure the EU reaches its updated 55% emissions reduction target for 2030 (compared to 1990 levels). This package is seen as a key next step in delivering the Green Deal and in putting Europe on the path to becoming the world's first net-zero continent by 2050.

Further detail on European Policy Developments is included in Section 9.

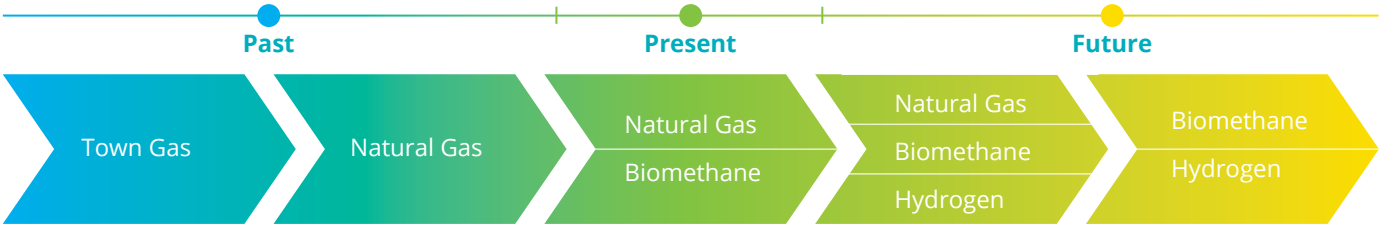
4.2 Decarbonising Ireland's gas network

Gas Networks Ireland is committed to decarbonising the gas network, to help Ireland achieve a net-zero emissions energy system by 2050. A decarbonised gas network can help reduce emissions, support the achievement of Ireland's climate ambitions and secure Ireland's energy security with least disruption. The gas network infrastructure is not inherently a fossil fuel network and it can be adapted to transport zero-carbon gases such as hydrogen, just as it has adapted to facilitating new and emerging energy carriers such as natural gas and biomethane in the recent past.

The gas network plays a critical role in Ireland's economy today, delivering approximately 32%[13] of the country's primary energy needs, serving homes, businesses and electricity generation. In the context of the wider energy system, gas is a critical component powering the production of 51%[14] of the country's annual electricity requirement in 2020. National policy is to achieve a 70% renewable energy share in electricity generation (RES-E), such as from wind and solar, by 2030. While Ireland has excellent renewable resources, renewable energy, by its very nature, is weather dependant and 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 systems is required. Natural gas and renewable gases provide the optimal complementary energy source for renewable energy such as wind and solar. It is well established[15] that 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[16]. It also produces negligible levels of nitrogen dioxide (NOx) and sulphur

Figure 4-2: Gas Infrastructure adapting to multiple Energy Carriers



13 Based on SEAI Energy in Ireland 2020 - https://www.seai.ie/publications/Energy-in-Ireland-2020.pdf
14 System and Renewable Data Summary Report – EirGrid
15 Refer to EirGrid All-Island Generation Capacity Statement 2021-2030; and the Electricity Association of Ireland in collaboration with the MaREI Centre in their report 'Our Zero e-Mission Future', February 2021
16 Government of Ireland, 2019, Climate Action Plan, https://assets.gov.ie/25419/c97cdecddf8c49ab976e773d4e11e515.pdf

A net-zero carbon gas network supports increased decarbonisation across Power Generation, Industry, Heating and Transport and can play a role in achieving negative emissions which experts agree are required to achieve net-zero.

dioxide (SOx) 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. Integration of Renewable Gas and CNG technologies have enabled the commencement of the decarbonisation journey for the gas network. This means Ireland can continue to benefit from the reliability of the gas network in a low carbon future.

Looking beyond 2030, the gas network can be fully decarbonised by utilising hydrogen. For this to happen, the gas and electricity networks will need to be further integrated. An integrated energy system can deliver clean energy and deliver Ireland to net-zero emissions by 2050 in line with the policy ambition set out at national and European level as summarised above in section 4.1. Should Natural Gas remain a long-term feature as a primary energy carrier, CCS could be utilised to abate up to 100% of carbon emissions.

A net-zero carbon gas network supports increased decarbonisation across Power Generation, Industry, Heating and Transport and can play a role in achieving negative emissions which experts agree are required to achieve net-zero. The guiding principles for transportation of renewable gases and for sector coupling are set out below, followed by a high-level overview of the key enabling technologies, as introduced in the preceding paragraphs.

4.2.1 Principles for transportation of renewable gases

In 2019, Gas Networks Ireland published "Vision 2050 - A Net Zero Carbon Gas Network for Ireland"[17]. The vision has continued to evolve through the development of a series of further scenarios, which consider the importance and impact of policy decisions on the scale of decarbonisation that can be achieved. Gas Networks Ireland's vision demonstrates how the gas network supports decarbonisation for domestic customers, industrial users, Transport, Agriculture and Power Generation.

As national and European energy policy has developed in the interim period, and continues to evolve, 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 likely that there will be multiple pathways to decarbonising the gas network and the wider energy system. Therefore, a broader framework is considered: a set of principles for the transportation of renewable gases (and thereby decarbonisation of the gas network). Figure 4.3 shows how renewable gases could be transported within the gas network through a variety of emerging pathways.

17 https://www.gasnetworks.ie/vision-2050/future-of-gas/GNI_Vision_2050_Report_Final.pdf

4. The role of the gas network in decarbonising Ireland's energy system (continued)

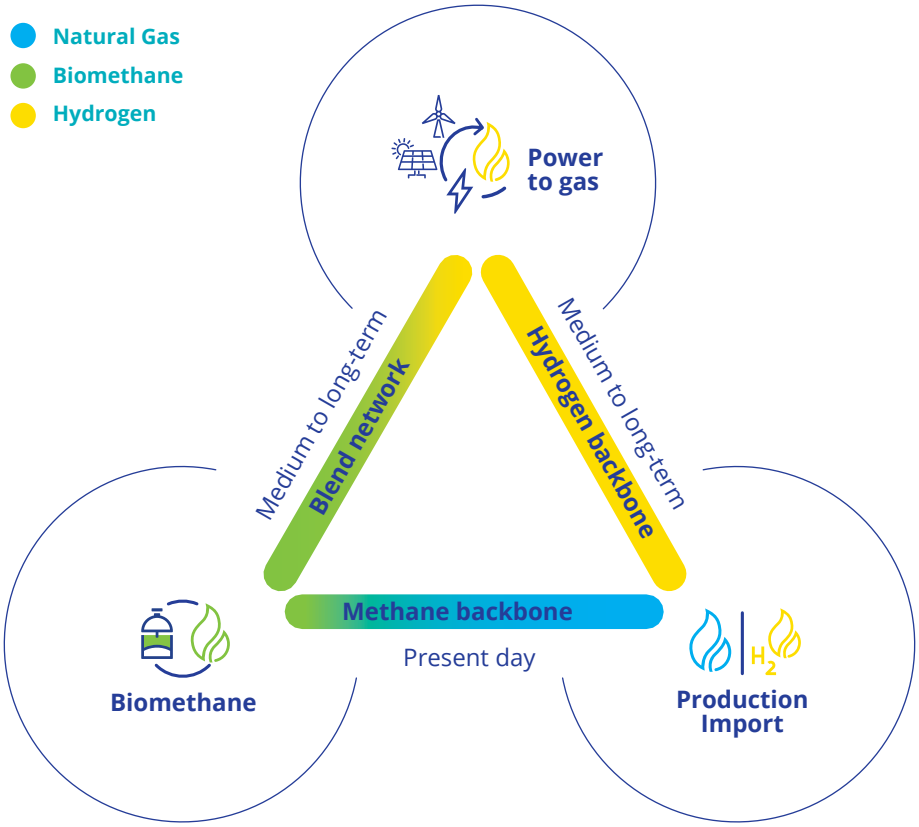
The European Commission's 'Strategy for Energy System Integration' envisages an integrated energy system which delivers decarbonisation "at the least cost across sectors while promoting growth and technological innovation".

The natural gas network as it exists today consists of a Methane Backbone, with small volumes of biomethane blended. In the short to medium-term, the level of biomethane blending will increase substantially. In the medium to long-term, blending of natural gas and biomethane with hydrogen will enable initial volumes of hydrogen to be utilised – contributing to a gradual decarbonisation of the gas mix. In the long-term, a dedicated Hydrogen Backbone may be developed, through the re-purposing of existing pipelines and/or construction of new pipelines.

The manner in which the gas network is decarbonised over time will depend on policy decisions and the available technical solutions.

In addition to delivering a decarbonised gas network, the above components will serve to further enhance Ireland's Security of Supply position, through the introduction of an additional energy supply carrier (hydrogen) to Ireland's energy mix, and by enabling the bulk transport of indigenously produced renewable gases (biomethane and hydrogen).

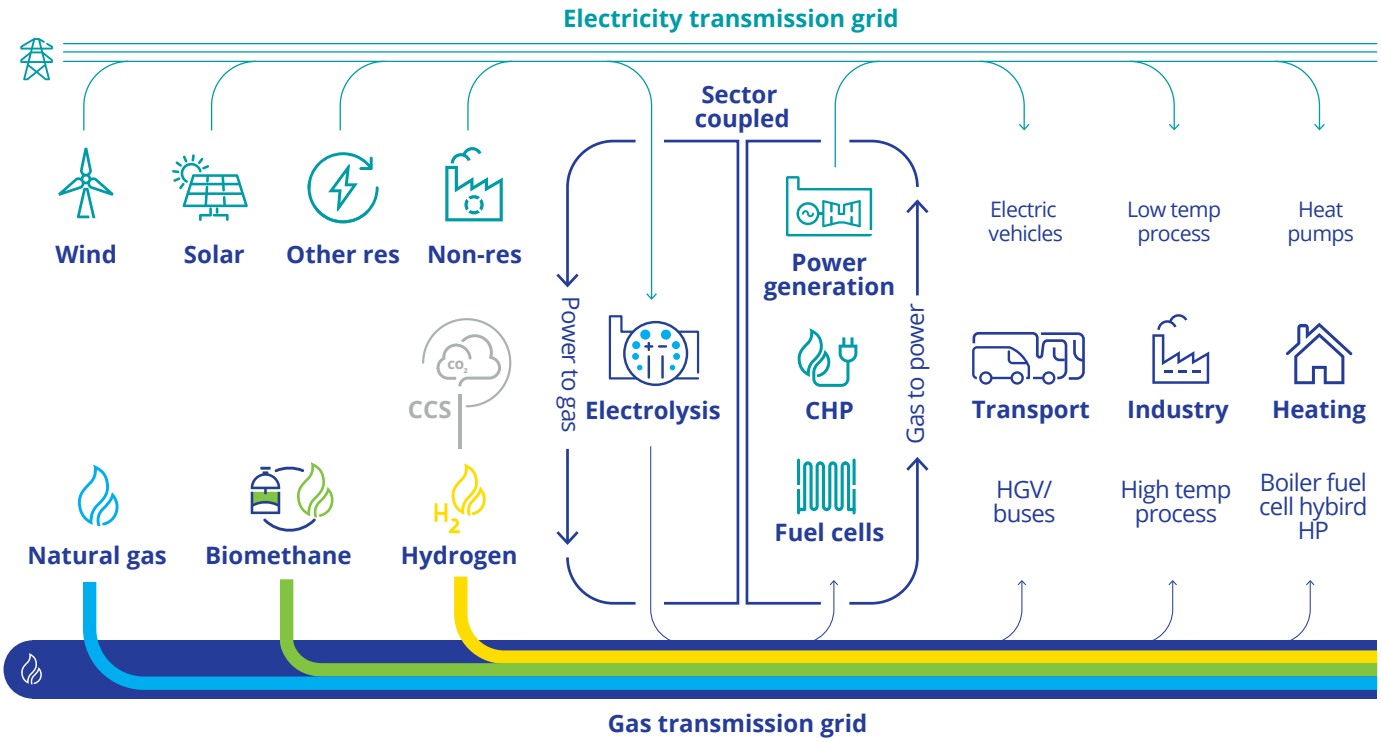
Figure 4-3: Principles for transportation of renewable gases



4.2.2 Principles for sector coupling
The European Commission launched its 'Strategy for Energy System Integration' on the 8th of July 2020. This is one of the most ambitious and all-encompassing elements of the European 'Green Deal', providing 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 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.

As per Action 54a in the Interim Climate Actions 2021 document, Gas Networks Ireland will continue to explore opportunities for greater energy system integration, building on the existing synergy which inherently exists between the gas and electricity transmission systems. Figure 4-4 demonstrates the principles of a potential coupled energy system. Such a system can address the challenges that cannot be overcome through electrification alone. These include serving the energy needs of high-temperature industrial processes, heavy goods transport, as well as harnessing and storing (through utilisation of the inherent storage capability of the gas system) renewable wind generation which might otherwise be curtailed at times of low electricity demand. Cross-vector integration between electricity, gas and heat can serve as an additional source of energy system flexibility and security of energy supply.

Figure 4-4: Principles for sector coupling

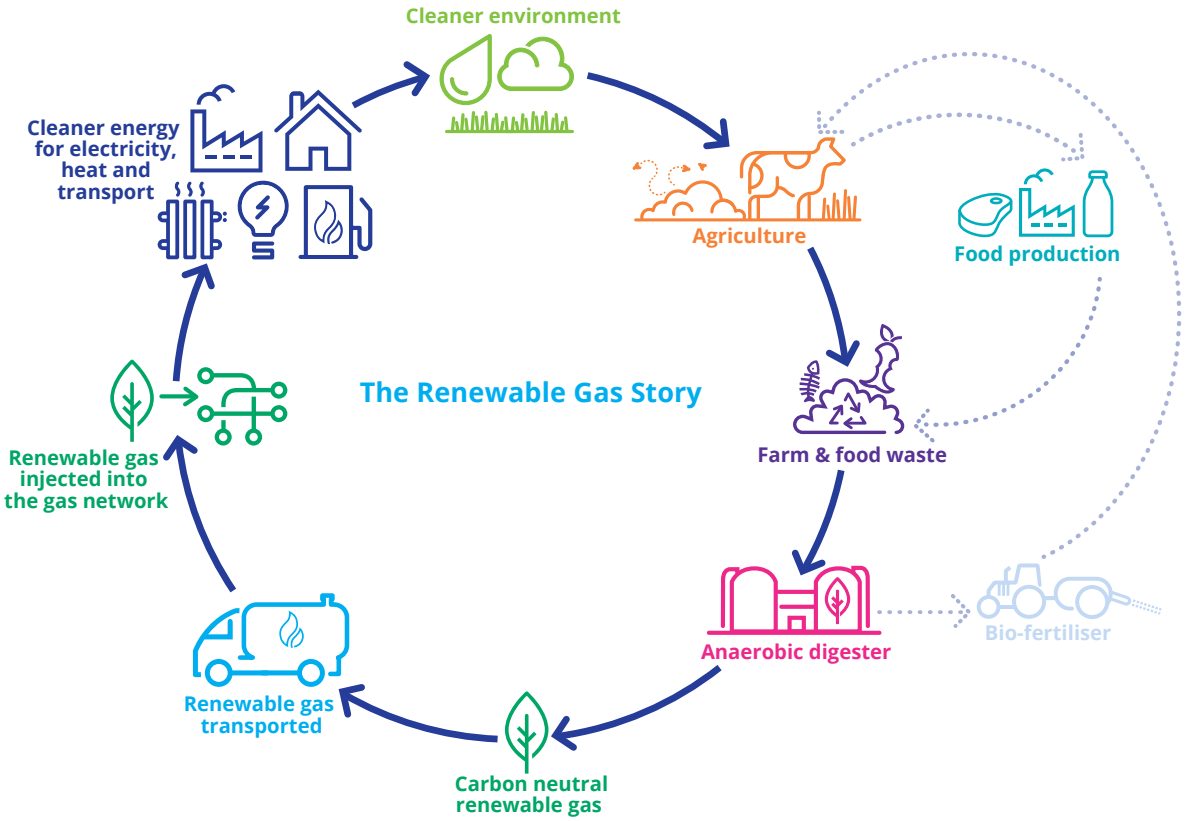


4. The role of the gas network in decarbonising Ireland's energy system (continued)

4.2.3 Key enabling technologies
Utilising a combination of technologies, various pathways to delivery of a net-zero gas network in 2050 will become available. Technologies such as Renewable Gas and compressed natural gas (CNG) are already integrated on our network and are delivering reduced emissions within the Heating and Transport sectors. Achieving a net-zero gas network will require further integration of these existing technologies but will also require development of and investment in Hydrogen at scale (as referred to in Action 54 of the Interim Climate Actions 2021). In addition, Gas Networks Ireland notes Action 49 of the Interim Climate Actions 2021 to "Examine and oversee the feasibility of the utilisation of Carbon Capture and Storage in Ireland". This section considers each of these technologies, in the context of enabling a pathway to achieve a net-zero gas network by 2050.

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. Development and utilisation of bio-CNG offers a real solution to decarbonising the HGV fleet. 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 delivering 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.

Figure 4-5: Renewable Gas Story



'Power to gas' describes the production of hydrogen by electrolysis, the chemical decomposition of water into hydrogen and oxygen.

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.

The Interim Climate Action Plan (March 2021) set out several actions to support the development of Renewable Gas production and related infrastructure, as summarised above in Section 4.1.

It is envisioned that a number of Centralised Grid Injection facilities will, in time, be geographically dispersed across the country at locations in close proximity to the existing gas grid. Renewable Gas producers within 80 km 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, for injection into the national gas grid. Direct injection anaerobic digestion facilities are also supported under the Gas Networks Ireland Connection Policy. As of July 2021, Gas Networks Ireland have issued approximately 130 initial stage connection feasibility reports in response to connection enquiries from potential developers. Enquiries can be sent to renewablegas@gasnetworks.ie. Section 8.5 (Renewable Gas) provides more detail in relation to Renewable Gas.

4. The role of the gas network in decarbonising Ireland's energy system (continued)

Hydrogen

Hydrogen is a gas that can be produced in various different ways, including from renewable electricity. Hydrogen produces zero CO_2 emissions when combusted, and can be blended with natural gas or used in its pure form. It is well suited to storage. Hydrogen is therefore considered an attractive option to decarbonise energy systems and has significant potential to drive a cleaner energy future for Ireland.

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 hydrogen produced using renewable electricity and water electrolysis will dominate.

The latter form is known as Green Hydrogen and it has the potential to feature as a key primary energy carrier in enabling Ireland to achieve net-zero greenhouse gas emissions by 2050, as evident by inclusion of actions 54a, 54b and 54c of the Interim Climate Actions 2021. '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 Government's preferred production method in the long-term once both the production equipment and renewable electricity sources such as offshore wind scale up sufficiently.

The European Commission communication 'A Hydrogen Strategy for a Climate-neutral Europe' sets out the ambition for hydrogen in Europe and the phases the Commission foresees in its development. There is recognition that hydrogen is required to achieve full decarbonisation of the energy mix 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 and the UK have signalled an intention to put substantial investment into hydrogen and establish it as a major pillar in their future decarbonised energy systems.

Potential demand side uses for Hydrogen span Heating, Industrial, Transport and Power Generation sectors:

- **Heating / industrial:** Hydrogen is a flammable gas and therefore may be utilised in applications ranging from domestic boilers to high heat industrial processes. Hydrogen boilers have been developed for domestic use and commercial boilers are under development. Hydrogen ready boilers which are compatible with natural gas may 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.
- **Transport:** Ervia, the parent company of Gas Networks Ireland, is a member of Hydrogen Mobility Ireland which is an initiative focused on developing hydrogen refuelling infrastructure for Ireland. Hydrogen may play a long-term role in heavy use transport, in vehicles carrying heavy loads or vehicles in constant use. The gas network may play a role in the hydrogen supply chain that serves hydrogen refuelling stations.
- **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.

Carbon capture and storage (CCS)

Carbon Capture and Storage (CCS) is a suite of technologies that can effectively capture up to 100% of the carbon dioxide (CO_2) emissions produced from industrial processes and the use of fossil fuels in electricity generation and industrial heating, 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.

Action 49 from the Interim Climate Actions 2021 document targets the establishment of a framework for analysis of the potential for CCS deployment for Ireland. While it is not envisaged the Gas Networks Ireland will play a direct role in the development and establishment of CCS, Gas Networks Ireland does envisage CCS providing a potential solution to reducing CO_2 emissions from large industry.

Furthermore, Ervia are currently carrying out a study into the feasibility of CCS for Ireland, and are part of a Horizon 2020 funded project, REALISE, which involves the capture of up to 90 % of CO_2 from multiple sources in operating refineries at a cost that is 30 % lower than existing capture methods. This includes the deployment of a demonstration carbon capture plant at Irving Oil refinery and the study of how carbon capture could be deployed in an industrial cluster (where several large industrial facilities share infrastructure) surrounding the oil refinery.

Gas Networks Ireland will continue to monitor this and other studies presently ongoing in assessing the feasibility of CCS as a solution to carbon emission abatement in Ireland, and will incorporate the outcomes into potential future decarbonisation pathways as appropriate.

4.3 Readiness of the gas network for transport of hydrogen

For over 40 years, Gas Networks Ireland has safely transported natural gas through Ireland's national gas network. Gas Networks Ireland is committed to delivering a net-zero emissions network by 2050, a crucial element in delivering on the wider long-term decarbonisation challenge for Ireland.

As part of this commitment, work has commenced to ensure the gas network will be ready to support the transport of hydrogen, as soon as volumes become available.
Gas Networks Ireland has developed a Hydrogen Innovation Centre at the Brownsbarn AGI site with funding from the Gas Innovation Fund. This facility is independent of the gas network and will use blends of natural gas and hydrogen for the purposes of assessing the compatibility of elements of the distribution network and gas appliances typically used in Ireland. Working in conjunction with University College Dublin, a wide range of tests are planned to gain a better understanding of natural gas/hydrogen blends. The facility will be able to begin the process of evaluating aspects of the network that are particular to Ireland and will also provide an opportunity for Gas Networks Ireland staff and stakeholders to gain experience of hydrogen blends. This begins the process of ensuring that Ireland's existing gas infrastructure is capable of safely transporting and storing hydrogen.

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 in the ability of the polyethylene distribution networks 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 is ongoing and there is progress in identifying the challenges and mitigations associated with transporting hydrogen. Gas Networks Ireland is a member of the Advisory Board of the EU funded HIGGS project (Hydrogen in Gas Grids) which aims to analyse the requirements of existing gas infrastructure and components to facilitate the injection of hydrogen into the high-pressure natural gas network. A testing facility has been constructed in Aragon, Spain as part of this project. 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 also actively supporting the work of the Gas Technical Standards Committee (GTSC) of the National Standards Authority of Ireland (NSAI) to develop Irish and European Gas infrastructure standards for hydrogen and hydrogen blends on existing natural gas networks. The European standards body CEN is currently undertaking a programme of pre-normative research to support this work and NSAI has established a Hydrogen Coordination Committee under the GTSC to ensure full engagement by Ireland with the programme.

Gas Networks Ireland maintains links with a number of Ireland's leading academic institutions which are conducting research into the potential role of hydrogen in Ireland. Gas Networks Ireland is 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.

4. The role of the gas network in decarbonising Ireland's energy system (continued)

Gas Networks Ireland is participating in project HyLight – an initiative of Hydrogen Ireland Association, and part-funded by Science Foundation Ireland and MaREI. The overall aim of HyLight is to provide the necessary tools to optimally guide the cost-effective and sustainable large-scale implementation of hydrogen technologies in Ireland to enable the sector integration necessary for a zero-carbon, secure, resilient energy system.

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, and several formal connection enquiries in progress. This provides an early indication of the level of interest there may be from renewable developers to enter a new green hydrogen production market. Gas Networks Ireland has already started looking into the implications of hydrogen producers connecting to the network, raising questions such as where the appropriate locations for connection are, and what storage would be required 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.

A key step in achieving hydrogen readiness is the development of a hydrogen safety case that meets the requirements of all applicable standards, regulatory requirements and national policy. Gas Networks Ireland is currently developing a detailed hydrogen technical strategy which will ultimately provide a road map for the business to transition to hydrogen and to become an informed hydrogen transporter. This will acknowledge the technical challenges, assess the impact and propose an implementation process for delivery of the technical strategy. The development of the technical strategy will include a high-level impact assessment which identifies the key risks associated with the transition to hydrogen and will be key in providing clear evidence that the transition will be managed to a risk level that is as low as reasonably practicable. The technical strategy will complement existing Gas Networks Ireland knowledge, experience and hydrogen initiatives, some of which are outlined above.

Gas Networks Ireland continues to monitor hydrogen developments in other jurisdictions. Notably in the UK, where future developments may determine the potential availability of hydrogen at the Moffat Entry Point, the Acorn Hydrogen Project[18] is a hydrogen production facility being developed at St Fergus, Scotland. The UK Hydrogen Strategy[19] targets development of 'archetypes' of a hydrogen economy through the 2020s, culminating in an ambition for 5 GW of low carbon hydrogen production capacity by 2030.

Gas Networks Ireland is currently developing a detailed hydrogen technical strategy which will ultimately provide a road map for the business to transition to hydrogen and to become an informed hydrogen transporter.

18 https://theacornproject.uk/wp-content/uploads/2020/05/Hydrogen-Coast-DIGITAL.pdf
19 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1011283/UK-Hydrogen-Strategy_web.pdf


Gas
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Ireland

5

Historic demand and supply

Key messages:

Annual ROI gas demands for 2020/21 are anticipated to be 1.6% below 2019/20 demand levels.

