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Gas Networks Ireland

Network Development Plan 2023

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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 October 2023, 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) pre-Screening to determine the requirement to carry out SEA Screening on the same. In accordance with EPA's Good Practice Guidance on SEA Screening, 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 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 NDP is prepared for the energy sector;
- The NDP applies to one or more of the sectors in the SEA Directive, however, is not considered to set a framework for development consent for projects listed in the EIA Directive; and
- The NDP is not considered to have the potential to significantly effect a Natura 2000 site.

In accordance with the EPA methodology, the NDP was therefore not taken forward to SEA Screening. No requirement for SEA is therefore identified as a result of this SEA Screening assessment. Gas Networks Ireland have made an SEA

Determination that the NDP 2023 will not give rise to likely significant environmental affects and does not require SEA Screening or an SEA.

NDP 2023 has also been screened for an Appropriate Assessment (AA). An AA of a plan or project is required if it is likely to have a significant effect on a European site, pursuant to the Birds and Natural Habitats Regulations (as amended) and the Planning and Development Act (as amended).

Following the review, it was determined that there is no material within NDP 2023 that could be determined as a source or could be defined as a pathway for effect on European site(s). Neither is there material contained within NDP 2023 that could be defined as a framework for development consent. In reaching this conclusion, the nature of the Plan and its potential relationship with all European sites within the Zone of Interest, and their conservation objectives, have been fully considered. Therefore, it was found that the NDP 2023 does not require an AA.

1. Foreword

Welcome to the 2023 Network Development Plan (NDP) published by Gas Networks Ireland. This document examines current gas demand and supply projections and provides a view of how the gas network may be required to develop to meet these projections over the coming ten-year period. The document follows a process of engagement and consultation, both internally and through informal consultation with key industry stakeholders.

Cathal Marley
Chief Executive Officer,
Gas Networks Ireland

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 gas network continues to play a key role within Ireland's energy system, providing 31% of the country's primary energy needs[1]. Approximately 720,000 households and businesses in Ireland rely on natural gas for a secure and competitive source of heating. In 2023, 47% of electricity generation was provided by natural gas[2].

"Approximately 720,000 households and businesses in Ireland rely on natural gas for a secure and competitive source of heating. In 2023, 47% of electricity generation was provided by natural gas."

National energy policy is a key input in the formation of the NDP modelling assumptions. There has been a significant increase in ambition in the decarbonisation trajectory and national targets in recent years, particularly since the 2021 revision of the Climate Action Plan. This increased ambition is welcomed, however the level of infrastructure and public buy-in needed across all sectors in order to meet carbon budgets and renewable energy share by sector targets poses significant deliverability challenges. With the objective of ensuring robust planning for the gas network from a security of supply point of view, the NDP Best Estimate scenario aims to align with existing policy measures in place at the time of the NDP modelling Data Freeze, however this scenario incorporates the much publicized delays in achieving some of these targets[3].

ROI annual gas demand is forecast to decrease in all NDP scenarios across the ten-year NDP time horizon. The decrease is primarily driven by the anticipated fall in gas demand in the Power Generation sector, followed by the projected decrease in Residential sector gas demand. While electricity demand is forecast to increase across the NDP period, the projected ambitious build out of renewables is expected to meet this growth in electricity demand, with gas-fired generation instead increasingly providing the balance of power generation. The projected decrease in Residential demand reflects current policy positions, which drive energy efficiency improvements for