In 2020 approximately 36% of Ireland's gas demand was supplied from indigenous sources. The balance of supply (64%) came through the subsea interconnectors via the Moffat Entry Point in Scotland.

The COVID-19 pandemic continues to have an impact on gas demand, particularly in the Industrial and Commercial sector, where reduction (and subsequent recovery) of gas demand has been seen to correlate with implementation (and subsequent easing) of the economic and societal restrictions associated with the pandemic.

Outages at several large gas-fired generators in ROI have led to a reduction in gas demand for Power Generation in 2020/21

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, most directly in the Industrial and Commercial sector.

In the Power Generation sector, the EirGrid/SONI All-Island Generation Capacity Statement 2021-2030 notes that "despite a short-term reduction in demand at the beginning of the measures to mitigate Covid-19, demand in Ireland is increasing and long-term demand is forecast to increase significantly". This short-term reduction seen in March to June 2020 did not extend into gas year 2020/21. October 2020 to June 2021 saw an increase in electricity demand of 5% against the same period in gas year 2019/20. All else being equal, this increase in electricity demand would have manifested in an increase in demand for gas in the Power Generation sector in gas year 2020/21 to date. However, other factors within the electricity market can strongly influence the demand for gas in the Power Generation sector.

The first half of the gas year showed a marginal increase (+0.2%) against the same period in 2019/20 while the second half of the gas year is expected to yield a decrease of -7.7%. The drivers for the second half anticipated reduction are not directly associated with the COVID-19 pandemic, but rather are associated with the wider electricity market dynamics (most notably a number of prolonged outages experienced at gas-fired generators in ROI during 2020/21) and increasing wholesale gas prices.

Industrial and Commercial gas demand experienced a 3.3% decrease in the first half of 2020/21, while a 4% increase is anticipated in the second half, when compared with the equivalent periods in 2019/20. 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 has been as influential in the Residential sector; the key factors influencing the trends in Residential gas demand are likely to be prevailing weather conditions coupled with the quantity and timing of new connections.

Industrial and Commercial gas demand experienced a 3.3% decrease in the first half of 2020/21, while a 4% increase is anticipated in the second half, when compared with the equivalent periods in 2019/20.

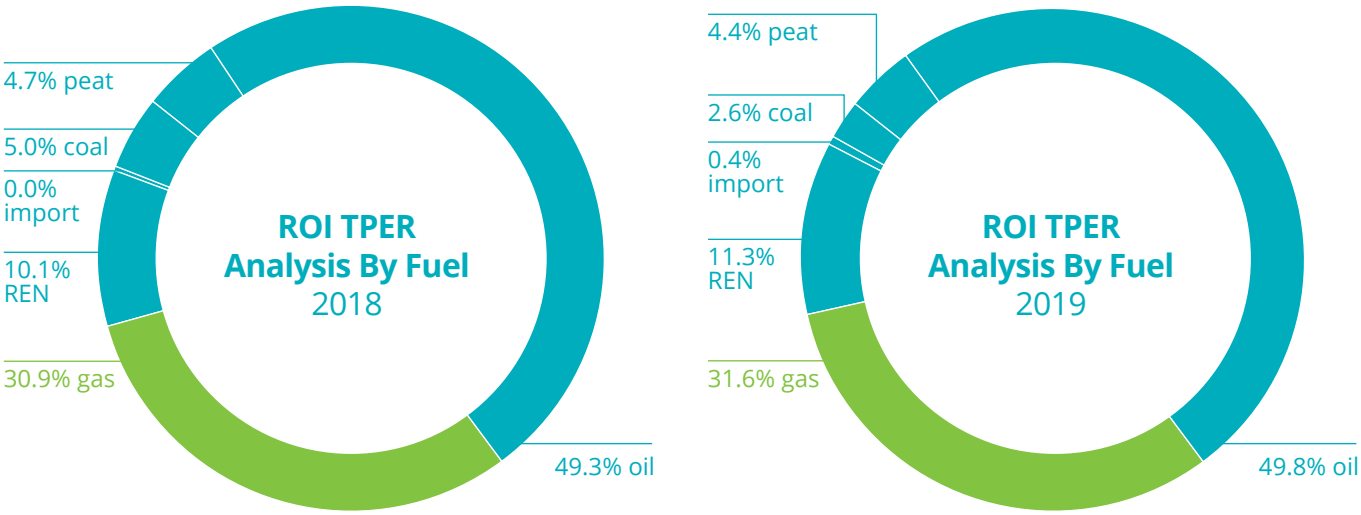
5.2 ROI annual primary energy requirement

The Sustainable Energy Authority of Ireland (SEAI) reported that Ireland's Total Primary Energy Requirement (TPER) for 2019[20] fell by 1.2% compared to 2018. Oil dominated the 2019 TPER, accounting for almost 50% of total energy demands, as shown in Figure 5-1. Gas accounted for 31.6% of 2019 energy demands, reflecting its role in electricity generation, industrial process and heating use. Renewable energy sources accounted for 11.3% of TPER in 2019.

20 SEAI Energy in Ireland 2020 - https://www.seai.ie/publications/Energy-in-Ireland-2020.pdf

5. Historic demand and supply
(continued)

Figure 5-1: ROI TPER analysis by fuel (2018 and 2019)



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 2020/21 are anticipated to be 1.6% below 2019/20 demands. This contrasts with increases of 1.5% in 2019/20 over 2018/19 and 2% in 2018/19 over 2017/18, as shown in Figure 5-2. In the Power Generation sector, annual gas demand for 2020/21 is projected to show a decrease of 4% below 2019/20, contrasting with a 3.5% increase the previous year. This decrease in Power Generation gas demand in 2020/21 is predominantly related to enduring outages at several large gas-fired generators throughout the year which are due back online in 2021/22. Over the longer-term, Power Generation sector gas demand has increased by 31% when compared to 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 GB, and more recently carbon prices favouring gas-fired generation ahead of coal for electricity generation. Following the introduction of updates to the wholesale electricity market in October 2018, electrical interconnector behaviour has generally been efficient in that the interconnectors are mainly importing to Ireland when Irish electricity prices are higher than GB markets, and exporting at times of high wind when Irish electricity prices are lower than in GB. Following the exit of the UK from the EU in January 2021, interconnectors had not been participating in the Day-Ahead market in the I-SEM, resulting in a reduction in their utilisation in the early part of 2021. However, interconnector utilisation has recovered since March 2021 with both EWIC and Moyle operating as net importers up to July 2021.

The Industrial and Commercial sector annual gas demand for 2020/21 is anticipated to be the same as 2019/20. While a reduction in demand in this sector was experienced in the first half of 2020/2021 (3.3% based on year-on-year comparison of October – March period), driven by restrictions associated with the COVID-19 pandemic, a recovery in Industrial and Commercial gas demand occurred in the second half of the gas year, with growth of 4% anticipated in this half.

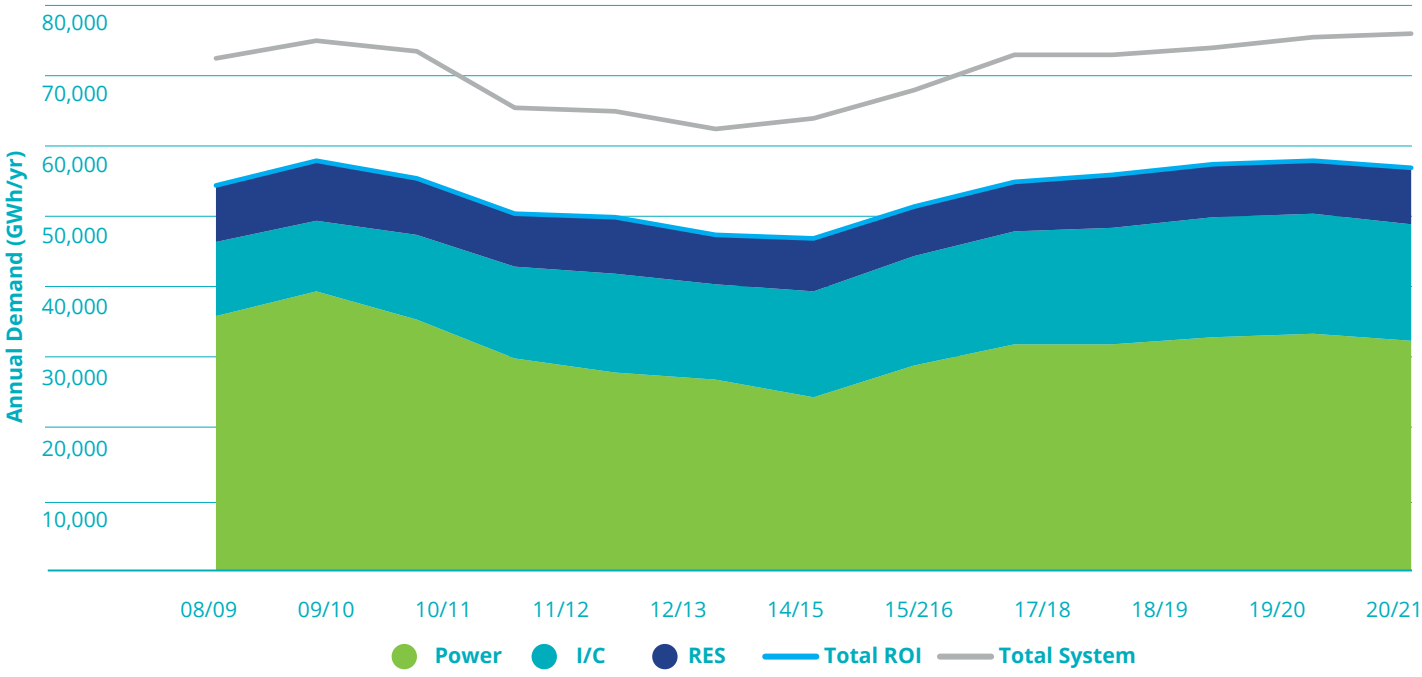
Within the Industrial and Commercial sector, Daily Metered (DM)[21] demand is projected to increase by 1.8% in 2020/21, while the Non-Daily Metered[22] (NDM) portion of Industrial and Commercial demand is anticipated to decrease by 4.5%. It is worth noting that the NDM sector is heavily influenced by weather.

Residential demand is projected to increase by 5.6% for 2020/21, showing a similar trend to the previous year. Composite Weather Variable and Degree Day are approximately the same year-on-year for the first half of 2020/21 (October 2020 to March 2021), which correlates with the fact that Residential demand for these months was only 0.7% lower than the same period in 2019/20. The second half of 2020/21 is anticipated to see a Residential demand 29% higher than the previous year, driven by large increases in demand in both April and May 2021.

Transport sector gas demand is projected to increase by 92% in 2020/21, as the roll-out of a nationwide Compressed National Gas (CNG) fuelling network continues. Further details on the CNG fuelling network rollout are included in Section 8.

Total Gas Networks Ireland annual system gas demand for 2020/21 is anticipated to increase by 0.2% over the previous year's gas demand. As noted in Section 5.2, ROI gas demand is projected to fall by 1.6% in 2020/21 vs. the previous year. In contrast NI and IOM gas demand is anticipated to increase by 6.4% against 2019/20. The historic gas demand is presented in Figure 5-2. The overall throughput for ROI in 2020/21 is projected to be 57,405 GWh or approximately 5.3 bcm.

Figure 5-2: Historic annual gas demand



21 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

22 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.

5. Historic demand and supply
(continued)

5.4 Historic peak day gas demand

The ROI peak day gas demand for 2020/21 was 248.5 GWh/d, which occurred on 8th January 2021 and is 10.3% higher than the 2019/20 peak day gas demand. This peak day coincided with a cold weather spell resulting in high Residential gas demand. In addition, lower than average wind speeds, coinciding with the fact that ROI was a net exporter of electricity to GB on this day, led to high gas demand for power generation. Therefore, the combined effect of the cold weather spell and the very high demand for gas in the Power Generation sector on the 8th January resulted in an ROI peak day gas demand considerably higher than in 2019/20.

Gas demand in the Power Generation sector, which represented 54% of the total gas demand on the peak day, increased by 3.8% in comparison to the 2019/20 peak day while gas demand in the Residential sector, representing 22% of total peak day demand, increased by 48%.

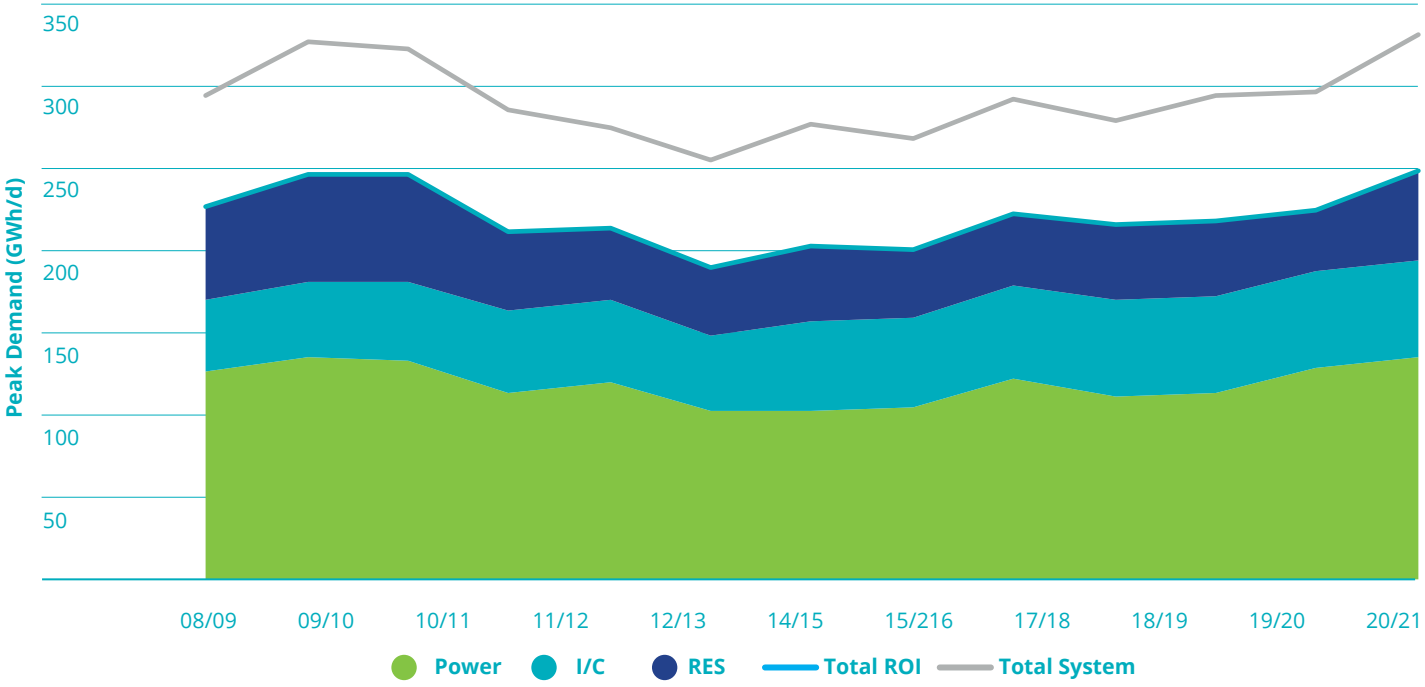
Industrial and Commercial peak day demand (representing 24% of total peak day demand) also showed a slight increase of 1% compared to 2019/20.

Gas-fired power generation accounted for 58% of the Single Electricity Market fuel mix on the 2020/21 ROI peak day, while wind generation accounted for c. 22%. It is notable that wind generation was not particularly low or near-zero on the peak day. However, electricity interconnectors operated as net exporters of electricity to GB, which when combined with high electricity demand in ROI, drove very high demand for gas-fired power generation.

The peak day demand in the NDM sector occurred on the 11th of February 2021, with gas demand reaching 83.2 GWh/d. This is higher (+11%) than the corresponding NDM peak day in 2019/20, the difference being related to differing weather and temperature conditions.

The Gas Networks Ireland system 2020/21 peak day gas demand was 12% higher than the 2019/20 peak while the NI and IOM combined peak day gas demand showed an increase of 16.6% over 2019/20.

Figure 5-3: Historic peak day gas demand



5.5 Ireland's weather

Based on a Degree Day (DD) comparison, the most recent winter (October 2020 to March 2021) was approximately 0.4% warmer than the previous year. Relative to the long run DD average, winter 2020/21 was approximately 1.5% cooler.

The coldest day in winter 2020/21, occurred on the 9th January, with an average temperature of -1.35°C, or a 16.85 DD. The corresponding coldest day in 2019/20 occurred on the 5th March with an average temperature of 1.8°C, or a 13.8 DD.

Gas demand on 9th January 2021 was not the peak gas demand day for winter 2020/21 but did coincide with a period of high gas demand from 5th to 9th January 2021, during which the 2020/21 peak day for gas demand of 248.5 GWh/d occurred (on the 8th January). The average temperature on the 8th January 2021 was -0.15°C or 15.65 DD.

5.6 Wind powered generation

The installed all-island wind generation capacity increased by 3% in 2020 from the previous year[23]. Wind powered generation output grew by 13.5% in 2020 compared to 2019, suggesting that wind generation load factors were increased in 2020.

On the peak day for wind generation in winter 2020/21, daily wind powered generation accounted for up to 76% of ROI daily electricity demand (1st October 2020). Wind accounted for only 3% of demand on the minimum day for wind generation (31st March 2021). On the 2020/21 peak day for gas demand (8th January 2020) wind accounted for c. 22% of electricity generation.

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)[24] 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 GB.

23 System and Renewable Data Summary Report – EirGrid
24 The Single Electricity Market (SEM) is the wholesale electricity market operating in the Republic of Ireland and Northern Ireland.

5.0 Historic demand and supply
(continued)

Figure 5-4: SEM fuel mix – January 2021 cold spell

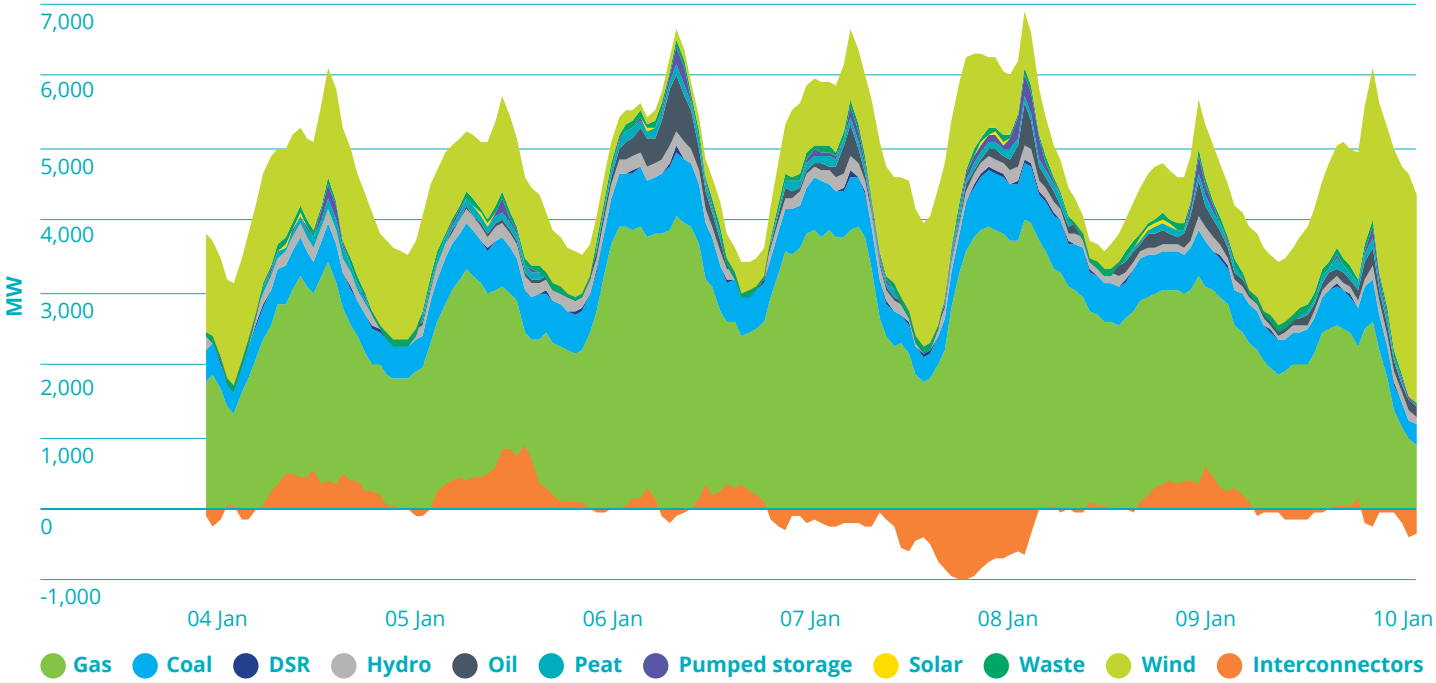
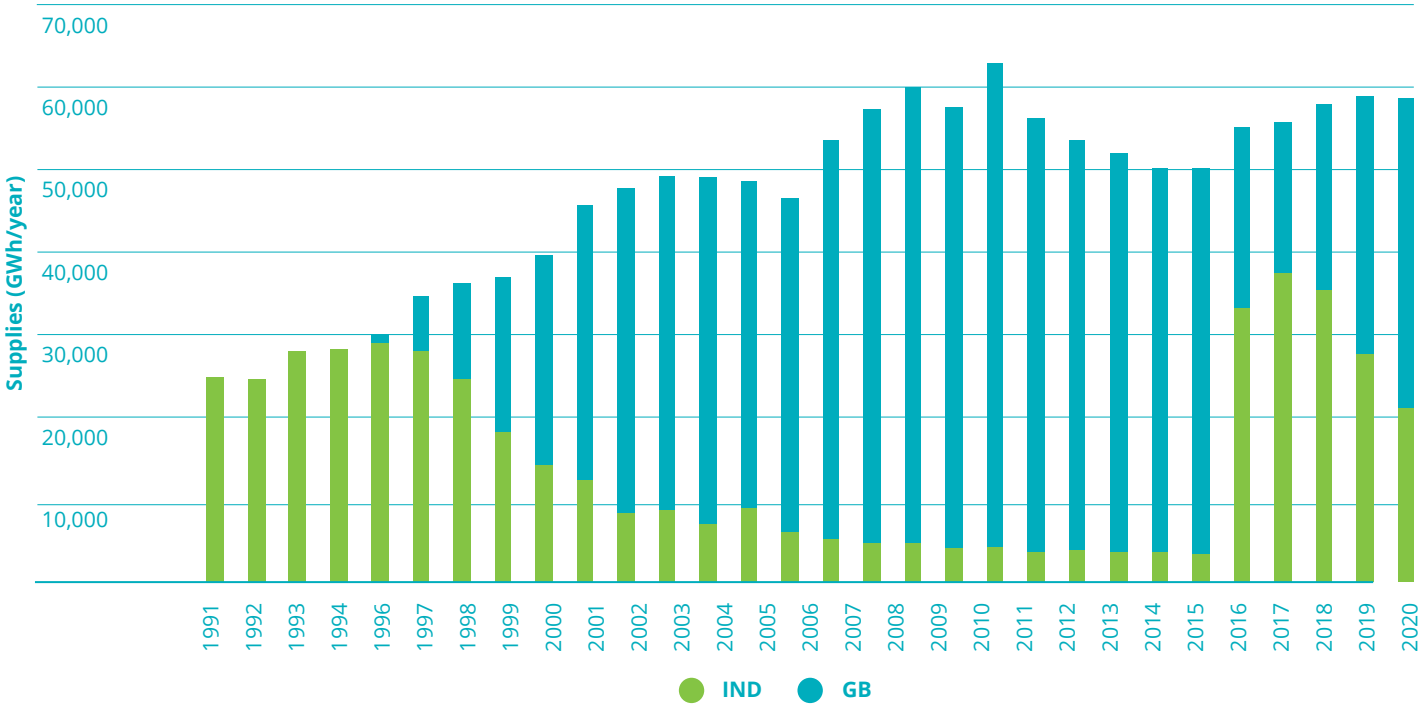


Figure 5-5: Historic annual indigenous (IND) gas production and Great Britain (GB) imports



Following this, the carbon price floor in GB 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.

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 been efficient in that the interconnectors are generally importing to Ireland when SEM prices are higher than GB markets, and exporting at times of high wind when prices in the SEM are lower than in GB[25].

It is notable that on the peak day for gas demand in ROI (which occurred on the 8th January 2021 as outlined in Section 5.4), electricity interconnectors operated as net exporters of electricity to GB. This, when combined with high electricity demand and moderate wind generation in ROI, drove the very high demand for gas-fired power generation. This is illustrated further in Figure 5-4, which shows the SEM fuel mix[26] over the period of the January 2021 cold spell.

Carbon prices on the European Emission Trading Scheme (EU ETS) continue to rise in line with various projections[27].

Following the withdrawal of the UK from the European Union, a UK Emissions Trading Scheme (UK ETS) replaced the UK's participation in the EU ETS on 1st January 2021. Similar to the EU ETS, the scheme applies to energy intensive industries, the Power Generation sector and Aviation. The first UK ETS auction was held on 19th May 2021; to date the UK ETS price has generally tracked the EU ETS price. It has been proposed that the UK ETS and EU ETS markets be linked in the future but a definitive plan for this link has yet to be announced.

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

Gas Networks Ireland continues 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.

Gas Networks Ireland continues 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 2020 approximately 36% of Ireland's gas demand was supplied from indigenous sources (Corrib and Kinsale). The balance of supply, almost 64% came through the subsea interconnectors via the Moffat Entry Point in Scotland.

It is noted that the final commercial volumes of gas supply from the Kinsale gas fields onto the Gas Networks Ireland transmission system via the Inch Entry Point occurred in July 2020.

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

6

Gas demand forecasts

Key messages:

Gas Networks Ireland has developed Low, Best Estimate and High demand scenarios which forecast gas demand across the Power Generation, Industrial and Commercial, Residential and Transport sectors.

In the Best Estimate demand scenario annual ROI gas demand is expected to grow by 15% between 2020/21 and 2029/30.

The 1-in-50 peak day forecast is expected to grow by 18% between 2020/21 and 2029/30.

National policy targets a 70% renewable energy share in electricity generation (RES-E), such as from wind and solar, by 2030. While annual gas demand in the medium to long-term will be inversely related to the delivered level of RES-E on the Single Electricity Market, peak day gas demand will not be as significantly impacted as gas-fired power generation will be required to meet almost all of Ireland's electricity requirements on days of low wind. While electricity interconnectors may operate in the net import direction on such days, equally they may operate as net exporters of electricity on such high demand / low wind days. This will depend on the wider electricity market dynamics, such as those experienced on the most recent winter peak day for gas demand in 2020/21, when the electricity interconnectors operated as net exporters to GB.

This section presents an overview of the gas demand outlook for the period 2020/21 to 2029/30. The NDP forecasts future gas demand by examining the development of individual Power, Industrial and Commercial, Residential and Transport sector gas demands[28].

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.

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 and Commercial, Residential and Transport sectors, based on a series of assumptions[29] which affect demand for each of these sectors. The primary forecasting inputs by sector are summarised in Figure 6-1.

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.

Figure 6-1: Key demand forecasting assumptions

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

28 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

29 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. 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 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 2020/21 to 2029/30, 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.

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.

Figure 6-2: Gas demand scenarios overview

Low demand	Best Estimate	High demand
EirGrid's low electricity demand scenario	EirGrid's median 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	Blended short term GDP projections plus ESRI's Economic outlook
+ New connections Low CNG Low	+ New connection Best Estimate CNG Best Estimate	+ New connections High CNG High

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) 714/2009 respectively.

Regulation (EU) 347/2013 requires that the ENTSOG and ENTSO-E use scenarios to underpin their respective Ten Year[30] 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[31].

For the short and medium-term, a Best Estimate 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 imports of energy from competitive sources are also 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 'National Trends' which covers the longer-term horizon. Gas Networks Ireland was also directly involved in the development of the assumptions which underpin the 'Global Ambition' and 'Distributed Energy' scenarios and agreed key assumptions with EirGrid in this regard and fed these assumptions into the joint ENTSOG / ENTSO-E scenario building work group.

Across the ten-year NDP forecasting horizon, 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.

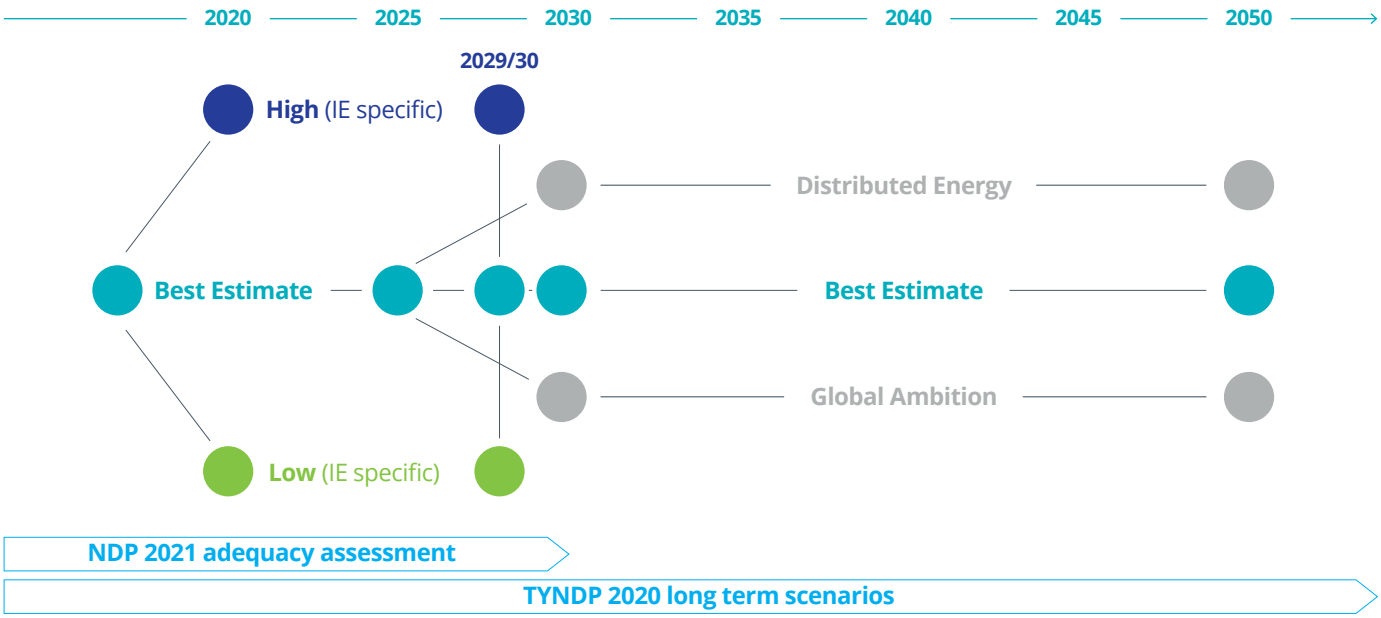
The NDP Best Estimate scenario is aligned to the TYNDP Best Estimate and National Trends scenarios. Because the primary purpose of the NDP is to assess and stretch the adequacy of the gas network over the 10-year period, Gas Networks Ireland develop Ireland-specific High and Low demand scenarios. The low level of divergence between the TYNDP scenarios to 2029/30 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 2021–2030[32].

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

30 Despite being called a Ten-Year Network Development Plan the scenario horizon extends out to 2050
31 https://www.entsog.eu/sites/default/files/2019-11/TYNDP_2020_Joint_ScenarioReport_web.pdf
32 https://www.eirgridgroup.com/site-files/library/EirGrid/208281-All-Island-Generation-Capacity-Statement-LR13A.pdf

6. 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 2020/21 to 2029/30.

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 51%[33] of the country's annual electricity requirement in 2020. Gas-fired generators are the largest customer sector in the gas market, accounting for approximately 58% of the total ROI demand in 2020.

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) 2021 – 2030:

- EirGrid has assumed the Moneypoint coal-fired power plant will not be available from October 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 three scenarios, Moneypoint is therefore assumed unavailable from October 2025. While it is noted in the GCS that ESB has not provided a closure notice for these units, in April 2021 ESB announced Green Atlantic[34], an ambitious programme to transform Moneypoint into a green energy hub, helping Ireland to become a leader in green energy production.
- The Kilroot[35] coal-fired power plant is assumed to 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 closed at the end of 2020 due to planning constraints.

33 System and Renewable Data Summary Report – EirGrid
34 https://www.esb.ie/tns/press-centre/2021/2021/04/09/esb-announces-green-atlantic-@-moneypoint
35 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

- In its GCS, EirGrid 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 GCS 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, it is assumed that Edenderry peat station remains in operation beyond 2023, co-firing peat and biomass at a ratio of 1:1.
- 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 are working to resolve planning challenges[36]. Therefore, the North-South Interconnector is assumed not complete within the duration of the NDP forecast horizon. In EirGrid GCS, it is assumed that the new North-South interconnector is constructed in 2025 and becomes operational in 2026. 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 2026 has been examined.
- There are a number of proposed electrical interconnector projects involving Ireland, including the Greenlink Interconnector with GB and the Celtic Interconnector with France. In its GCS, EirGrid have included an assessment of the impact of the build-out of the Celtic Interconnector only as a sensitivity to their adequacy analysis, given that the project is still at a preliminary stage. Hence the NDP forecast horizon does not include the connection of the Celtic Interconnector, however a sensitivity analysis is included in the NDP to assess the impact of a new interconnector connecting towards the end of the NDP horizon.
- Gas Networks Ireland has included in its scenarios new entrant generators which were successful in T-4 capacity auctions run by EirGrid for capacity years 2022-2023, 2023-2024 and 2024-2025.[37]
- To reflect the level of connection enquiries received by Gas Network Ireland in the Power Generation sector, and to meet the system adequacy shortfall as outlined in the EirGrid GCS Adequacy Analysis, further generation capacity in the form of Open Cycle Gas Turbines (OCGTs) has been assumed to be in place for gas year 2024/25 in a sensitivity to the Gas Networks Ireland Best Estimate NDP scenario.

The Irish Government had a target of 40% of electricity to be generated from renewable sources by 2020[38] which has now been reached[39].

Beyond 2020, assumptions on renewables integration targets in our scenarios have been informed by the National Energy and Climate Plan[40] (NECP) and the Government Climate Action Plan 2019[41]. It is noted that the EirGrid / SONI All-Island Generation Capacity Statement (GCS) 2021-2030 aligns to the ambition set out in the Climate Action Plan and NECP targets on assumed wind capacity development rates after 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 9,400 MW and 1,581 MW in ROI and NI respectively, by 2030.
- In our High gas demand scenario, Gas Networks Ireland has assumed a scenario wherein the 70% RES-E target is not met. In this scenario, a share of 55% RES-E by 2030 is assumed, in line with the 2018 draft NECP[42].
- In this scenario, wind generation is anticipated to increase to 6,041 MW and 1,400 MW in ROI and NI respectively, by 2029.

36 At the time of the NDP 2021 modelling data freeze, planning approval had been obtained for the North-South interconnector however a legal challenge to this approval was ongoing in the NI jurisdiction.
37 As noted by EirGrid in its GCS, following certain capacity auctions, a number of awarded contracts have been terminated and are not progressing, and as such have been removed from the EirGrid studies. The associated new entrant generators have been excluded from the NDP base case scenarios also.
38 White Paper: Ireland's Transition to a Low Carbon Energy Future 2015-2030
39 https://www.EirGridgroup.com/newsroom/electricity-consumption-f/
40 National Energy and Climate Plan 2021-2030 https://assets.gov.ie/94442/f3e50986-9fde-4d34-aa35-319af3bfac0c.pdf
41 Government of Ireland, 2019, Climate Action Plan https://www.gov.ie/en/publication/5350ae-climate-action-plan/
42 Government of Ireland, 2018, Draft NECP, https://assets.gov.ie/77391/05ae14cb-4c23-46fb-8dfd-ab54c8a17a8c.pdf

6. Gas demand forecasts
(continued)

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. locational constraint requiring a minimum number of generators in the Dublin area being on-load simultaneously).

- Technical parameters for generation plant have been modelled per Commission for Regulation of Utilities (CRU) published values[43].
- Existing interconnectors have also been modelled per CRU published values, but with the added inclusion of the existing North-South tie-line between ROI and NI.
- Technical operational constraints on the EirGrid system have been modelled per the existing EirGrid operational constraints[44].

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 or elimination of technical operational constraints on the transmission system.
- Reduction of thermal generator minimum-generation thresholds, in order to create sufficient headroom for renewable generation on days of high wind.
- Increasing the System Non-Synchronous Penetration (SNSP) level from existing 70%[45], 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 measures have not been incorporated into the NDP scenarios as the technical requirements to execute these measures have not yet been established. Hence, the RES-E targets associated with each NDP scenario are not met by the installed wind capacity development rates assumed. Sensitivity analysis has been conducted as part of the NDP process to assess potential additional measures, taken from a combination of those outlined above which would enable the RES-E target being met by 2030. The results of this sensitivity are included in section 6.6.8.

In the event that the above technical constraints are addressed, future NDP base case 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 generation.

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 dispatch.
- Peat fired capacity has fallen significantly since the end of 2020 due to the closures of West Offaly and Lough Ree power stations. Edenderry peat fired power station remains high in the merit order due to priority dispatch associated with the co-firing of biomass at the plant.
- The electricity interconnectors, EWIC and Moyle, are anticipated to be net exporters of electricity to GB in the short-term, due in part to the freezing of the carbon price floor at £18/ton CO_2 in GB to March 2023[45]. 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 with the

43 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
44 EirGrid Operational Constraints Update June 2021
45 UK Government Budget 2021, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/966868/BUDGET_2021_-_web.pdf

advent of the UK Emissions Trading System (UK ETS). Towards the final years of the NDP horizon, i.e. gas years 2028/29 and 2029/30, it is expected that EWIC and Moyle will again operate as net exporters in the Best Estimate and Low scenarios due to an increase in renewable penetration. In contrast, in the High gas demand scenario, it is projected that ROI will be importing to meet demand due to the lower renewables installed capacity.

- Both coal and gas prices have increased in gas year 2020/21; the cost of coal-fired generation vs. gas-fired generation during this period has promoted coal to a higher position relative to previous years, despite an increase in carbon prices. This trend is anticipated to continue over the short-term, however the split in gas and coal prices is expected to narrow in the medium-term. Coal fired generation is anticipated to fall off completely towards the middle of the NDP period due to the previously mentioned assumptions around plant closures at Moneypoint and Kilroot.
- 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 2021-2030. This is based on thermal plant capacities given for 2021 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.

Peat fired capacity has fallen significantly since the end of 2020 due to the closures of West Offaly and Lough Ree power stations.

6. Gas demand forecasts
(continued)

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

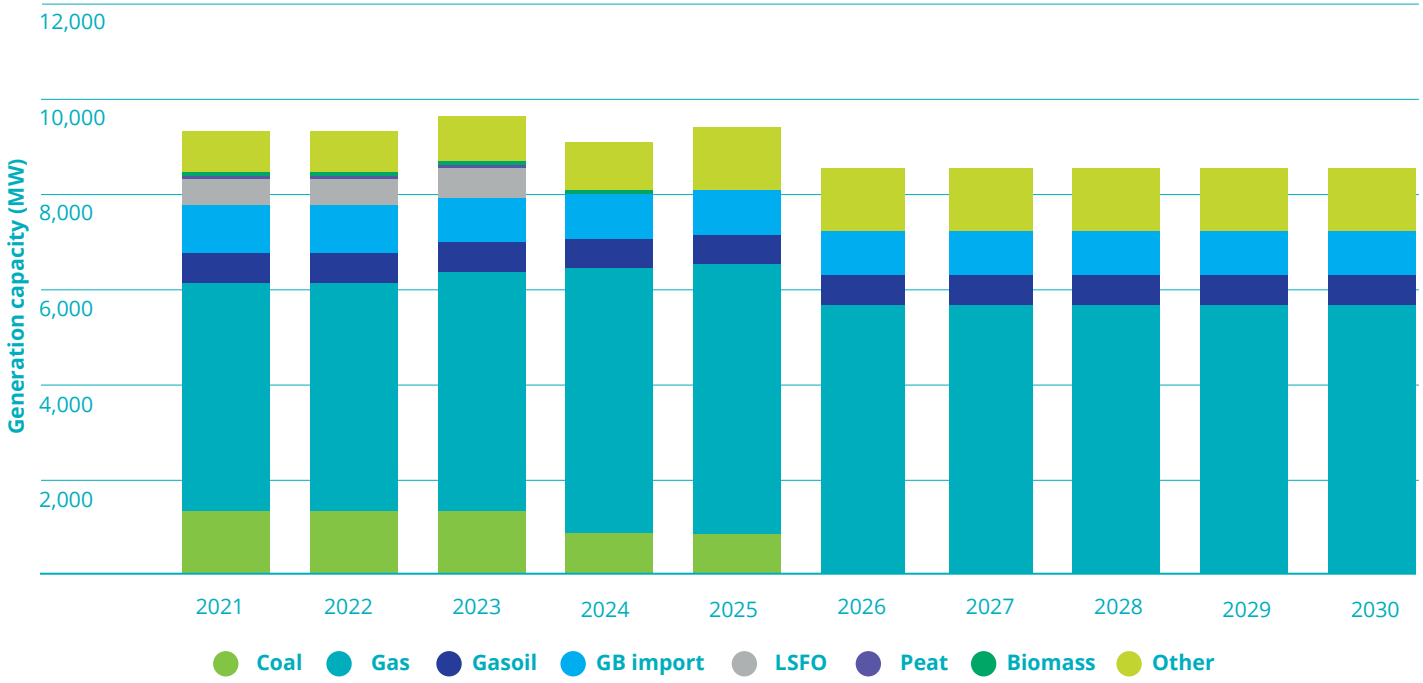
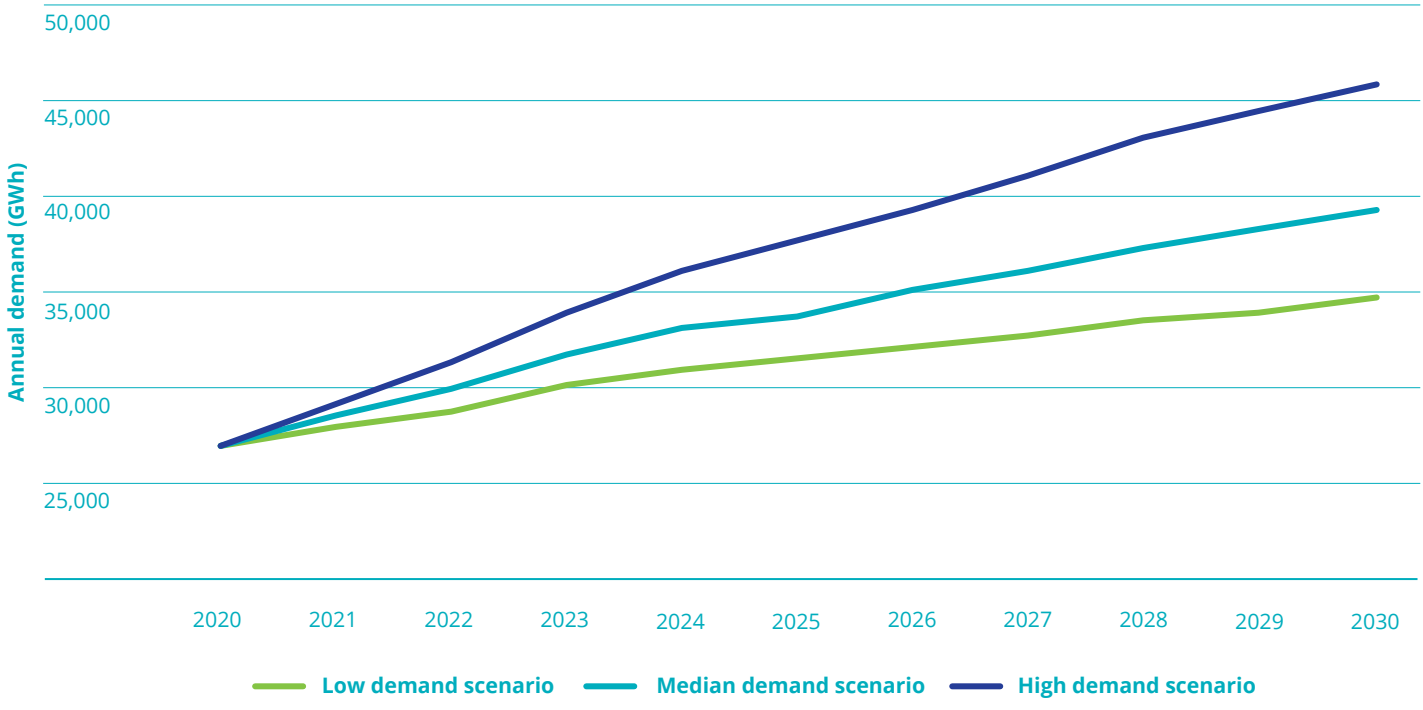


Figure 6-5: Electricity demand forecasts for ROI



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) 2021-2030. For the 1-in-50 severe winter peak day projection, a calculated 1-in-50 year electricity demand is used, which considers the actual '1-in-50' 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 figure forward in line with the electricity demand forecast growth rate.

An assessment of the first three years of the Integrated Single Electricity Market (I-SEM) 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. 50% of Ireland's power generation fuel mix in the three years following commencement of the updated SEM. On days of low wind, gas has contributed towards 93% of the generation fuel mix.

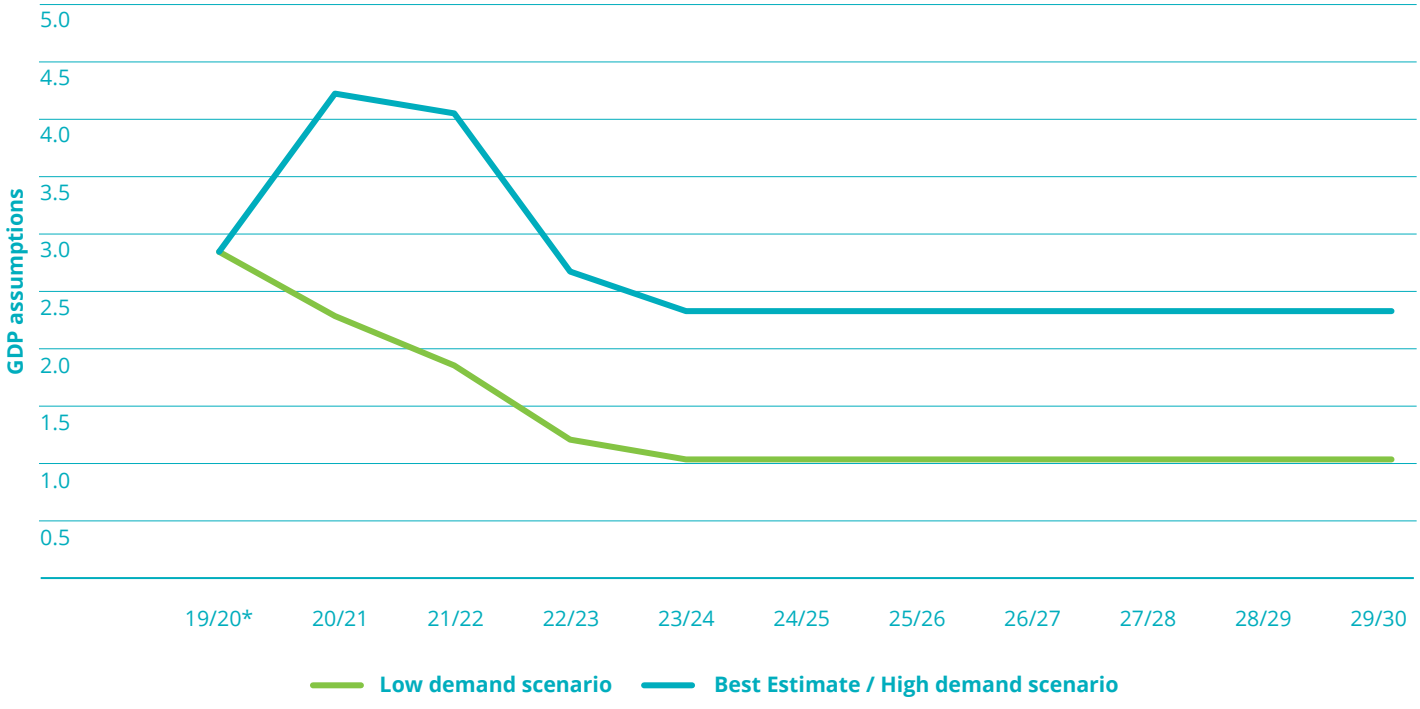
6.5.2 Industrial and Commercial sector

Industrial and Commercial sector gas demand is assumed to continue to increase in line with anticipated new connection numbers and in proportion with Gross Domestic Product (GDP)[46]. 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 and Social Research Institute (ESRI), Central Bank and the International Monetary Fund (IMF). The anticipated negative economic impact of the COVID-19 pandemic and associated restrictions, as outlined in NDP 2020 (and based on best available assumptions at the time), did not materialise with GDP growing by 3.4% in 2020. Hence, the short-term economic outlook has recovered and is reflected in the forecasts mentioned above and shown in Figure 6-6.

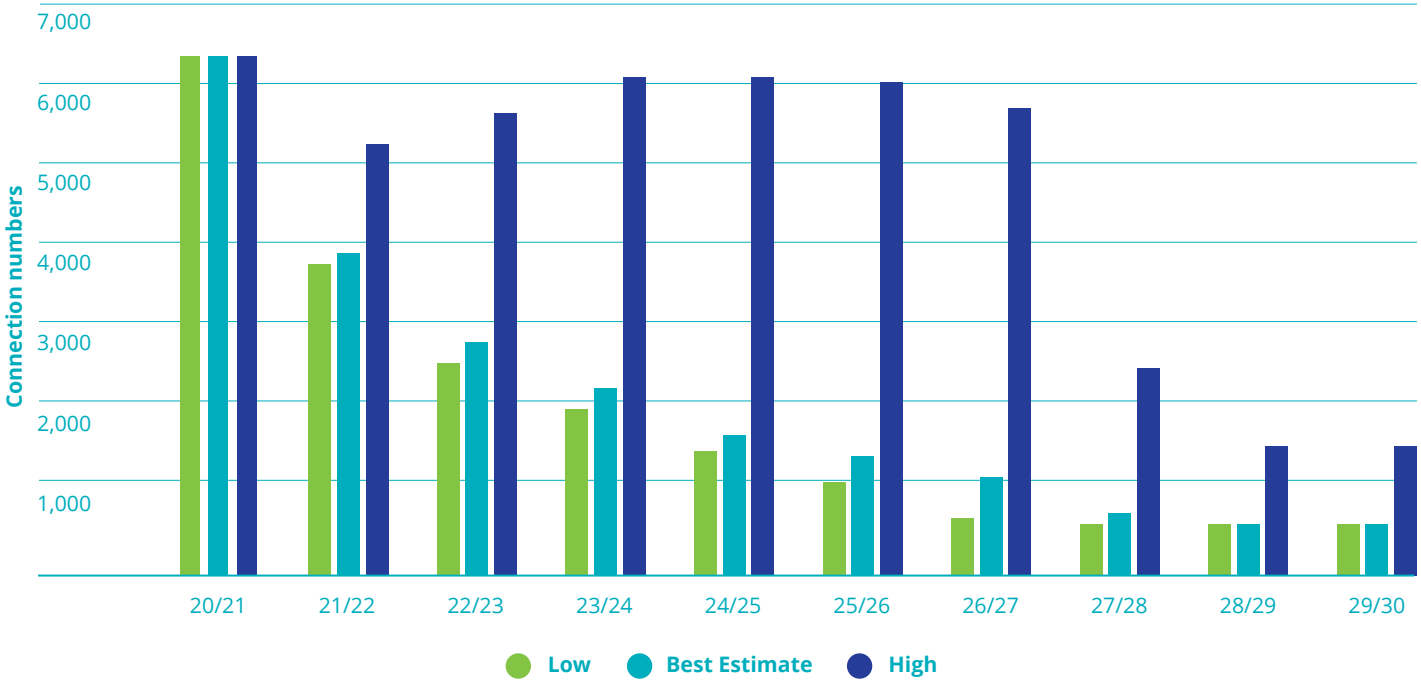
Figure 6-6: GDP growth assumptions

*Actual GDP for 2019/20 is shown for context



6. Gas demand forecasts
(continued)

Figure 6-7: Residential new connection numbers



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.

In addition to GDP, new connections in the Industrial and Commercial sector are also driving growth in all NDP demand scenarios in line with Gas Networks Ireland's I/C new connections growth strategy.

6.5.3 Residential sector

The forecast for new residential connections is shown in Figure 6-7[47]. 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 Mechanical and Electrical consultants to a government paper recommending an effective ban on natural gas boilers, albeit 5 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 2021 with new housing orders reducing by 28% of the 2020 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

46 Industrial and Commercial sector growth rate is assumed to be 80% of GDP based on observed historical trends.
47 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.

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 and Commercial and Residential gas demands are derived from the National Energy Efficiency Action Plan 2017[48] (NEEAP4).

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 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.

Six public access CNG stations are now in operation, with two further stations under construction.

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.

6.6 The demand outlook
This section presents an overview of the gas demand outlook for the period 2020/21 to 2029/30.

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 GB, growing electricity demand, and, up to gas year 2019/20, carbon and fuel prices favouring gas-fired generation ahead of coal in the merit order for electricity generation. 2020/21 is projected to show a divergence from this trend due to increasing gas prices and as a direct result of a number of large CCGTs being on extended outages during 2021. It is anticipated, however, that power generation gas demand will recover from 2021/22 onwards when these units come back online.

Following updates to the wholesale electricity market in October 2018 via the I-SEM project, electrical interconnector behaviour has generally been efficient in that the interconnectors are mainly importing to Ireland when Irish electricity prices are higher than GB markets, and exporting at times of high wind when prices in the SEM are lower than in GB[49]. It is expected that this trend will continue in the short to medium-term in all scenarios. The trend may gradually swing back towards imports from GB to Ireland over the latter part of the forecast horizon should carbon prices on the ETS continue to rise as forecasted. These prices will depend on how carbon policy develops in the UK following the Brexit transition period. The UK ETS scheme, which was introduced in early 2021, is still in its infancy and plans to link it to the EU ETS are yet to be finalised. In all NDP demand scenarios, it is assumed that the UK ETS and EU ETS carbon prices converge towards the latter part of the NDP period.

Table 6-2: Annual CNG demand forecasts

GWh/yr	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Low	16.8	41.6	73.0	107.6	160.8	209.6	254.6	296.5	327.8	355.9
Best Estimate	16.8	41.6	76.3	122.1	197.7	277.6	365.8	461.5	543.4	603.1
High	20.8	84.9	172.9	286.9	432.7	562.4	681.8	799.4	898.5	974.5

48 National Energy Efficiency Action Plan, https://www.gov.ie/en/publication/93ee2-national-energy-efficiency-action-plan-neeap/
49 SEM committee Single Electricity Market Performance Quarterly Reports, available at https://www.semcommittee.com/publications

6. Gas demand forecasts
(continued)

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 the favouring of base load gas plant in the merit order ahead of coal and the closure of West Offaly and Lough Ree peat stations at the end of 2020. In the medium to longer-term, further growth in this sector is driven by the continued increase in electricity demand coupled with the anticipated closure of coal-fired generation units. However, some of this growth is negated by the projected levels of renewable generation penetration, particularly offshore wind. 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. The potential impact of these developments is assessed in the sensitivity in section 6.6.8.

Over the forecast horizon, growth of 15% 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 33% in their median electricity demand scenario, however it is dampened slightly in the longer term due to strong renewables penetration assumed by 2030.

The High demand scenario uses similar inputs and assumptions, with the exception of a) taking EirGrid High electricity demand forecast and b) including a renewables build-out rate which achieves 55% RES-E by 2030. Growth of 33% in Power Generation gas demand is anticipated in the High demand scenario.

The Low demand scenario uses the Low electricity demand forecasts as a primary input. It also assumes prolonged operation of Edenderry peat station beyond 2023 (co-firing on biomass). Growth of 5% in the Power Generation sector is projected over the ten-year horizon in the Low demand scenario.

Across all three demand scenarios a step change in demand is observed in 2022/23, resulting from coal losing its footing in the merit order, due to the gap between gas and coal prices narrowing (based on assumed fuel pricing). A second, less pronounced, step in demand in 2025/26, comes as a result of coal and peat plant closures, and is 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. This results in the highest projected annual gas demand for Power Generation figures across the NDP horizon. In all three scenarios, these step changes are negated somewhat towards the latter part of the NDP due to renewables penetration.

6.6.2 Industrial and Commercial sector gas demand

In the Industrial and Commercial sector, the Best Estimate demand scenario profile shows strong growth of 21% over the period of interest. In the Low and High demand scenarios, Industrial and Commercial sector gas demand is expected to grow by 5% and 24% respectively.

Anticipated growth in this sector is strongly linked to economic performance; as noted in Section 6.5.2, strong GDP growth is assumed in the short to medium-term. The previously forecast short-term negative economic impact of the COVID-19 pandemic and associated restrictions, as outlined in NDP 2020, did not materialise for 2020 and economic growth is now forecast for the full NDP 2021 horizon.

In addition to GDP growth, an increase in the projected number of additional (one-off) connections is also driving growth in the Industrial and Commercial sector. The Best Estimate scenario forecast number of new Daily Metered (DM) connections is 16% higher towards the latter part of the NDP horizon when compared to NDP 2020, with Gas Networks Ireland continuing to receive more large connection enquires year on year. Similarly, the High and Low scenarios show similar increases in forecast new DM connections of 31% and 19% respectively by the back end of the NDP horizon.

Industrial and Commercial sector projections take account of NEEAP4 Energy Efficiency measures in the sector.

Figure 6-8: Power Generation sector gas demand

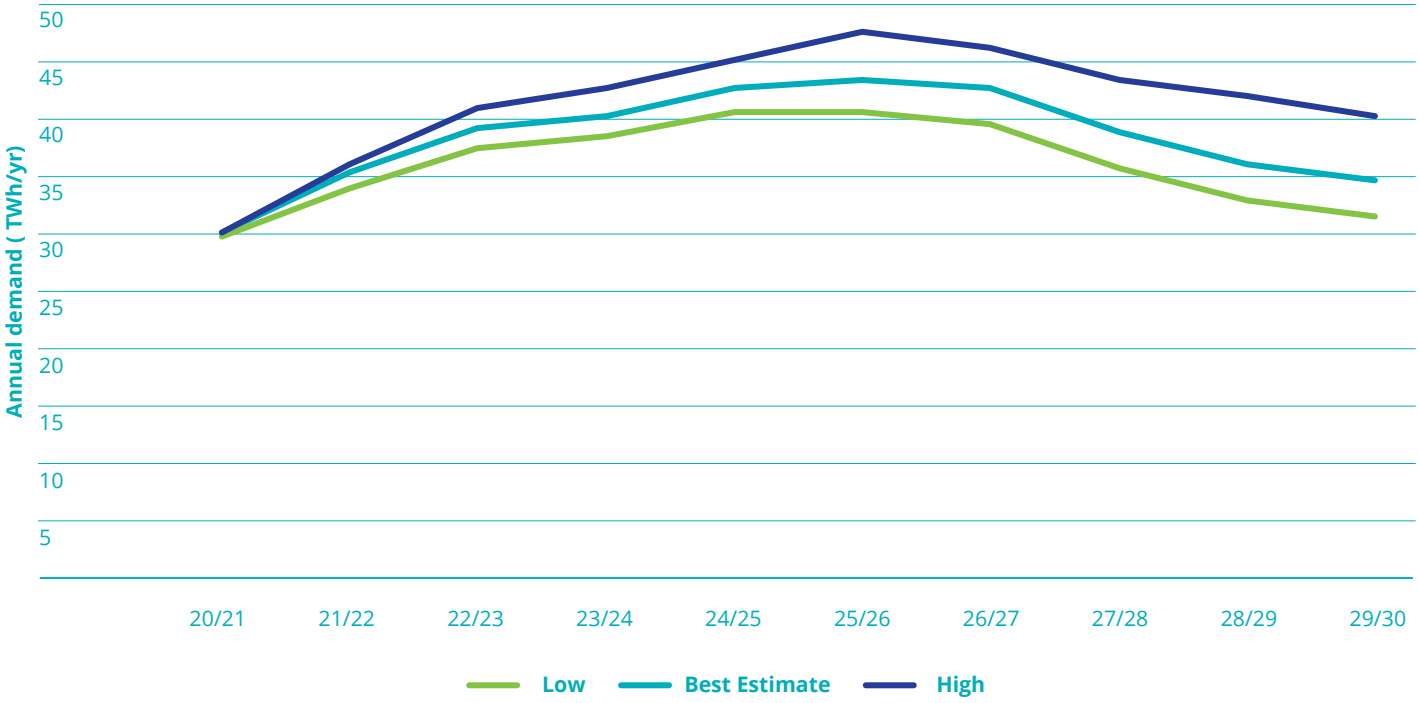
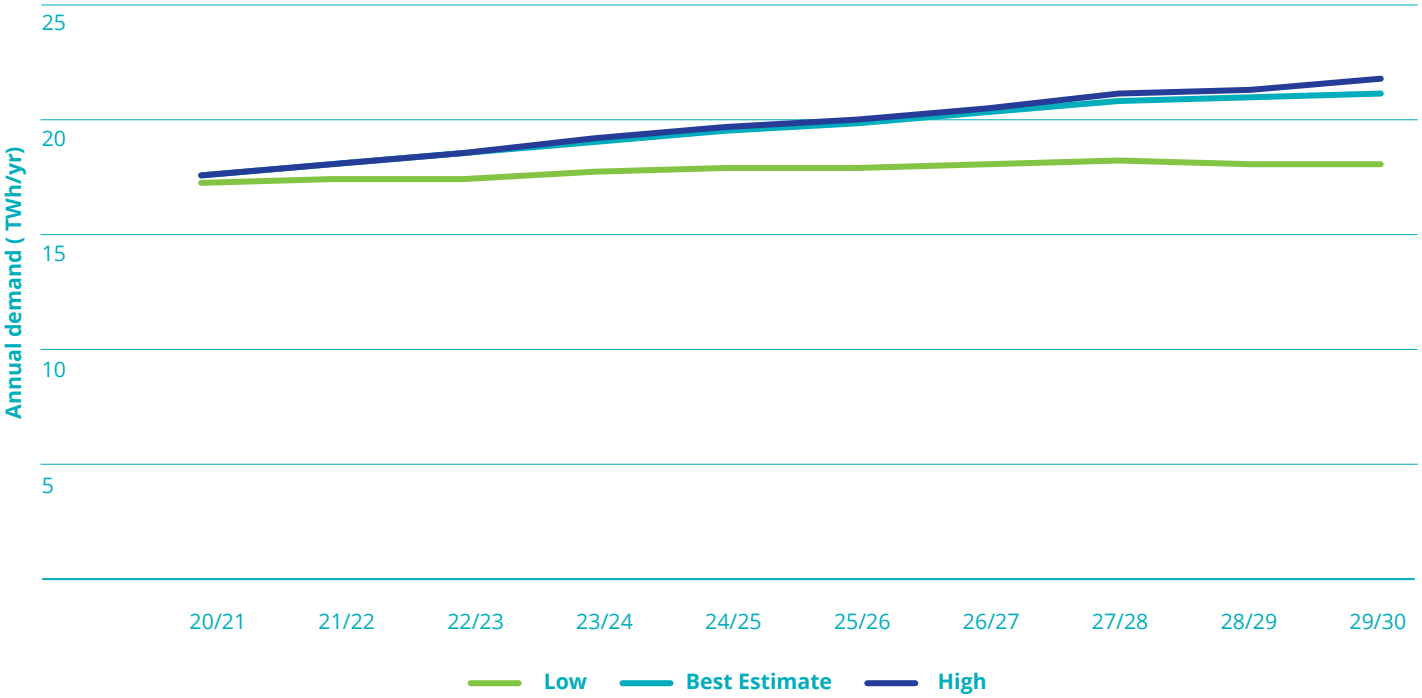


Figure 6-9: Industrial and Commercial sector gas demand



6. Gas demand forecasts
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Figure 6-10: Residential Sector Gas Demand

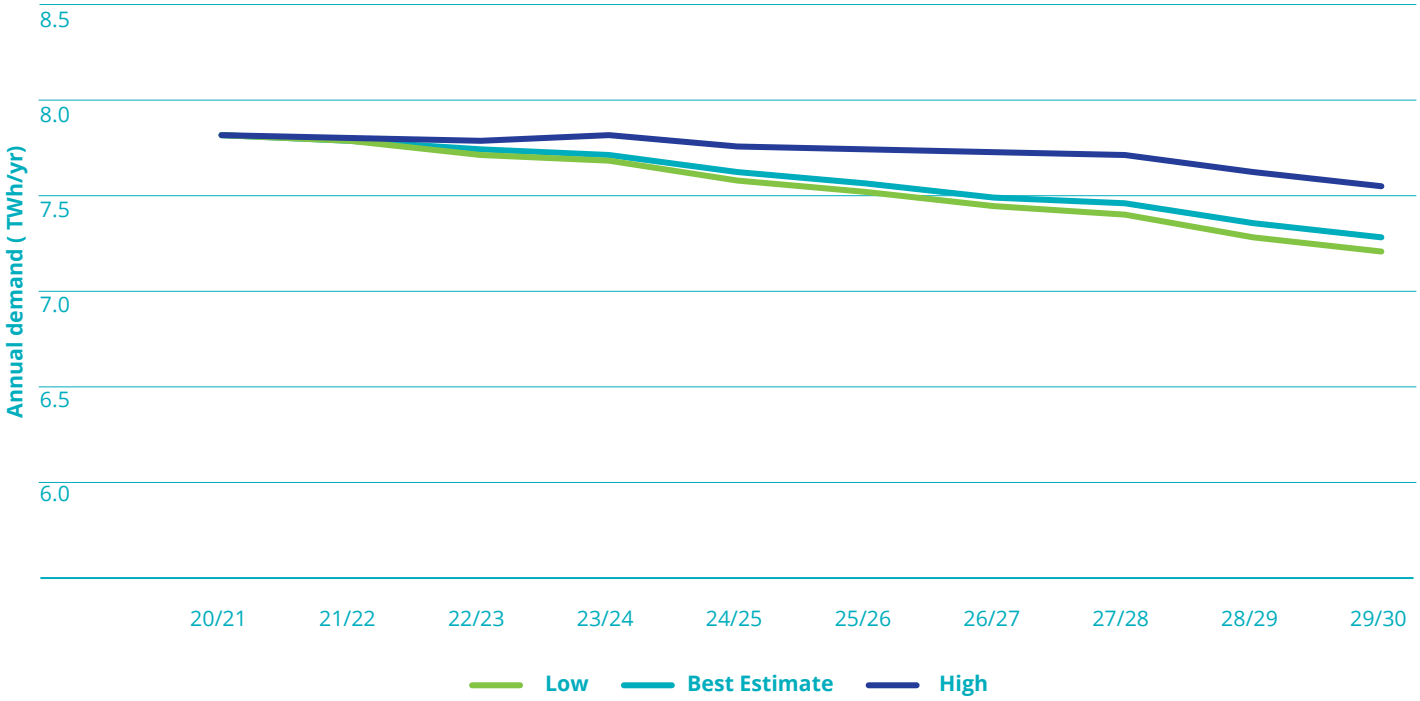
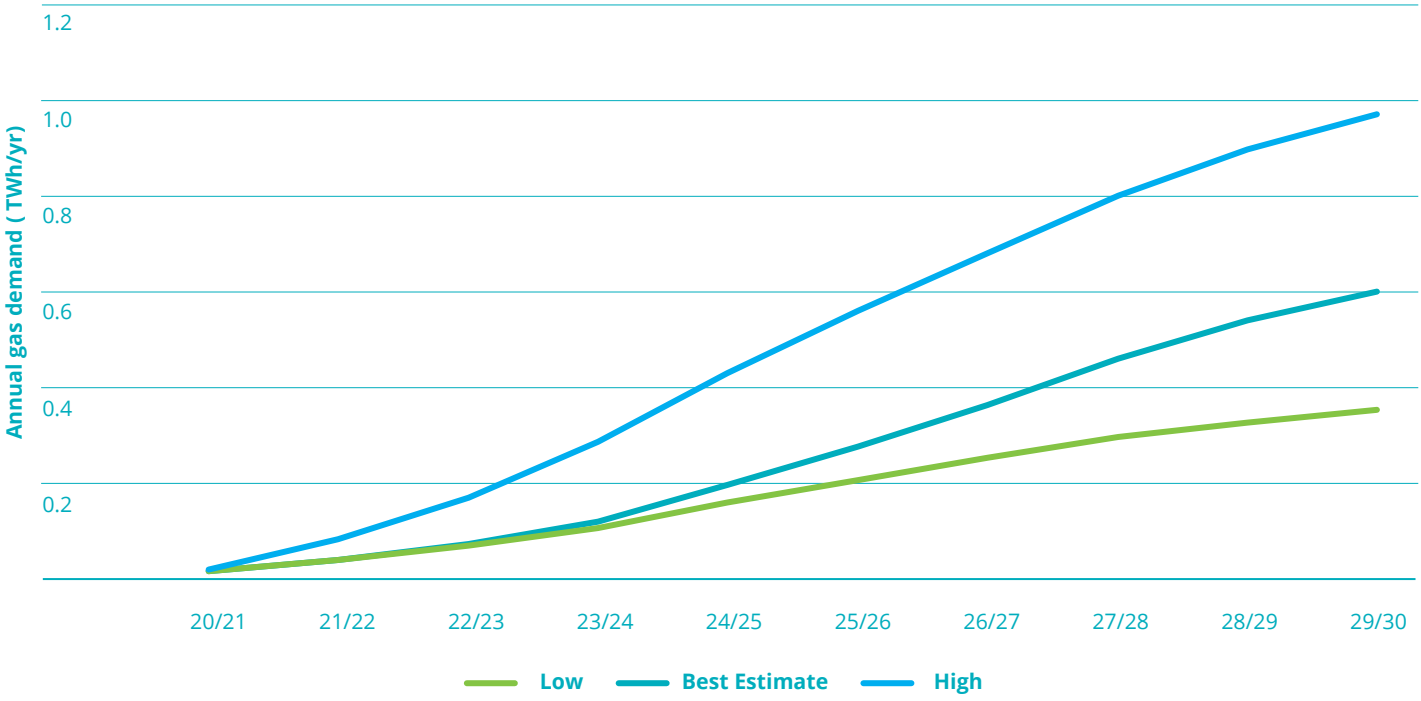


Figure 6-11: Transport Sector Gas Demand



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, coupled with an anticipated increase in disconnection rates in this sector. The Best Estimate scenario projects a reduction of 5.7% in the Residential gas demand sector across the forecast horizon. In the High and Low demand scenarios, 2.8% and 6.6% reduction in demand is predicted respectively.

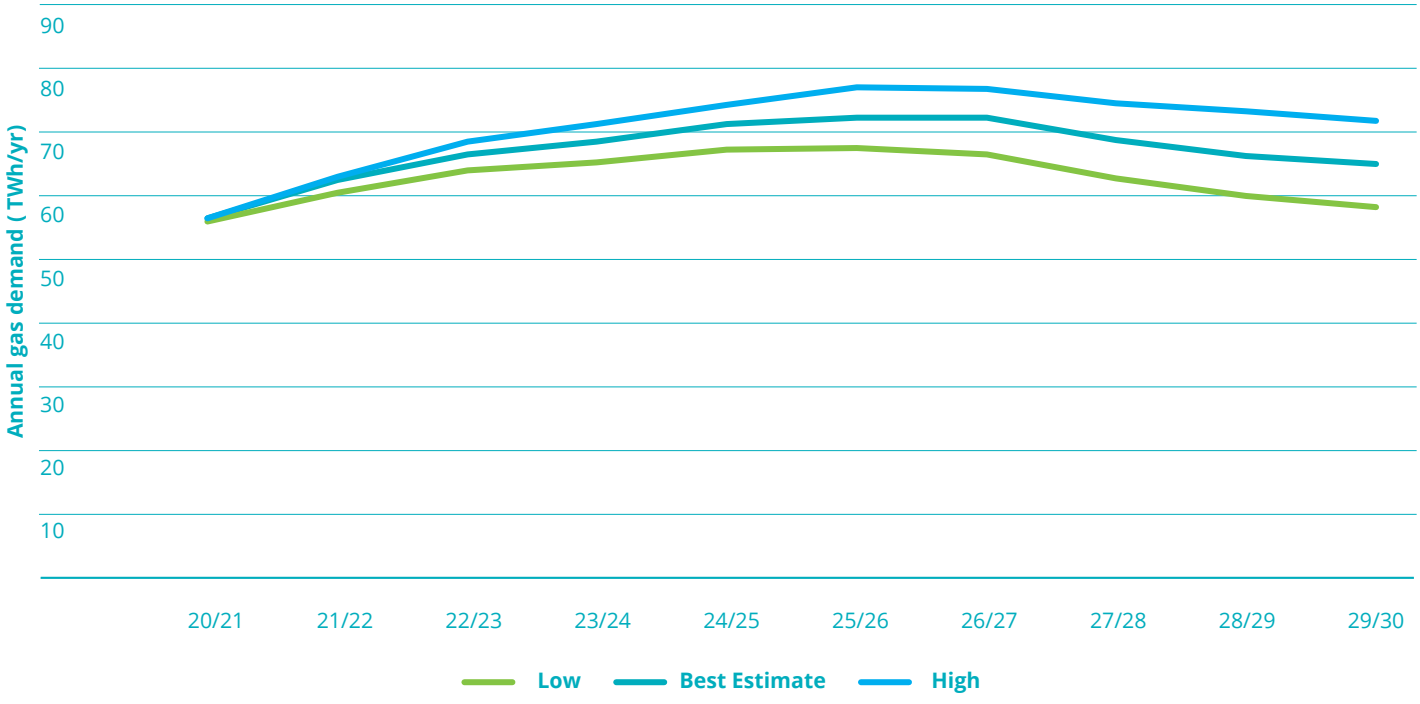
6.6.4 Transport sector gas demand

In the Transport sector, 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 connections expected to continue and increase across the ten-year NDP period. The Best Estimate demand scenario projects that 600 GWh/yr is in place by 2029/30, while the High and Low demand scenarios assume demands of 972 GWh/yr and 355 GWh/yr respectively.

6.6.5 Total annual gas demand

In the Best Estimate demand scenario, annual ROI gas demand is expected to grow by 15% between 2020/21 and 2029/30 with growth of 4% and 27% forecast in the Low and High demand scenarios respectively over the same horizon. The strong growth is a result of increasing Power Generation and Industrial and Commercial sector gas demands. Growth in Power Generation gas demand is driven by increasing electricity demand, and anticipated closures of other thermal plant on the SEM. Assumed new entrants to the SEM between 2023 and 2025 also contribute to the projected increase in the Power Generation sector.

Figure 6-12: Total Annual ROI Gas Demands



6. Gas demand forecasts
(continued)

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

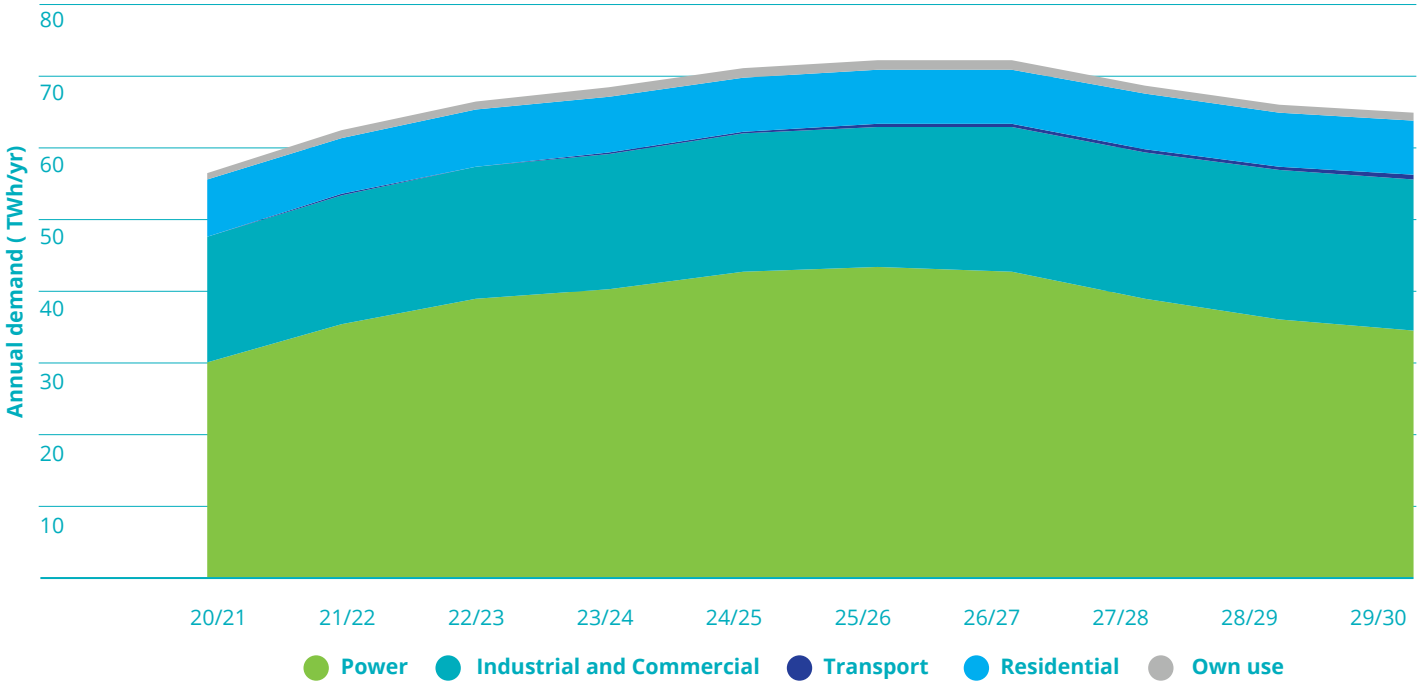
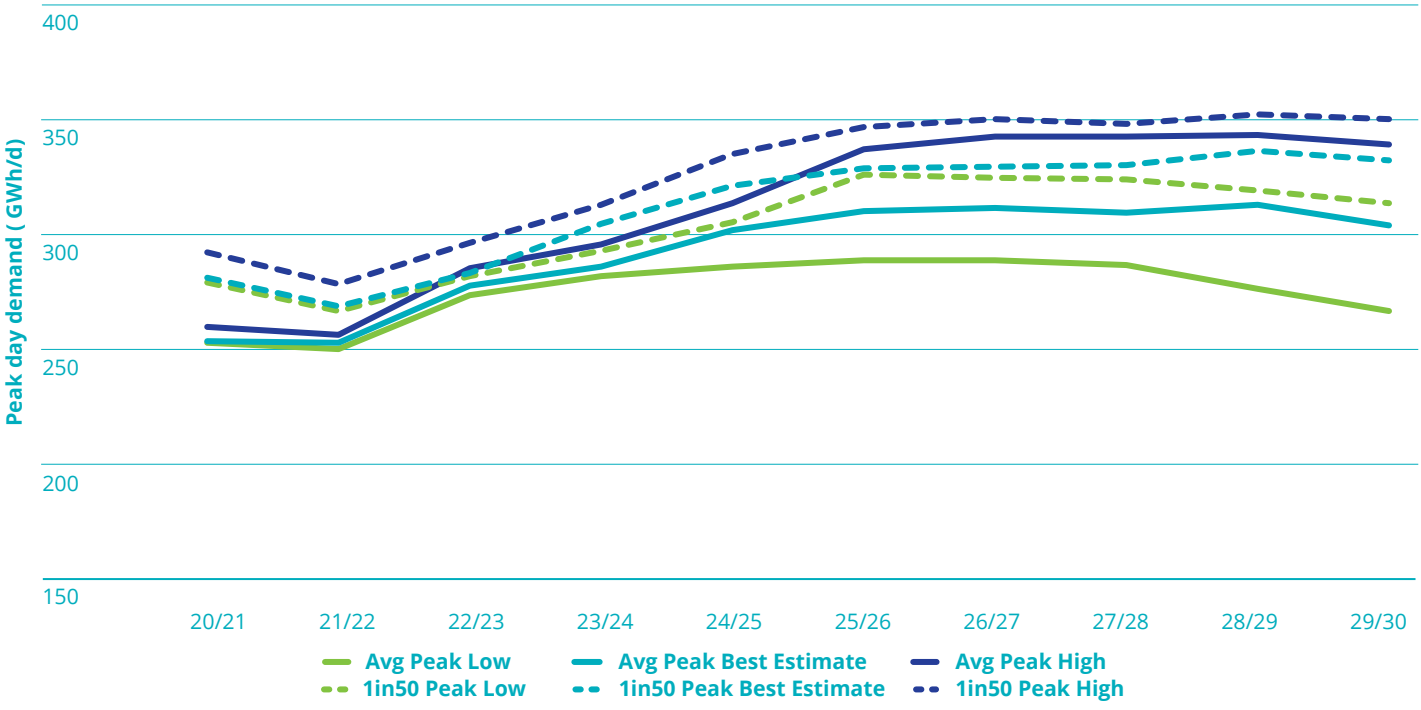


Figure 6-14: Peak day gas demand forecast



However, as outlined in section 6.6.1, the high level of renewables penetration towards the latter part of the NDP period dampens this growth in Power Generation gas demand in all three NDP scenarios.

An increase in the number of additional (one-off) connections in the Industrial and Commercial sector, coupled with strong projected economic growth, also contribute to the overall ROI growth projections. The aggregate ROI system demands for the three NDP scenarios 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 18% in the Best Estimate scenario while in the Low and High demand scenarios, growth of 12% and 20% is expected respectively. Average year peaks are expected to grow by 20% in the Best Estimate scenario and by approximately 5% and 31% in the Low and High demand scenarios respectively.

There is some decoupling of peak day and annual gas demand in the Power Generation sector 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.

The increasing penetration of renewable generation, particularly of offshore wind, does have a slight dampening effect on the peak day gas demand, with installed wind capacity assumed at 57% growth over the final four years of the NDP forecast horizon. In the final year of the NDP forecast horizon, peak day gas demand in certain scenarios demonstrates a slightly negative growth trend against year six (gas year 2025/26). A significant portion of this, however, is simply down to the assumed market dynamics between ROI and GB as modelled, with assumed long-term fuel and carbon pricing shifting to favour peak day imports from GB, displacing some gas generation from OCGT units. It is noted that the direction of interconnector flow changes regularly based on market conditions at a given time, and the modelled behaviour is no indication of what may actually transpire on the system at this level of daily granularity i.e. depending on market conditions at a point in time, interconnectors may operate as net exporters, thus increasing the peak day gas requirement over and above that shown in Figure 6-14.

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).

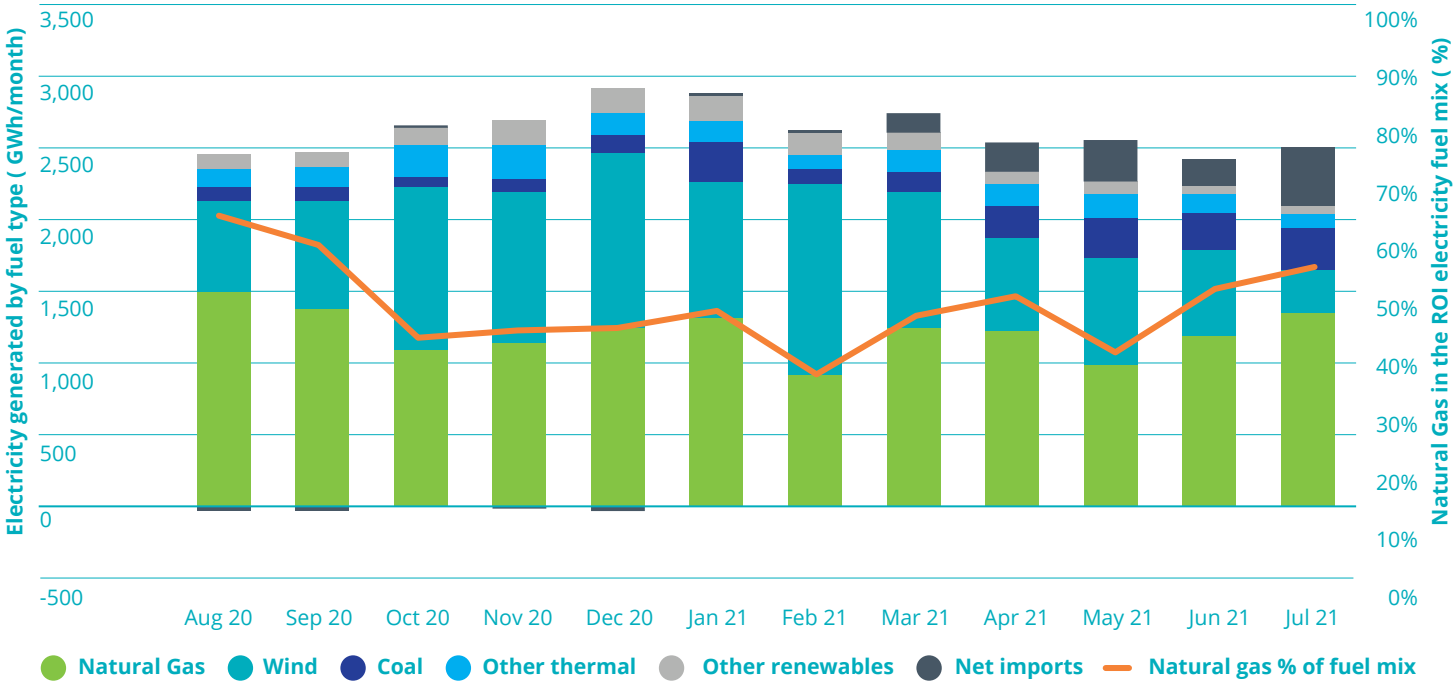
Table 6-3: Indicative carbon emissions by fuel type[50]

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

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

6. Gas demand forecasts
(continued)

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



Gas-fired generation accounted for approximately 51% of Ireland's electricity generation in 2020[51]. 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 710,000 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; it has provided and maintained 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 2021. 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 future operation of Moneypoint power station beyond 2025;
- potential change to future operation of Edenderry peat-fired power station beyond 2023 following the closures of West Offaly and Lough Ree power stations at the end of 2020;
- continued build-out of Wind Generation towards the 70% by 2030 RES-E target;

- new generator entrants to the SEM (both gas-fired and other energy sources), coming online between 2023 and 2025 aligning to T-4 capacity auction results;
- potential additional future electricity interconnection;
- UK carbon price projections.

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 2021 modelling assumptions to varying extents, whether as part of the NDP base case scenarios or as additional sensitivity analysis. The additional sensitivities are listed below; each was conducted with the Best Estimate scenario as the base scenario.

1. Electricity system developments required to meet the 70% RES-E target by 2030
2. Build-out of the North-South Interconnector in 2026
3. Build-out of additional interconnection with GB/France
4. Increase in the number of gas fired new generator entrants to the SEM in 2024

Note: The sensitivities were completed in isolation to ascertain the standalone effects on annual gas demand and 1-in-50 peak day gas demand.

Table 6-4 summarises the 10-year growth in ROI gas demand over NDP forecast horizon, for each of the sensitivities. A comparison against the equivalent results from the Best Estimate scenario is also included.

The results of the sensitivity assessments are described in further detail in the following sections.

6.6.8 Meeting RES-E target of 70% by 2030

While the Best Estimate and Low gas demand scenarios include the renewable generator build out rates included in the EirGrid / SONI All-Island Generation Capacity Statement (GCS) 2021-2030, neither scenario achieves the RES-E target of 70% by 2030, for the reasons outlined in Section 6.5.1. This sensitivity explores a number of measures that could, when combined, allow the RES-E target to be met in the NDP Best Estimate scenario. The first potential measure tested was the removal of the following existing operational constraints[52] on the Irish electricity network: a) system inertia requirement, b) system non-synchronous penetration (SNSP) limit and c) minimum generation constraints. It was found that removing these constraints resulted in an increase in renewable generation, due to less gas-fired generation being constrained on and to a decrease in renewables curtailment.

The second measure investigated was to increase the capacity factor of onshore wind farms in line with EirGrid's Tomorrow's Energy Scenarios (TES) 2019[53] Coordinated Action scenario.

Table 6-4: Sensitivity analysis results vs. Best Estimate (base case)

Scenario	2020/21 -> 2029/30 % growth (ROI annual)	vs. base case	2020/21 -> 2029/30 % growth (ROI 1-in-50 peak day)	vs. base case
Base case: Best Estimate	+ 15%		+ 18%	
S1: Meeting 70% RES-E target	- 6%	↓	+ 11%	↓
S2: North-South interconnector in 2026	+ 14%	↓	+ 17%	↓
S3: Additional interconnection to GB / France	+ 15%	=	+ 15%	↓
S4: Additional gas-fired generation	+ 15%	=	+ 37%	↑

52 https://www.EirGridgroup.com/library/
53 http://www.EirGridgroup.com/site-files/library/EirGrid/EirGrid-TES-2019-Report.pdf

6. Gas demand forecasts (continued)

The combination of increased capacity factors and removal of the operating constraints resulted in the RES-E target of 70% being met in 2030. It is noted that the measures modelled in this sensitivity analysis are somewhat arbitrary, for the purpose of examining the potential effect on gas demand for Power Generation in the context of the NDP modelling. This is not to say that the measures modelled are technically feasible or otherwise, from a practical perspective.

Table 6-4 shows that this sensitivity scenario yielded a negative growth in total annual ROI gas demand of -6% over the NDP horizon (compared to growth of +15% in the Best Estimate scenario). There is substantially less of an impact on severe 1-in-50 peak day gas demand, with growth of 11% projected for this sensitivity (against +18% in Best Estimate scenario). This is due to a continued reliance on gas fired generation in times of low wind conditions which can prevail during winter cold spells. As a result of the increased wind capacity factors in this sensitivity, however, the amount of wind in the fuel mix on the severe 1-in-50 peak day is slightly higher than in the base case Best Estimate scenario, contributing towards lower growth across the ten-year NDP horizon when compared to the Best Estimate scenario.

This result is significant in the context of planning infrastructure requirements on the gas network, as the network must continue to have increased capacity to deliver anticipated peak day demand requirements.

6.6.9 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 expected 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 2021 in any of the three demand scenarios. However, the EirGrid / SONI All-Island Generation Capacity Statement (GCS) 2021-2030 assumes that the interconnector becomes operational in 2026; hence 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 between ROI and NI. The net impact in a given year will be dependent on the prevailing electricity market dynamics in Ireland and GB.

Table 6-4 shows that the impact of this sensitivity scenario on the base case (Best Estimate) gas demand is minor, with a decrease of 1% in both the annual ten-year growth and in the peak day 10-year growth relative to the Best Estimate scenario.

A more notable impact of the North-South Interconnector is the enablement of the reduction in wind curtailment it will deliver on the island of Ireland resulting from the additional capacity for electricity flow between ROI and NI.

6.6.10 Additional electricity interconnection to GB/France

A number of interconnector projects have attained Project of Common Interest (PCI) status as part of the European Ten-Year Network Development Plan (TYNDP), including Celtic Interconnector (between Ireland and France) and Greenlink Interconnector (between Ireland and GB). As these projects are still at a preliminary stage, they have not been included in any of the three NDP demand scenarios. They have instead been assessed as part of a sensitivity assessment, whereby additional interconnector capacity between Ireland and GB was added to the NDP Best Estimate model to investigate the potential impact of Greenlink on the Irish electricity system.

The increase in interconnection with GB is anticipated to result in an increase in both imports to ROI from GB and exports from ROI to GB (depending on market conditions), while also decreasing net annual electricity transferred across the existing North-South interconnector. In addition, less curtailment of renewables is anticipated due to the increased capability to export excess electricity during high wind periods. The impact on annual gas demand is negligible under the modelled market conditions as the increase in imports and exports are balanced.

The effect on 1-in-50 peak day demand is more significant, showing a decrease in peak day ten-year growth (-3%) relative to the Best Estimate scenario. On the peak day, the new interconnector is importing strongly, thereby reducing the output at some gas-fired generators to minimum generation levels at periods throughout the day. As noted previously, this is entirely a function of the market conditions assumed on the model, including fuel and carbon prices in both markets (SEM and BETTA). The peak day impact is highly sensitive to these assumptions – the additional interconnection may as easily result in peak day exports should alternate market conditions prevail.

While the modelling was limited to additional interconnection between Ireland and GB, the results of this analysis may also be extended conceptually to further interconnection between Ireland and France, as specific market conditions are too uncertain to predict with any level of accuracy over the time period being considered.

6.6.11 Additional gas-fired generation

Several new gas-fired generators, which were successful in recent 2021 T-4 capacity auctions, are due to become operational between 2023 and 2025 and will to an extent replace some of the thermal generators retiring during this timeline. However, EirGrid still identifies capacity shortages in their adequacy assessments included in the EirGrid / SONI All-Island Generation Capacity Statement (GCS) 2021-2030. In their Median Demand, Low Availability scenario, a deficit of generation capacity of 570 MW is identified for 2030. In this sensitivity analysis, the effect of meeting this capacity deficit through additional Open Cycle Gas Turbines (OCGTs), is analysed.

Annual gas demand remains largely unaffected by the inclusion of the additional OCGT capacity (aggregate totalling 570 MW) from 2024 onwards. This is because the new OCGTs are anticipated to operate at low load factors, due to an anticipated lower position in the merit order than existing base-load Combined Cycle Gas Turbines (CCGT).

These newer OCGTs will, however, displace older, less efficient OCGTs and distillate units in the merit order. As a result, the impact on 1-in-50 peak day gas demand is significant, showing a substantial increase in peak day ten-year growth, 19% higher than the equivalent increase in the Best Estimate scenario.

7

Gas supply

Key messages:

The Corrib gas field is expected to meet up to 25% of annual Gas Networks Ireland system demands (33% of ROI demand) in 2020/21, with the Moffat Entry Point providing the remaining 75%.

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 2020/21 to 2029/30.

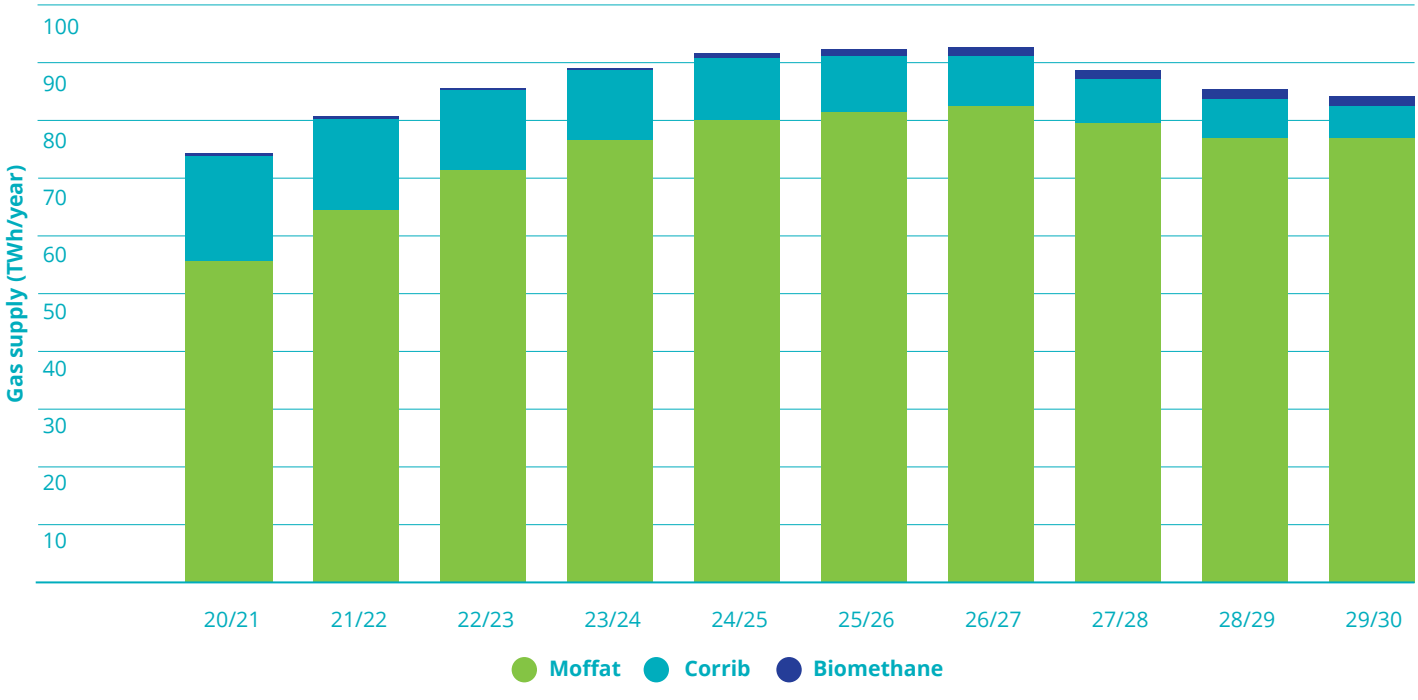
As noted in the 2020 NDP, the reduction in Corrib and Inch gas supplies re-established the Moffat Entry Point in Scotland as the dominant supply point in 2018/19. For 2020/21, the Corrib gas field is projected to account for 33% of ROI supply, with gas imports via the Moffat Entry Point accounting for the balance of gas supplies (67%).

Looking forward, the above trend continues to the end of the forecast horizon. In 2021/22 Corrib is anticipated to meet up to 20% of annual Gas Networks Ireland system[54] demands (26% of ROI demand), with the Moffat Entry Point providing the remaining 80%. By 2029/30 Corrib gas supplies will have declined to less than 16% of initial peak production levels. By the end of the forecast horizon Moffat will account for approximately 92% of annual Gas Networks Ireland system demands (approximately 89% of ROI demand).

Figure 7-1 presents the forecast Gas Networks Ireland system annual gas supply for the period to 2029/30 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 is expected to supply approximately 12% of Gas Networks Ireland system demand and 17% of ROI peak day gas demand in 2021/22 in the event of a 1-in-50 winter peak day.

Figure 7-1: Annual Gas Networks Ireland System Gas Supply Forecasts – Best Estimate Scenario



54 Gas Networks Ireland system supply is equivalent to the total gas supplied at the Moffat and Bellanaboy Entry Points, including all supplies for ROI, NI and IOM.

7. Gas supply
(continued)

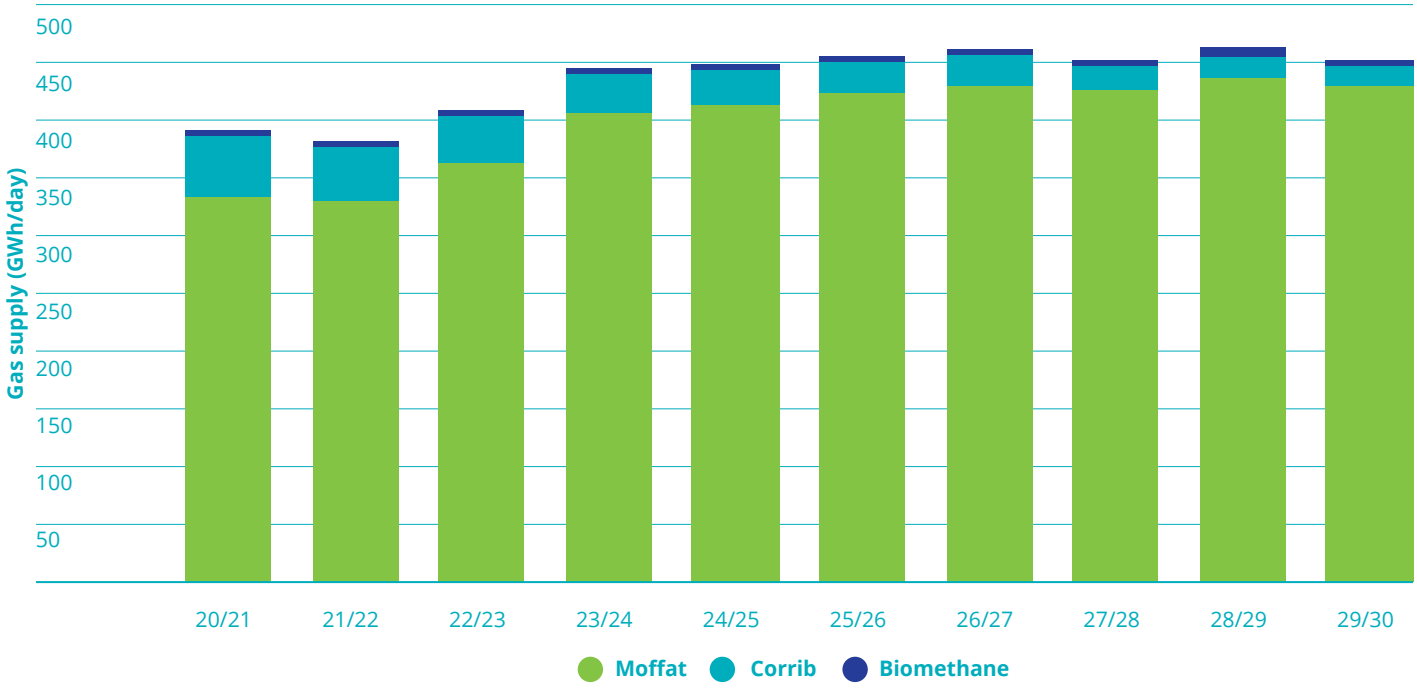
The Moffat Entry Point would be expected to meet nearly 88% and 83% of Gas Networks Ireland system demand and ROI demand respectively in 2021/22, in such circumstances. Moffat is anticipated to meet 95% and 94% of Gas Networks Ireland and ROI system peak day demands respectively in 2029/30.

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 seven years of the forecast horizon. While the capacity on the interconnector pipeline infrastructure is more than sufficient to 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 has commenced analysis of potential long-term solutions to the Moffat constraint. In the short to medium-term, operational measures have been identified which will be sufficient to mitigate the constraint over the duration of the forecast horizon considered in the NDP; one such option would be to increase gas inventory storage on the subsea interconnectors over the winter months. Following a period of further monitoring of supply and demand developments in the coming years, Gas Networks Ireland will be positioned to implement the appropriate pre-emptive operational mitigation measures as and when required.

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 system 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 with upstream counterparties. The UK wholesale gas market is extremely liquid with diverse supply sources from the UK, Norway, mainland Europe and further afield.

Figure 7-2: 1-in-50 peak day gas supply forecast – Best Estimate scenario



Wholesale supply contracts into the ROI market are for variable duration and volumes because 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).

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.

7.3 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 an appropriate support mechanism, Gas Networks Ireland has produced three renewable gas production scenarios (Low, Best Estimate and High).

Table 7-1: Corrib forecast maximum daily supply

	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Daily Supply (mscm/d)	5.24	4.44	3.90	3.34	2.94	2.66	2.39	2.12	1.85	1.58
Daily Supply (GWh/d)	54.8	46.5	40.8	34.9	30.8	27.8	25.0	22.2	19.4	16.5

7. Gas supply
(continued)

Table 7-2: Renewable gas supply forecast

TWh/yr	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Low	< 0.1	< 0.1	< 0.1	0.3	0.6	1.0	1.3	1.5	1.6	1.6
Best Estimate	< 0.1	< 0.1	< 0.1	0.3	0.6	1.0	1.3	1.5	1.6	1.6
High	< 0.1	< 0.1	<0.1	0.3	0.6	1.1	1.6	2.2	3.0	3.8

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 anticipates 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 facilities and therefore biomethane production. This has informed Gas Networks Ireland's assumption regarding 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 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 7-2 shows Gas Networks Ireland's renewable gas production forecast. Renewable gas is discussed further in Section 8.5.

7.4 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 is 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.

As outlined in Section 4, looking beyond 2030, the gas network can be fully decarbonised by utilising hydrogen. In the interim it is possible that hydrogen could materialise on the network within the forecast horizon of the NDP, in low blended volumes. Gas Networks Ireland continue to monitor hydrogen developments in Ireland and other jurisdictions, and will incorporate supply projections for hydrogen in the NDP as soon as they become available.

Gas growth

Key messages:

The gas network in Ireland is a critically important strategic infrastructure providing a natural gas supply to over 710,000 Residential, Industrial and Commercial customers across the country.

The gas network remains key to Ireland's future economic growth, with thousands of businesses and homes connecting to natural gas every year. In the five years from 2016 and 2020, Gas Networks Ireland connected over 50,000 homes and businesses to the natural gas network and growth continues across all sectors as homes and businesses look to connect to this cost effective, versatile, reliable, safe and environmentally friendly source of fuel.

The network will also play an important role in reducing Ireland's Greenhouse Gas (GHG) emissions with decarbonisation of the gas network a primary focus for GNI into the future. The introduction of renewable gases such as biomethane and hydrogen into Ireland's gas network will enable more than 710,000 current natural gas users to economically switch to more renewable gases to reduce their carbon footprint.

Power Generation and Data Centres are two sectors that will rely more and more on natural gas to meet both their primary and secondary/back-up fuel requirements. Significant growth is expected in these two key sectors as the electricity grid struggles to meet demand and increased flexible capacity is required to meet peak demand. Gas Networks Ireland has been working with participants across these two industries and has contracted with a number of Power Generation and Data Centre operators over the past number of years. This is expected to grow considerably in the coming months and years as the availability of natural gas capacity becomes even more important for these operators.

The commercial sector relies heavily on natural gas with over 50% of fuel used by businesses across the country coming from the natural gas network. This choice is driven primarily by advantages such as cost, versatility, reliability and convenience offered by natural gas over other fuels. The cleanliness of this fuel is now becoming more of an advantage as businesses strive to lower their carbon footprints. Emissions savings compared with oil and LPG are becoming more important for businesses and this continues to drive growth in the commercial sector for Gas Networks Ireland as new customers join the natural gas network.

Gas Networks Ireland estimates that there are up to 300,000 households in Ireland that are located on or close to the gas network and that are using oil-fired central heating systems. The emissions associated with these households can be instantly reduced by more than 20% by simply connecting these homes to the natural gas network and switching the heating systems from oil to natural gas.

Natural Gas remains a fuel of choice among builders and developers involved in the design and construction of multi-occupancy buildings or apartment block developments.

Public access CNG stations have been constructed at the Circle K Service Station in Dublin Port, Circle K Cashel on the M8 motorway, Circle K Clonshaugh in Dublin and Circle K Ballysimon Road in Limerick.

There are currently 8 additional contracts for publicly available stations with forecourt operators on the core motorway network.

The first renewable gas injection facility in Ireland was commissioned in 2019 and was declared a gas entry point in May 2020.

8. Gas growth
(continued)

Gas Networks Ireland currently transports natural gas to over 710,000 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'[55] and the resulting report recognises that increasing the number of dwellings connected to the gas network has the potential to reduce emissions where dwellings are switching from, for example, oil or coal to natural gas. It is evident that gas, both natural and renewable, has an essential role to play in Ireland's transition to a low carbon economy. The advent of renewable gas will have a profoundly positive impact on the challenge of decarbonising domestic heating as this is one of the most challenging sectors to decarbonise. Once a sufficient level of renewable gas is available on the gas network, there will be an opportunity for up to one million homes, including those already connected and those with relatively easy access to the gas network, to be decarbonised via the gas network.

Compressed Natural Gas (CNG) is a low emission solution that can be used to decarbonise parts of the Transport sector. CNG is natural gas that has been compressed to fit into a gas vehicle's tank. It is particularly suitable for use in commercial vehicles where electric solutions are not a viable option. 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 685,000 residential customers throughout Ireland. This represents around one third of all homes in Ireland. Between 2016 and 2020, Gas Networks Ireland connected almost 27,000 newly built homes to the natural gas network with an average completion of approximately 5,300 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).

Gas Networks Ireland currently provides a safe, reliable and secure supply of natural gas to over 685,000 residential customers throughout Ireland. This represents around one third of all homes in Ireland.

55 https://www.esri.ie/publications/access-to-and-consumption-of-natural-gas-spatial-and-socio-demographic-drivers-0

Despite an increase in homes being built in Ireland to meet the housing shortages, there was a drop of almost 33% in the number of new homes connecting to the gas network during 2020 compared with 2019. A proportion of this reduction can be explained by the global Covid-19 pandemic in 2020 which placed heavy restrictions on the construction industry, among others, and resulted in a reduction in new home completions. The reduction is mainly due, however, to much more stringent Building Regulations (Near Zero Energy Buildings/NZEB) introduced at the end of 2018 making it easier for builders to meet these standards through the use of renewable technologies such as electric heat pumps compared with the installation of a natural gas network through the housing estate and the inclusion of multiple solar panels on all of the newly built homes.

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 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 Continuous Professional Development (CPD) presentations, that natural gas, in conjunction with solar PV or solar thermal technology, 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-term and hydrogen in the medium to long-term, gas will also deliver decarbonisation in the home heating sector.

In addition to the traditional housing estates built over the past number of decades, a growing focus has been on the development of multi-occupancy buildings (MOB) in the form of large-scale apartment blocks. This demand for high density, often located in urban environments, is growing and many developers are now focussing on the design and construction of multi-story apartments to meet this new demand. These developments are generally situated in urban areas where there is a widespread availability and capacity on the natural gas network, and more and more developers are opting for natural gas as their fuel of choice while also implementing hybrid renewable solutions. Gas Networks Ireland has published a number of case studies in recent years demonstrating the use of high efficiency condensing natural gas boilers in conjunction with Combined Heat and Power (CHP) and either solar PV or electric heat pumps and how these solutions can meet the BER A-Rated requirements of new developments of this type. Our most recent case studies illustrate two different solutions using natural gas and CHP, one using a combination including commercial electric heat pumps https://www.gasnetworks.ie/home/gas-benefits/case-studies/bridgefield/ and the other using natural gas, CHP and solar PV https://www.gasnetworks.ie/home/gas-benefits/case-studies/griffith-wood/.

8. Gas growth
(continued)

Both solutions incorporate district heating systems with a Central Boiler contained within a single boiler house and one natural gas meter providing gas to the CHP unit and back-up boiler. The CHP provides the electricity to the electric heat pump in the first case (Bridgefield), or to the public lighting units in the second case (Griffith Woods). The waste heat from the CHP unit, considered to be a renewable contribution, plus the output from the electric heat pump, provide the majority of the hot water requirements and can be "topped-up" when needed from the natural gas boiler(s). In the case of the Griffith Wood development, the electricity output from the solar PV panels provide electricity for the public areas of the apartment (e.g. lights, lifts, security etc). These are excellent cases of well-designed solutions meeting A-Rating requirements and offering residents the best value for money proposition due to the high efficiency operation of the energy systems.

In relation to the built environment, between 2016 and 2020, Gas Networks Ireland connected over 20,500 mature/existing homes to the natural gas network, on average approximately 4,100 per year. These were existing homes converting from other fuel sources, mainly oil, to natural gas. The conversion from oil to gas generally formed part of energy efficiency measures carried out on the home including, for example, the addition of 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 the cost of deep retrofit activities.

Gas Networks Ireland estimates that there is 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[56]. This would result in significant benefits from an environmental perspective, considering natural gas heating systems emit 22% less CO_2 and negligible levels of NOx and SOx when compared to oil heating systems. 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 and 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 larger or older homes[57]. There are some estimates that highlight that the typical cost of a full scale deep retrofit to BER B2 or A3 standard can be between €40,000 and €60,000[58]. This 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 generally includes the cost of an electric heat pump, installation of underfloor heating, wall and attic insulation, exchange of all external doors, creation of an air-tight environment etc. The levels of disruption associated with deep retrofits can be very high, with residents potentially being required to move out for a period of weeks or even months while the deep retrofit 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 as possible. 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 cylinder), switching to high efficiency condensing gas boilers and electronic heating controls, replacing lighting with LED equivalents and installing solar PV panels.

56 'The Future of Oil and Gas in Ireland', Policy Advisory by the Irish Academy of Engineering, February 2013.
57 https://www.irishtimes.com/news/health/500-000-homes-to-be-retrofitted-for-energy-efficiency-1.3929819.
58 https://superhomes.ie/ - SuperHomes Cost of Works.

Between 2016 and 2020, Gas Networks Ireland connected almost 3,000 new Industrial and Commercial customers to the natural gas network, an average of almost 600 per year.

This work can be carried out at up to one third of the cost[59] of the deep retrofit works, and with significantly less disruption (works can be carried out in a shorter timeframe and without displacing the occupants). 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 preparing these homes for renewable gas as it becomes available in greater quantities on the network.

Gas Network Ireland's alternative to the Government plan to "deep retrofit 500,000 homes by 2030" should be to "decarbonise 1,000,000 homes by 2040" focussing on the short-term switch from oil to natural gas followed by a longer-term investment in decarbonisation of the natural gas network with indigenous renewable gases such as biomethane and hydrogen.

8.2 Industrial and Commercial sector development

Gas Networks Ireland currently provides a safe, reliable and secure supply of natural gas to c. 30,000 Industrial and Commercial customers throughout Ireland. Between 2016 and 2020, Gas Networks Ireland connected almost 3,000 new Industrial and Commercial customers to the natural gas network, an average of almost 600 per year. These were made up of a high number of Small and Medium Enterprise (SME) low energy commercial consumers and a smaller number of higher energy consuming industrial 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.

59 This is based on analysis carried out by Gas Networks Ireland.

8. Gas growth
(continued)

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 industries are almost fully reliant on natural gas as a means of providing heat, hot water, steam and even electricity to their manufacturing or production processes. These industries 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.

Interactions between Gas Networks Ireland and the IDA over the years has proven that the availability of natural gas is a critical requirement for almost all large Foreign Direct Investment (FDI) organisations considering setting up new manufacturing facilities in Ireland. Organisations like Shire Pharmaceutical, WuXi Pharmaceuticals and Center Parcs all set the availability of natural gas as one of the most critical requirements when deciding to set up operations in Ireland.

For example, the multi-national holiday village operator Center Parcs funded a 28 km natural gas network extension from Athlone to their holiday village development in Co. Longford to ensure that they had access to this cost competitive, secure, flexible and environmentally friendly fuel to fuel and power their €200 million development. They constructed a significant downstream gas network within their site and installed individual natural gas boilers in every one of their 500+ lodges to provide heating and hot water to the residents while natural gas is also used for cooking in their restaurants and cafes. They also installed a number of Combined Heat and Power (CHP) engines to provide electricity and heating/hot water to their facilities, with a particular focus on providing constant heat to their indoor tropical swimming pool.

In addition, many Industrial and Commercial customers like those mentioned above, including those in the Public Sector responsible for energy procurement, are now actively looking to renewable gas as a means of further decarbonising their businesses and 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) or disruption involved with changing fuels. Further information about renewable gas can be found in Section 8.5.

Some of the other key areas of focus for GNI in the Industrial and Commercial sector are detailed in the following sections.

8.2.1 Data centres

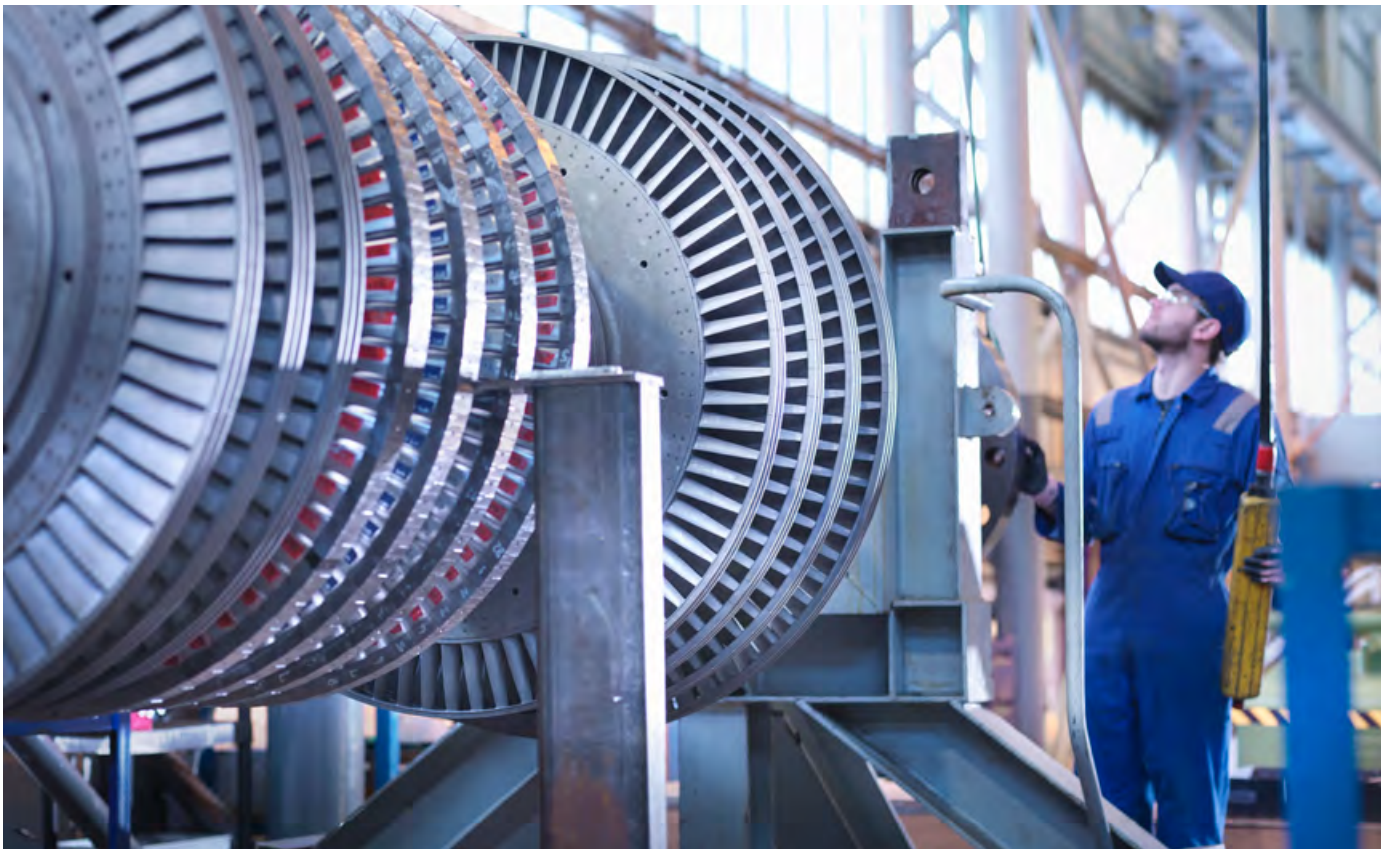
Data centres have emerged as a potential growth sector in Ireland due to the country's global connectivity to Europe and the Americas, combined with excellent utility infrastructure, moderate climate, stable economic policies and IDA[60] support. By 2030 data centres and other large users could consume 23% of Ireland's electricity[61]. Data centres are inherently large users of electricity with their annual usage varying from 12 GWh_e/yr for a small data centre to a 520 GWh_e/yr for a very large data centre. There are now an estimated 70 data centres[62] currently operating in Ireland with 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 in several different ways to complement the electricity grid for data centre operation.

60 The IDA (Industrial Development Agency) is a semi state body whose main objective is to encourage investment into Ireland by foreign-owned companies
61 https://www.eirgridgroup.com/site-files/library/EirGrid/208281-All-Island-Generation-Capacity-Statement-LR13A.pdf
62 Ireland's Data Hosting Industry Q2 2018 Update http://www.bitpower.ie/images/RDDSTUDY/Bitpower_2018_Q2_Update_V4.pdf

Firstly, natural gas can be used for onsite electricity generation to meet the primary needs for electrical power to meet the requirement of their Information and Communications Technology (ICT) equipment. This can be an arrangement in which there is insufficient electricity grid capacity and the gas-fired generation is designed to be the lead generator, with back-up provided by back-up generators operating on diesel. Some grid electricity can also be used on site depending on capacity available. The second use can be to provide additional electricity capacity at peak times when the electricity grid cannot meet the demands of the data centre and the local area demands. The gas-fired generation then acts as a peaking unit, only being called upon when required. In this case, this same gas-fired equipment can also be used as a back-up in the case of local grid power outage. A third use of natural gas for data centres is solely for back-up generation in the case of local grid power outages, thus replacing the traditional alternative of diesel back-up. Recent developments in fast start-up gas engine technology has enabled this back-up solution to become reality, removing the requirement for diesel generation during testing and outages, and alleviating a concern that all data centres have in relation to CO_2 emissions associated with combustion of diesel fuel (note that all back-up engines are tested several times per week to ensure that they

Data centres have emerged as a potential growth sector in Ireland due to the country's global connectivity to Europe and the Americas, combined with excellent utility infrastructure, moderate climate, stable economic policies and IDA support.



8. Gas growth
(continued)

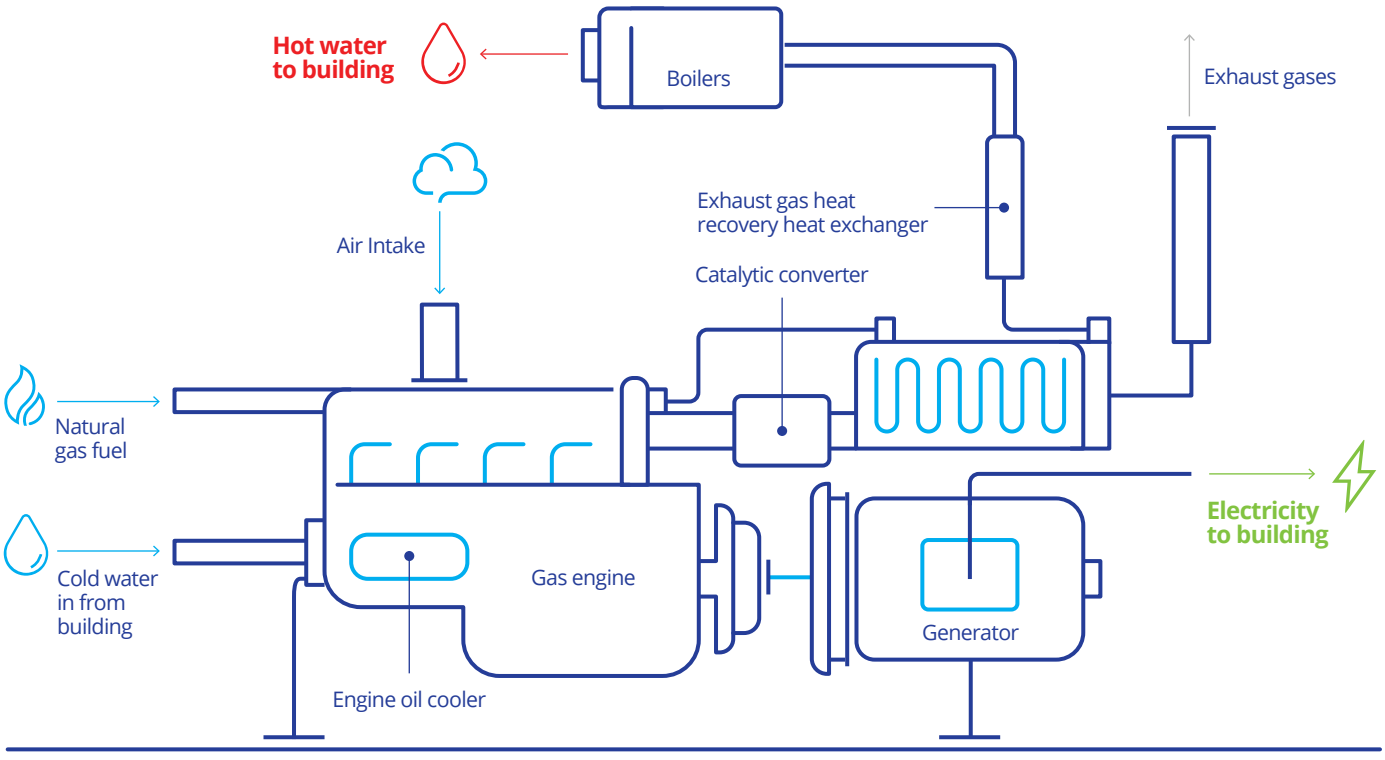
are available and online if an outage occurs, so the use of diesel can be considerable, together with the associated emissions).

Due to the inherent reliability of the natural gas network, achieved by the fact that all gas pipelines are buried underground and not impacted by adverse weather conditions, data centres have realised that they can leverage this existing reliable and versatile gas network infrastructure, offering Data Centre operators a primary source of power for data centres requiring 99.999% availability. Gas Networks Ireland has already contracted with a number of Data Centre operators for natural gas connections and currently supplies natural gas to a number of operating facilities. Furthermore, Gas Networks Ireland is in discussions with multiple Data Centre developers and operators and we expect considerable growth of gas connections in this sector in the coming years.

8.2.2 Combined Heat and Power
Growth in the Combined Heat and Power (CHP) sector is another area which could potentially influence network 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, moving away from low efficiency centralised power generation to localised high efficiency generation and reducing the reliance on the national electricity grid. This move to a more distributed generation arrangement also provides significant carbon emissions and energy savings today compared with grid electricity.

According to the SEAI[63], the use of CHP in 2019 avoided 499 kt CO_2 emissions when compared with separate electricity and heat production. Also, in 2019 6.6% of Ireland's electricity was from CHP installations, down from 7.0% in 2018. In 2019, there were 17 units exporting electricity to the

Figure 8-1: Combined heat and power



63 https://www.seai.ie/publications/CHP-Update-2020.pdf

grid. These units exported 1,337 GWh of electricity in 2019, a decrease of 4.1% on 2018. Unfortunately, these figures show a decrease in the uptake of CHP technology, however the operational capacity of CHP in Ireland at the end of 2019 was 322 MW_e (319 units), an increase of 3.1 MW_e (1.0%) in operating capacity from 2018, so some progress is being made. In addition, there was a primary energy saving of 20% or 1,531 GWh from CHP plants in 2019 compared to separate heat and electricity production which proves that the use of this technology not only reduced primary energy consumption but also reduces emissions which puts this technology in a favourable position to assist Ireland with meeting its climate change targets.

Applications of CHP technology range from small to medium users such as nursing homes, fire stations, hospitals and hotels up to large industrial applications such as data centres, dairy processing plants and the pharmaceutical sector. 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 several years now, including at three CHP Conferences held during the last four 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 ten-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 flexible thermal peaking power generation plants.

The latest T-4 capacity auction awards, coupled with the requirement to run a T-3 Capacity Auction in early 2022, signal that there is capacity shortfall on the electricity system which needs to be addressed. There are short, medium and long-term requirements for additional flexible peaking power plants and this demand is expected to result in significant growth across this sector for natural gas-fired solutions requiring gas connections to the Gas Networks Ireland network.

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.

8. Gas growth
(continued)

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.

The Center Parcs project mentioned earlier 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 was fully commissioned in 2020. This provided an additional benefit to the residents and businesses of Ballymahon on top of the Center Parcs benefits.

Gas Networks Ireland has also begun working closely with Local Authorities (County and City Councils) to identify synergies in relation to Public Realm Works planned by these Local Authorities. The term "Public Realm" broadly refers to those areas of a town or city to which the public has access. It includes streets, footpaths, parks, squares, bridges and public buildings and facilities. Works associated with these areas generally involves civil works to improve the quality of the services provided in these areas, for example resurfacing of streets and roads to improve the road surface for motorists, pedestrianising certain routes within cities, redesigning public areas to make them more amenable or comfortable etc. After such works are carried out by Local Authorities, there is generally a long moratorium period during which these roads, streets or surfaces in general cannot be opened for any services (gas, electricity, telecoms, water etc). Gas Networks Ireland has been engaged with multiple Local Authorities to secure advanced notification of planned Public Realm Works to give residents and business owners along these streets or roads the opportunity to connect to the natural gas network in advance of the works commencing. Gas Networks Ireland will instigate letter-drops to all affected homes and businesses alerting them to the fact that this impending moratorium can rule out possible natural gas connections for up to five or ten years. This approach has been very successful in several areas during 2020 and 2021, receiving very positive feedback from both residents/business owners and Local Authorities alike, and will be widened to include additional Local Authorities in the future.

8.3 New towns and suburbs policy

The towns of Nenagh, Wexford, Listowel and Ballymahon 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 commercial requirements of the new towns section of the Gas Networks Ireland Connections Policy.

An independent analysis has been carried out by the Contract Research Unit at IT Sligo to identify a means to decarbonise Sligo's large energy users, across all sectors, currently reliant on carbon intensive Oil and LPG for energy demand. The proposed Satellite Gas Network and Virtual Pipeline would address the existing regional disparity in terms

of access to Natural Gas, leading to the uptake of Combined Heat and Power (CHP) technology and maturing Renewable Gas markets (Anaerobic Digestion). Studies undertaken to date indicate the Sligo Local Gas Network (SLGN) project is a feasible solution to establishing a local and circular bio-economy and ensuring balanced regional development and economic growth, and is widely used in other countries to address these challenges and opportunities. Gas Networks Ireland is working with SLGN to understand the technical and commercial feasibility of such a project and how this would fit into Gas Networks Ireland's unregulated business model. Note that extending the natural gas network to Sligo under Gas Networks Ireland's existing Connections Policy has been ruled out several times on the basis of an unacceptable return on investment for Gas Networks Ireland.
Gas Networks Ireland can 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 provided they are commercially feasible and represent a good commercial business case. Gas Networks Ireland is progressing several suburb project proposals and the 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 has been delayed a number of times by planning issues, but when completed (in late 2021), 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).

Other areas are already being analysed and designs developed to enable them to be progressed beyond the business case analysis. This is expected to result in several additional Suburb Infill projects by the end of 2021 and into 2022.

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 approximately 20% of all energy related carbon dioxide (CO_2) emissions in the road Transport sector[64].

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[65] Core Road 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.

By the end of the current NDP period, Gas Networks Ireland is expecting to see annual CNG demand of c. 600 GWh/yr, equivalent to meeting the annual fuel requirement of approximately 1,200 HGVs. Please see Section 6.6.4 for more information on the projected Transport sector gas demand.

64 Source SEAI: Emissions from transport excluding International Aviation:11,890kTCO_2. Emissions from road freight: 2291 kTCO_2
65 TEN-T – Trans-European Transport Network. https://ec.europa.eu/transport/themes/infrastructure/ten-t_en

8. Gas growth
(continued)

Gas Networks Ireland is utilising high capacity fast fill technology which provides quick, efficient and safe refuelling which is very similar in nature to that of diesel refuelling. The normal fill time for a natural gas HGV is three to five minutes from empty. This is essential given 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 six activities such as Programme Management, Pilot CNG Network, CNG Vehicles and Supports, Renewable Gas Injection Facility, System Operation and Data Analysis and Communication and 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 additional fast fill CNG stations, four renewable gas injection facilities, four CNG mobile refuelling units which will act as a back-up solution to the CNG stations and the launch of a CNG Vehicle Grant Scheme which supports the purchase of c. 400 CNG vehicles across Ireland. There will also be additional private and public stations with 71 stations expected by 2030.

Public access stations have been constructed at the Circle K Service Station in Dublin Port, Circle K Cashel on the M8 motorway, Circle K Clonshaugh in Dublin and Circle K Ballysimon Road in Limerick. 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.

Figure 8-2: Ballysimon Road CNG station

Figure 8-3: Cashel CNG station

Currently, Gas Networks Ireland has 8 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.

Virginia International Logistics is a family owned business with multiple locations in Ireland and the UK with over 35 years of experience in Temperature Controlled, Dry Freight and Containerized Transport. Virginia currently operates a private CNG station in Ballycoolin, Co. Dublin and has installed a public CNG refuelling station in Virginia, Co. Cavan. CNG trucks have replaced a portion of Virginia's diesel-powered fleet, with the rest of the fleet also transitioning to CNG in the coming years.

The Cavan site is part of Gas Networks Ireland's wider strategy to develop a market for natural gas as a lower-emission transport fuel.

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.

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.

The Green Connect CNG Vehicle Grant Scheme was launched 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.

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.

8. Gas growth
(continued)

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 2019, 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 the development of 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 100 km of the site, which is currently in the planning process.

Figure 8-4: Green generation, Nurney, Co. Kildare

Gas Networks Ireland envisages more regional CGI facilities will be required over time to support the growing demand for agriculture sector anaerobic digestion facilities remote from the gas grid. Direct injection anaerobic digestion facilities are also supported under the Gas Networks Ireland Connection Policy. As of July 2021, over 180 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 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) presents a significant opportunity for renewable gas and its by-product digestate which is the key ingredient for organic fertilizers and soil improvers.

The focus of the Farm to Fork strategy is on sustainable, low carbon, local and organic food production requiring 20% displacement of chemical fertilisers and significantly more organic farming practices. This will drive demand for more organic fertiliser alternatives. 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 form 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

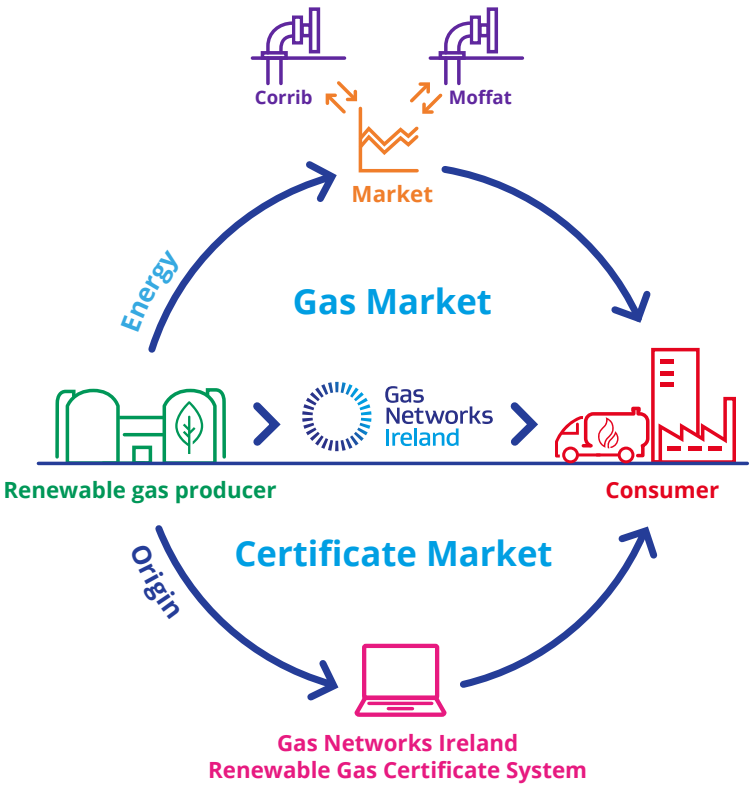
as biomethane can only be produced sustainably and in adherence to a full GHG Lifecycle Assessment from source to end-use that can demonstrate minimum net GHG savings. Only biomethane that is produced in line with these strict sustainability criteria can be accepted and recognised as renewable gas, and 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).

Over the NDP period, GNI will work collaboratively with industry stakeholders, researchers and relevant Government Departments to develop the roadmap for renewable gas and partake and contribute to the implementation of biomethane actions in the Climate Action Plan. This includes working with the Department of Environment Climate and Communications (DECC) to set a revised target for biomethane grid injection by 2030.

Guarantees of origin.

GNI has already established a Renewable Gas Registry which is issuing 'Certificates of Origin' to producers injecting renewable gas into the gas grid. DECC are in the process of appointing Gas Networks Ireland as the Issuing Body for Guarantees of Origin in Ireland as described in Article 19 of RED II. Producers of Renewable Gas will be required to hold a certificate of sustainability issued by an EU Voluntary Scheme to ensure sustainability criteria set out under the re-cast EU renewable Energy Directive (RED II) which comes into legal effect in 2021 are met. This assurance is vital to providing confidence to consumers that the gas delivered is renewable and can be counted against their emission reduction targets. It will give government and regulators certainty that sales of renewable gas are transparent and accounted for.

Figure 8-5: Renewable gas certification system



9 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 has been completed.

The focus has now moved to the European 'Green Deal' and the ongoing review of the gas legislative framework in order to deliver gas market arrangements to better facilitate renewable gases.

Following Brexit, as anticipated there has been no negative impacts on gas flows through the interconnectors and the focus now moves to monitoring any future market changes which may results in divergence between GB and the EU.

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 included 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 DECC, CRU and neighbouring TSOs to ensure that all Brexit related considerations were addressed in the context of minimising changes to Ireland's daily interaction with the UK in the transportation of gas. To date there has been no knock-on effect for Ireland. A situation may arise 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

The EU Green Deal (published in December 2019) presented a high-level roadmap of key policies and measures to guide energy and decarbonisation policy. It has resulted in more ambitious targets and increased pressure to decarbonise, at both EU and national levels. To date, 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 particular interest to Gas Networks Ireland and the European energy industry in 2020 were the publication of the EU strategies for Energy System Integration and Hydrogen (July 2020) and Reducing Methane Emissions (October 2020). These three strategies collectively pave the way towards a "fully decarbonised, more efficient and interconnected energy sector". As indicated in EU Strategy around Reducing Methane Emissions, the European Commission will consider legislation on eliminating routine venting and flaring. Associated obligations, when introduced, may have operational, reporting and regulatory implications for Ireland's gas network. Obligations are anticipated to be prescriptive in how network operators detect, quantify, monitor, verify, report and repair methane emissions on their network.[66] Proposed obligations are expected to be published by the European Commission in Q4 2021.

66 GNI already actively manage and are continuously improving volumes of operational methane emitted from both our owned and operated assets and those under management control, and are in the process of aligning with the Oil and Gas Methane Partnership (OGMP) 2.0 reporting framework (www.ogmpartnership.com). This framework is considered industry best practice, and when adopted, it will ensure GNI have a more robust and accurate view of what the actual methane emissions are.

9.0 Commercial market arrangements
(continued)

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

As a key next step in delivering on the Green Deal, the European Commission's 'Fit for 55 Package', delivered on 14th July 2021, put forward legislative proposals to ensure the EU reaches its updated 55% emissions reduction target for 2030 (compared to 1990 levels). This series of thirteen cross-cutting legislative proposals includes eight revisions of existing legislation and five brand new proposals. The proposed amendments, most relevant to Gas Networks Ireland, relate to the EU Emissions Trading System (ETS), Renewable Energy Directive, Energy Efficiency Directive, and Alternative Fuels Infrastructure Directive. This Package is the starting point for Member States, the European Parliament and the Commission to debate and decide on a complete overhaul of EU energy and climate legislation over the coming years. These proposed changes will, in turn, have a major impact on national policies.

In terms of other upcoming amendments to EU legislation, the revision of the Third Energy Package for gas (Directive 2009/73/EU and Regulation 715/2009/EU), expected from the European Commission in Q4 2021, is of most significance to Gas Networks Ireland. The aim of this review is to design a competitive, decarbonised gas market, fit for renewable gases. Gas Networks Ireland has actively fed into this review to date, via direct consultation input and representation through its various EU gas association memberships.

Finally, the ongoing revision of the Regulation on Trans-European Networks in Energy (TEN-E) (which governs the PCI process) to ensure consistency with the ambition set out in the Green Deal is important. In particular, the cross-border criteria included in the current version of the Regulation, which are challenging for Ireland to meet post-Brexit, with no direct connection to the EU gas network.

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


Gas
Networks
Ireland

10

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 2021 NDP highlights that the forecasted 1-in-50 peak demand may surpass the combined system entry capacity in the last seven years 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. Operational Measures have been identified to relieve this constraint in the short to medium-term. Such measures, which include management of gas inventory storage in the subsea interconnectors, will be sufficient to mitigate the constraint over the ten-year forecast horizon considered in the NDP.

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

Gas Networks Ireland is currently preparing a business plan for the next price control period (PC5) which will be submitted to the CRU in 2021.

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 2021 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 investment 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 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 Ireland 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 ISO55001 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:

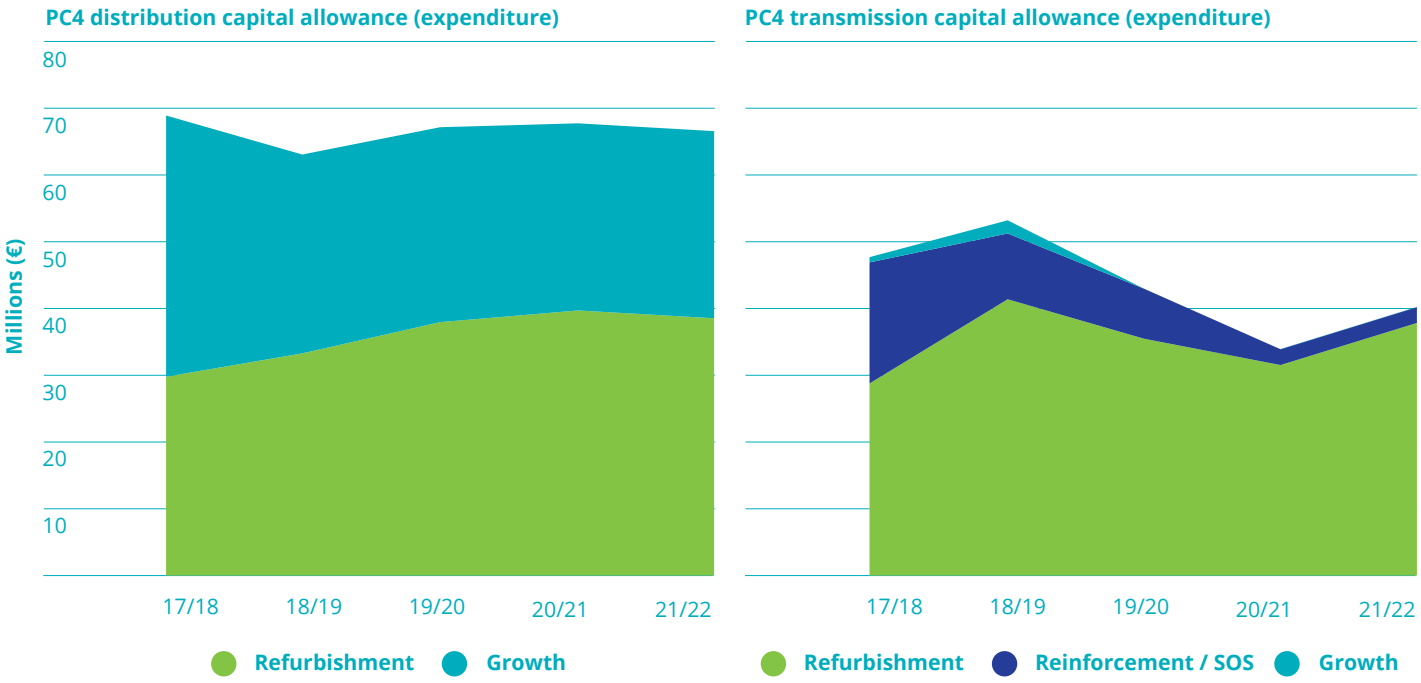
- **Scope:** this provides an overview of the assets and provides comprehensive technical detail on the relevant asset system and its anatomy, i.e. each of its primary parts/components.
- **Asset risk:** this details how asset risk is assessed for, and how an asset risk score is assigned to, the assets, 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 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 future investment in the distribution and transmission network for the duration of PC4 as illustrated in Figure 10-1 (excluding non-pipe).

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 Commission for Regulation of Utilities 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.

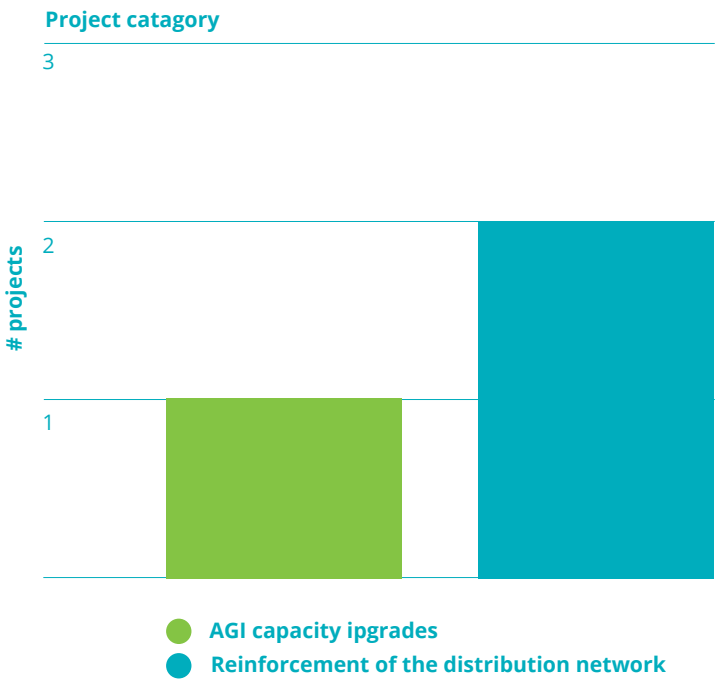
In addition to RAB-funded regulated investments, the Causeway Project is a regulated project funded by a combination of regulatory OPEX allowances (Innovation fund), co-funded from a grant from the CEF Transport Fund and upfront customer contributions. The current CNG projects outlined in the Network 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.

Gas Networks Ireland is currently preparing a business plan for the next price control period (PC5) which will be submitted to the CRU in 2021. This plan will set out the investment requirements for a five-year period to September 2027 to ensure the provision of a safe high-quality service for all gas customers, a continued focus on efficient spend, efficiently facilitating the energy transition and maintaining a safe and resilient network.

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.

Figure 10-2: Capital projects completed in 2020



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 which the CGI is an integral part, has been shortlisted for funding from the Climate Action Fund and is going through a project validation phase with the Department of Environment, Climate and Communications. 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 gas onto the gas grid and will be a major step in contributing to Ireland's climate targets.

10.1.4 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:

- AGI capacity upgrades
- Reinforcement of the distribution network

In 2020, three projects were completed including 1 AGI Capacity Upgrade, and 2 Reinforcements of the Distribution Network. 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 NIP 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.

10.0 Gas network capacity
(continued)

Table 10-1: Short-term requirements

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

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 three years in order to reinforce and increase capacity in the network. These projects consist of Above Ground Installations (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.

Gas Networks Ireland is focused on the delivery of new Compressed Natural Gas (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 three years and are classed under "Other – New CNG" projects. The table above also includes Centralised Gas Injection (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 ten years in order to reinforce and increase capacity in the network. These projects consist of Above Ground Installations (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.


Gas
Networks
Ireland

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CRU commentary

The Russian invasion of Ukraine and the subsequent measures taken by the EU Commission, including the 'RePowerEU Plan' and updates to the 'Fit for 55 Package', have focused attention on gas demand and supply requirements throughout the EU.

While the direct impact of a related supply issue is lower in Ireland than for many of our EU colleagues, the accompanying energy crisis has further focused minds on energy security and diversification of supply as our community advances towards a decarbonised economy. Gas Networks Ireland's Ten-Year Network Development Plan (TYNDP) plays an integral role in shaping that decarbonised future, assessing and forecasting Ireland's supply and demand and planning for introducing associated initiatives and projects to maintain secure supply as we meet our ambitious targets. CRU would like to highlight the following findings and elements of the TYNDP 2021-2030 that will feed into the future role of a secure and decarbonised gas network in Ireland.

The various scenarios tests in the TYNDP are intended to test the capability of the gas network. The results show that gas demand is expected to grow over the ten year period by 4% in the Low demand scenario and by between 15% and 27% based on the Best Estimate and High demand scenarios. CRU would like to highlight the impact of the COVID-19 pandemic and the associated uncertainty it brought on the figures presented in this year's TYNDP.

In light of the declining output from Corrib, Moffat remains the dominant supply point over the period with its contribution to total system demand expected to increase to 92% by 2029/30. Given that a significant portion of that supply meeting demand from gas fired power generation (which accounted for 51% of electricity generated in 2020), the impact of changes in the power generation sector are a major factor in terms of future gas supply and demand profiles. With demand from gas fired power generation projected to grow significantly as older, non-gas generation plant exit the electricity system, power generation continues to be a key driver for gas demand in Ireland for the period of the TYNDP. Additionally, as renewable electricity generation grows, the Irish gas network will require greater flexibility as it is increasingly used as a backup fuel for the intermittent renewable generation.

The TYNDP also outlines Gas Networks Ireland's growth initiatives, which aim to promote sustainable development and increase usage of Ireland's gas network in a cost-effective manner. These include:

- Developing biomethane grid injection infrastructure
- CNG refuelling stations for Heavy Good Vehicles
- Planning for hydrogen transportation

The CRU will continue to work with Gas Networks Ireland on the progression of such initiatives.

This year's TYNDP introduces a new section on sensitivity analyses. It estimates the impact of fulfilment of policy outcomes (reaching 2030 RES-E targets, completion of interconnector projects and expected procurement of new gas-fired generation) on gas demand in comparison with the base case. The CRU notes that the RES-E target in the 2021-30 National Development Plan has shifted from 70% and 80% and therefore should be reflected in the next iteration of the TYNDP.

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, Department for Business, Energy and Industrial Strategy UK (BEIS) and the European Commission to ensure that Ireland's energy security is maintained. In parallel, we note the work being done at a national level under the DECC National Energy Security Framework. CRU also welcomes the opportunity to feed into the upcoming DECC consultation on the review of the security of energy supply of Ireland's natural gas and electricity systems, to support Ireland's energy security.

The CRU would like to take this opportunity to thank Gas Networks Ireland for producing the TYNDP 2021-2030, while acknowledging the work done maintaining Ireland's security of supply throughout the initial years of the Covid pandemic and as we enter into a new gas security era across the EU.

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, 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 Industrial and Commercial sites.
- **Daily metered (DM)** sites with an annual demand greater than 5.55 GWh and less than 57 GWh, and includes the medium Industrial and Commercial, hospitals and large colleges etc.
- **Non-daily metered (NDM)** with an annual demand of 5.55 GWh or less, and includes the small Industrial and Commercial 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 Industrial and Commercial components:

- **Power sector:** The individual power stations are separated out from the LDM total.
- **The Industrial and Commercial sector:** Which is comprised of the demand from the remaining LDM sites, the DM sector and the NDM Industrial and Commercial 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 Industrial and Commercial demand combined into the TX DM Industrial and Commercial category; and
- Distribution demand has been subdivided into the DX NDM demand, with all of the remaining LDM and DM Industrial and Commercial demand combined into the DX DM Industrial and Commercial category

Table A1-1: Historic Gas Networks Ireland Annual Gas Demands (Actual) [67]

GWh/yr	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21
ROI	55,726	50,435	50,072	47,582	47,136	51,478	55,070	56,348	57,481	58,344	57,405
NI and IOM	17,852	15,142	15,031	15,132	16,970	16,992	18,168	16,984	17,005	17,693	18,818
Total	**73,578**	**65,577**	**65,103**	**62,714**	**64,106**	**68,470**	**73,237**	**73,332**	**74,485**	**76,036**	**76,223**

Table A1-2: Historic Gas Networks Ireland Peak Day Gas Demands (Actual)

GWh/d	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21
ROI	244.1	211.7	213.2	187.0	203.8	199.4	221.8	215.9	218.5	225.4	248.5
NI and IOM	79.3	74.1	62.7	68.2	72.8	69.9	70.1	63.1	75.9	70.6	82.3
Total	**323.4**	**285.8**	**275.9**	**255.2**	**276.6**	**269.2**	**291.9**	**279.0**	**294.4**	**295.9**	**330.9**

67 Actual demands shown (not weather corrected) with Residential estimated as % of NDM

Appendix 1: Historic demand
(continued)

Figure A1-1: Historic ROI daily demand of transmission connected sites

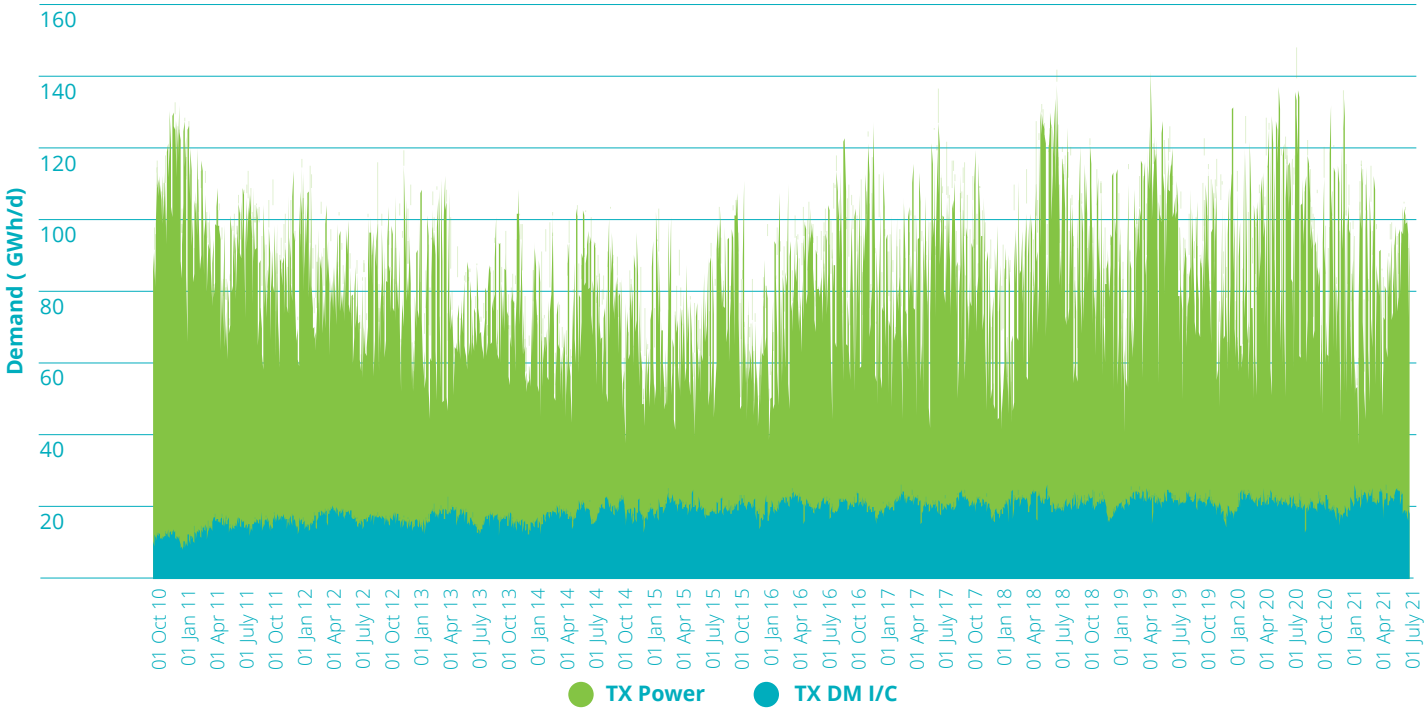

Figure A1-2: Historic ROI daily demand of distribution connected sites

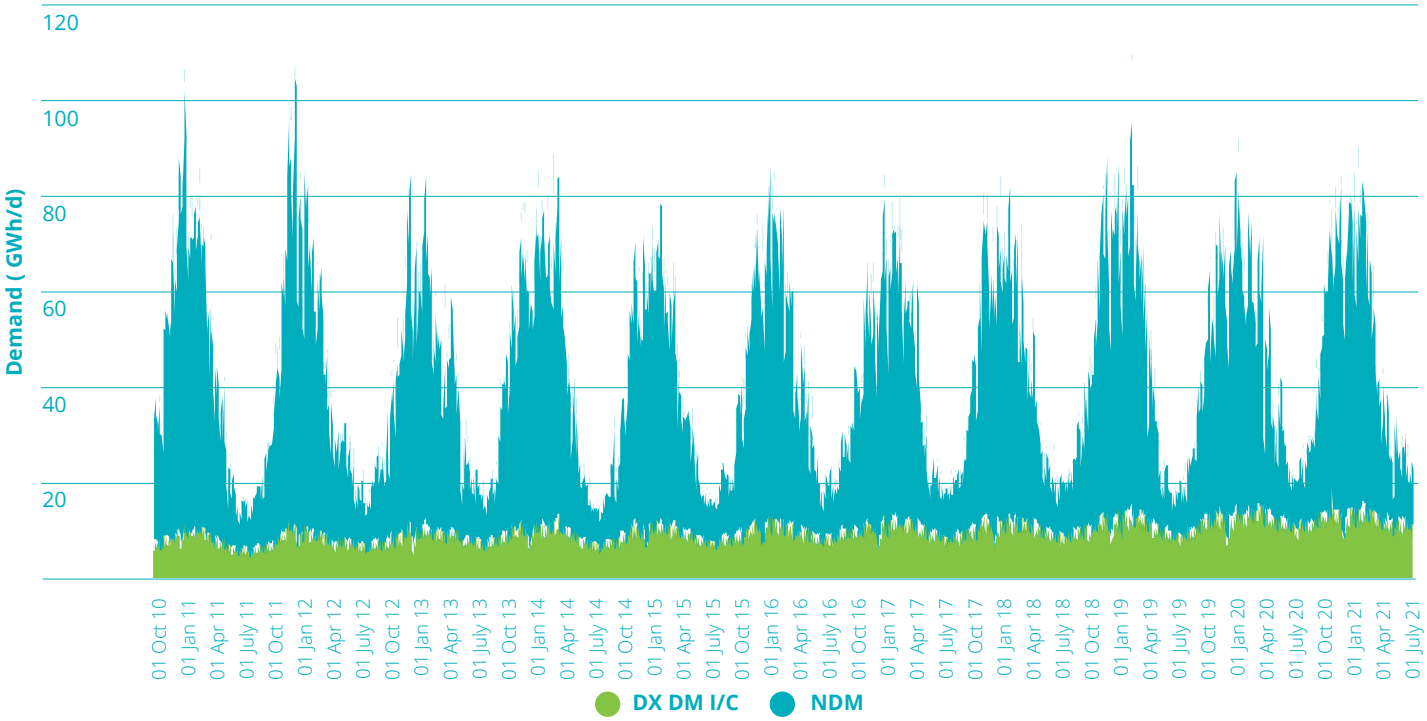

Table A1-3: Historic ROI annual gas demands (actual)

GWh/yr	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21
Power[68]	35,365	29,864	28,156	26,910	24,708	29,061	32,181	31,936	33,050	33,772	32,389
I/C	12,021	13,244	13,700	13,682	15,013	15,581	15,835	16,485	17,149	16,879	16,876
Residential	8,340	7,326	8,216	6,991	7,414	6,835	7,054	7,927	7,282	7,693	8,121
Total	**55,726**	**50,435**	**50,072**	**47,582**	**47,136**	**51,478**	**55,070**	**56,348**	**57,481**	**58,344**	**57,387**

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

GWh/d	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21
Power	132.2	114.1	119.9	102.0	102.4	104.7	121.6	110.1	113.0	129.4	134.3
I/C	49.6	49.4	50.4	46.8	54.8	54.9	56.6	61.0	60.2	58.8	59.3
Residential	64.2	48.2	44.2	39.9	46.6	40.1	43.6	44.8	45.3	37.2	55.0
Total	**246.0**	**211.7**	**214.4**	**188.7**	**203.8**	**199.7**	**221.8**	**215.9**	**218.5**	**225.4**	**248.5**

The transmission connected demand, Figure A1-1, does not appear to be particularly weather sensitive. The gas demand of the power sector 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.

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[69]

GWh/yr	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20
Moffat[70]	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**

68 Power sector gas demand is amended to account for those I/C connections which generate electricity for their own use less process gas
69 Daily gas supply taken from Gas Transportation Management System (GTMS)
70 Table shows total Moffat supplies including ROI, NI and IOM

Appendix 1: Historic demand
(continued)

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

GWh/d	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21
Moffat	303.9	255.7	251.2	232.7	248.3	189.5	172.9	171.4	213.2	233.9	280.8
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	52.3
Total	**337.6**	**287.6**	**277.9**	**259.1**	**276.3**	**269.3**	**293.4**	**279.7**	**301.4**	**301.4**	**333.1**

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

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

GWh/d Peak day	10/11	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21
TX Power	132.2	114.1	119.9	102.0	102.4	104.7	123.8	106.1	113.0	129.4	134.3
TX DM I/C	12.0	17.7	17.8	16.1	18.8	21.1	20.0	21.7	20.3	23.1	18.7
DX DM I/C	12.3	11.9	12.2	12.6	13.3	13.5	13.6	14.0	15.5	15.5	15.8
DX NDM	89.5	68.0	64.6	57.9	69.4	60.4	61.2	68.4	69.7	57.4	79.8
Total ROI	**246.0**	**211.7**	**214.4**	**188.7**	**203.8**	**199.7**	**218.6**	**210.1**	**218.5**	**225.4**	**248.5**
Annual											
TX Power	35,365	29,864	28,156	26,910	24,708	29,061	32,181	31,936	33,050	33,772	32,389
TX DM I/C	4,978	6,147	6,088	6,439	7,085	7,455	7,562	7,642	7,888	7,659	7,699
DX DM I/C	3,020	3,235	3,419	3,432	3,593	3,776	3,842	4,038	4,494	4,570	4,754
DX NDM	12,363	11,188	12,409	10,802	11,749	11,184	11,485	12,733	12,049	12,343	12,563
Total ROI	**55,726**	**50,435**	**50,072**	**47,582**	**47,136**	**51,478**	**55,070**	**56,348**	**57,481**	**58,344**	**57,405**

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	20/21
TX Power	133.0	117.4	119.9	108.7	103.2	123.2	127.3	142.2	141.5	148.4	136.5
TX DM I/C	18.4	20.4	22.9	23.1	25.1	25.4	26.3	26.4	26.0	25.2	26.5
DX DM I/C	12.3	12.7	13.7	12.8	13.8	14.1	14.0	15.8	15.9	18.7	17.3
DX NDM	94.9	73.0	75.5	65.8	73.5	71.5	71.0	97.2	76.4	74.8	83.2
Total ROI	**258.5**	**223.5**	**231.9**	**210.4**	**215.6**	**234.1**	**238.6**	**281.7**	**259.8**	**267.1**	**263.5**
Power	133.0	117.4	119.9	108.7	103.2	123.2	127.3	142.2	141.5	148.4	136.5
I/C	57.5	53.7	59.1	56.5	62.7	63.4	64.3	74.4	68.6	69.2	70.4
Residential	68.0	52.4	52.9	45.2	49.7	47.6	47.0	65.0	49.6	49.5	56.6
Total ROI	**258.5**	**223.5**	**231.9**	**210.4**	**215.6**	**234.1**	**238.6**	**281.7**	**259.8**	**267.1**	**263.5**

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 (%)	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Low	3.2	2.6	1.7	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Best Estimate	5.9	5.7	3.7	3.2	3.2	3.2	3.2	3.2	3.2	3.2
High	5.9	5.7	3.7	3.2	3.2	3.2	3.2	3.2	3.2	3.2

Table A2-2: Residential new connections

	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Low	6340	3825	2605	2055	1555	1130	730	630	630	630
Best Estimate	6340	3975	2880	2280	1755	1443	1193	755	630	630
High	6340	5288	5680	6105	6105	6080	5705	2580	1580	1580

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 and 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 and 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 and 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 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 assumptions
(continued)

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

GWh/d	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Power	140.5	127.8	173.1	186.9	196.1	213.1	218.1	218.3	213.7	212.5
I/C	71.0	71.3	59.4	58.3	60.3	60.2	57.6	57.3	57.9	57.1
Residential	63.8	63.5	45.8	43.3	44.3	47.4	44.0	43.7	43.4	39.8
Transport	0.0	0.1	0.2	0.3	0.4	0.6	0.7	0.8	0.9	1.0
Own Use	4.3	4.1	3.8	4.2	4.3	4.7	4.1	3.9	3.6	3.6
Sub total	**279.6**	**266.8**	**282.3**	**293.0**	**305.4**	**325.9**	**324.6**	**324.0**	**319.5**	**313.9**
IOM	6.6	6.6	6.6	6.6	6.6	5.8	5.8	5.8	5.8	5.8
NI	100.5	102.7	113.7	131.4	119.1	121.1	125.0	117.0	115.3	114.4
Total	**386.7**	**376.1**	**402.7**	**431.0**	**431.2**	**452.8**	**455.3**	**446.8**	**440.6**	**434.0**

Table A2-4: 1-in-50 Peak day demand – Best Estimate demand scenario

GWh/d	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Power	141.4	157.9	171.2	208.8	175.2	211.0	205.7	209.1	219.6	211.6
I/C	71.7	62.1	63.0	55.6	77.5	66.1	68.9	68.8	67.3	72.7
Residential	63.8	45.2	44.6	35.4	62.4	46.4	49.1	46.5	43.8	41.5
Transport	0.0	0.1	0.2	0.3	0.5	0.8	1.0	1.3	1.5	1.7
Own Use	4.6	3.7	4.2	4.3	5.5	4.6	5.0	4.8	4.3	4.7
Sub total	**281.5**	**269.0**	**283.3**	**304.5**	**321.1**	**328.8**	**329.7**	**330.4**	**336.4**	**332.1**
IOM	6.6	6.6	6.6	6.6	6.6	5.8	5.8	5.8	5.8	5.8
NI	100.5	102.7	113.7	131.4	119.1	121.1	125.0	117.0	115.3	114.4
Total	**388.6**	**378.4**	**403.7**	**442.5**	**446.9**	**455.7**	**460.4**	**453.2**	**457.5**	**452.3**

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

GWh/d	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Power	152.3	160.5	183.5	166.6	186.8	227.3	198.7	233.8	235.7	225.2
I/C	71.6	63.4	63.1	77.0	78.3	66.9	80.8	67.7	69.8	74.7
Residential	63.8	50.7	44.9	63.5	63.4	45.9	63.1	39.1	40.0	42.7
Transport	0.1	0.2	0.5	0.8	1.2	1.5	1.9	2.2	2.5	2.7
Own Use	4.7	4.0	4.3	5.5	5.7	5.4	5.7	5.5	4.7	4.9
Sub total	**292.4**	**278.9**	**296.3**	**313.3**	**335.3**	**347.0**	**350.1**	**348.3**	**352.7**	**350.3**
IOM	6.6	6.6	6.6	6.6	6.6	5.8	5.8	5.8	5.8	5.8
NI	100.5	102.7	113.7	131.4	119.1	121.1	125.0	117.0	115.3	114.4
Total	**399.6**	**388.2**	**416.7**	**451.4**	**461.1**	**473.9**	**480.9**	**471.1**	**473.7**	**470.4**

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

GWh/d	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Power	150.5	140.8	174.2	175.8	175.4	178.4	173.4	181.5	168.9	175.3
I/C	56.4	62.5	57.2	58.3	63.1	63.1	61.9	59.0	60.3	57.4
Residential	42.5	43.6	38.7	43.7	42.7	42.4	48.5	41.2	42.7	29.9
Transport	0.0	0.1	0.2	0.3	0.4	0.6	0.7	0.8	0.9	1.0
Own Use	3.6	3.5	3.7	3.9	4.5	4.5	4.6	4.3	3.7	3.4
Sub total	**253.1**	**250.5**	**274.1**	**282.0**	**286.1**	**288.9**	**289.1**	**286.7**	**276.4**	**266.9**
IOM	6.3	6.3	6.4	6.4	5.9	5.2	5.2	5.2	4.8	5.2
NI	85.9	85.5	96.2	107.0	94.7	97.0	101.4	93.9	92.5	91.8
Total	**345.2**	**342.3**	**376.6**	**395.3**	**386.7**	**391.1**	**395.7**	**385.9**	**373.7**	**363.9**

Table A2-7: Average year peak day demand – Best Estimate demand scenario

GWh/d	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Power	150.5	144.2	166.3	172.0	195.4	193.0	207.5	195.1	202.3	198.7
I/C	57.4	60.6	61.8	64.2	61.7	67.1	61.6	66.2	65.0	62.3
Residential	42.4	44.2	45.1	45.0	40.4	44.7	37.4	42.1	39.2	37.4
Transport	0.0	0.1	0.2	0.3	0.5	0.8	1.0	1.3	1.5	1.7
Own Use	3.6	3.8	4.3	4.5	4.0	4.9	4.0	4.8	4.8	4.1
Sub total	**254.0**	**252.9**	**277.7**	**285.9**	**302.1**	**310.4**	**311.5**	**309.5**	**312.8**	**304.1**
IOM	6.3	6.3	6.4	6.4	5.9	5.2	5.2	5.2	4.8	5.2
NI	85.9	85.5	96.2	107.0	94.7	97.0	101.4	93.9	92.5	91.8
Total	**346.1**	**344.7**	**380.2**	**399.3**	**402.7**	**412.7**	**418.2**	**408.6**	**410.1**	**401.1**

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

GWh/d	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Power	153.2	143.8	170.7	179.0	193.7	216.7	222.0	224.4	219.4	229.6
I/C	57.9	65.1	66.4	68.3	67.2	70.9	70.0	68.4	74.7	64.4
Residential	45.2	43.6	43.5	43.4	47.0	43.3	44.6	42.9	42.7	38.2
Transport	0.1	0.2	0.5	0.8	1.2	1.5	1.9	2.2	2.5	2.7
Own Use	3.4	3.8	4.3	4.4	4.7	5.0	4.6	4.7	4.5	4.3
Sub total	**259.7**	**256.5**	**285.4**	**295.9**	**313.7**	**337.4**	**343.1**	**342.6**	**343.7**	**339.1**
IOM	6.3	6.3	6.4	6.4	5.9	5.2	5.2	5.2	4.8	5.2
NI	85.9	85.5	96.2	107.0	94.7	97.0	101.4	93.9	92.5	91.8
Total	**351.9**	**348.3**	**387.9**	**409.2**	**414.3**	**439.6**	**449.7**	**441.7**	**441.0**	**436.1**

Appendix 2: Demand forecasts assumptions
(continued)

Table A2-9: Annual demand – Low demand scenario

TWh/yr	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Power	29.9	34.1	37.6	38.5	40.5	40.6	39.5	35.7	33.0	31.5
I/C	17.2	17.3	17.4	17.7	17.8	17.9	18.0	18.1	18.0	18.0
Residential	7.9	7.9	7.9	7.8	7.7	7.7	7.6	7.6	7.5	7.4
Transport	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4
Own Use	**0.8**	**1.0**	**1.1**	**1.1**	**1.2**	**1.2**	**1.2**	**1.1**	**1.1**	**1.1**
Sub total	55.8	60.3	64.0	65.2	67.3	67.5	66.5	62.8	59.9	58.3
IOM	1.6	1.6	1.6	1.6	1.5	1.3	1.3	1.3	1.2	1.3
NI	16.1	16.4	17.3	18.8	18.8	18.6	18.8	18.6	17.9	17.8
Total	**73.5**	**78.3**	**82.9**	**85.6**	**87.6**	**87.4**	**86.7**	**82.6**	**79.1**	**77.4**

Table A2-10: Annual demand – Best Estimate demand scenario

TWh/yr	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Power	30.1	35.4	39.0	40.3	42.6	43.4	42.8	38.8	36.0	34.6
I/C	17.5	18.1	18.4	19.0	19.4	19.7	20.2	20.6	20.8	21.1
Residential	7.9	7.9	7.9	7.9	7.8	7.7	7.7	7.6	7.6	7.5
Transport	0.0	0.0	0.1	0.1	0.2	0.3	0.4	0.5	0.5	0.6
Own Use	**0.9**	**1.0**	**1.1**	**1.2**	**1.2**	**1.2**	**1.3**	**1.2**	**1.2**	**1.2**
Sub total	56.4	62.4	66.5	68.4	71.2	72.3	72.3	68.8	66.1	64.9
IOM	1.6	1.6	1.6	1.6	1.5	1.3	1.3	1.3	1.2	1.3
NI	16.1	16.4	17.3	18.8	18.8	18.6	18.8	18.6	17.9	17.8
Total	**74.1**	**80.4**	**85.4**	**88.8**	**91.5**	**92.2**	**92.5**	**88.7**	**85.3**	**84.1**

Table A2-11: Annual demand – High demand scenario

TWh/yr	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Power	30.2	36.0	40.8	42.6	45.0	47.4	46.3	43.5	42.1	40.1
I/C	17.5	18.1	18.4	19.1	19.6	19.9	20.5	21.0	21.3	21.6
Residential	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.8	7.8	7.7
Transport	0.0	0.1	0.2	0.3	0.4	0.6	0.7	0.8	0.9	1.0
Own Use	0.9	1.0	1.1	1.2	1.3	1.3	1.3	1.3	1.3	1.3
Sub total	**56.5**	**63.1**	**68.5**	**71.1**	**74.1**	**77.1**	**76.6**	**74.4**	**73.3**	**71.7**
IOM	1.6	1.6	1.6	1.6	1.5	1.3	1.3	1.3	1.2	1.3
NI	16.1	16.4	17.3	18.8	18.8	18.6	18.8	18.6	17.9	17.8
Total	**74.1**	**81.0**	**87.5**	**91.5**	**94.4**	**97.0**	**96.8**	**94.3**	**92.5**	**90.8**

Table A2-12: Maximum daily supply volumes

GWh/d	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Corrib	52.2	44.8	39.3	33.8	30.0	26.9	24.1	20.9	18.6	15.6
Moffat	386.9	386.9	386.9	386.9	386.9	386.9	386.9	386.9	386.9	386.9

Appendix 3: 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[71] 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 2029/30;

- 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 A3-1: Entry point assumptions

	Moffat	Corrib
Pressure (barg)	47.0[72]	Up to 85.0
Gross calorific value (MJ/scm)	39.8[73]	37.7
Max supply (mscm/day)	35	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 mscm/d. 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).

[71] NI transmission system is not included in the modelling. NI is treated as a demand at Twynholm, Scotland.
[72] Anticipated Normal Off-take Pressure (ANOP).
[73] Figure based on average historic values.

Appendix 3: Transmission network modelling
(continued)

Note on Calorific Value at Moffat

The pending outcome of an ongoing consultation regarding incorporation of the recently developed Institution of Gas Engineers and Managers (IGEM) gas quality standard, may have a consequential impact on the permissible Calorific Value ranges of within-specification gas in GB (and therefore at Moffat Entry Point) within the NDP forecast horizon. The draft standard has been produced by an IGEM Gas Quality Working Group and an industry consultation was undertaken in July 2020 – all of the documents produced by this working group are available on IGEM's website[74]. The timeline for implementation of the IGEM standard cannot be certain, as ultimately the changes require legislative amendments.

[74] https://www.igem.org.uk/technical-services/gas-quality-working-group/

Glossary

AA	Appropriate assessment
AD	Anaerobic digester
AGI	Above ground installation
ALARP	As low as reasonably practicable
ANOP	Anticipated normal offtake pressure
BER	Building energy rating
BETTA	British electricity trading and transmission arrangements
CAM	Capacity allocation mechanism
CAP	Climate action plan
CCGT	Combined cycle gas turbine
CCS	Carbon capture and storage
CCUS	Carbon capture utilisation and storage
CEF	Connecting europe facility
CGI	Central gas injection
CHP	Combined heat and power
CNG	Compressed natural gas
CO_2	Carbon dioxide
CPS	Carbon price support
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 and Social Research Institute
ESIPP	Energy Systems Integration Partnership Programme
EU ETS	European Emission Trading Scheme
EWIC	east west interconnector
EU	European Union
FDI	Foreign direct investment
FSR	Functional specification and requirements
GB	Great Britain
GCS	Generation capacity statement
GDP	Gross domestic product
GHG	Greenhouse gas
GNI	Gas Networks Ireland
GRAZE	Green Renewable Agricultural and Zero Emissions
GTMS	Gas transportation management system
GTSC	Gas Technical Standards Committee
GWh	Gigawatt hour
GWhe	Gigawatt hour (electric energy)
GWh/d	Gigawatt hours per day
GWh/yr	Gigawatt hours per year
GWh_e/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 and Commercial
IC	Interconnector
ICT	information and communications technology
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 and Climate Plan
NEEAP	National Energy Efficiency Action Plan
NGV	Natural gas vehicle

Glossary
(continued)

NI	Northern Ireland
NOx	Nitrogen dioxide
NSAI	National Standards Authority of Ireland
NTS	National transmission system
NUIG	National University of Ireland Galway
NZEB	Nearly zero energy buildings
OCGT	Open cycle gas turbine
OECD	The Organisation for Economic Co-operation and Development
PC4	Fourth price control
PC5	Fifth price control
PCI	Project of common interest
PfG	Programme for Government
PMA	Pressure maintenance agreement
PSO	Public service obligation
RAB	Regulated asset base
RED	Renewable energy directive
RES	Renewable energy source
RES-E	Renewable energy source use in electricity
RES-T	Renewable energy source use in transport
RGFI	Renewable Gas Forum Ireland
ROI	Republic of Ireland
SEA	Strategic environmental assessment
SEAI	Sustainable Energy Authority of Ireland
SEM	Single electricity market
SLGN	Sligo Local Gas Network
SME	Small and medium enterprise
SNSP	System non-synchronous penetration
SOx	Sulphur dioxide
TEN-E	Trans-European Networks in Energy
TEN-T	Trans-European Networks in Transport
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
UK ETS	UK Emission Trading Scheme
UCD	University College Dublin
UNFCCC	United Nations Framework Convention on Climate Change

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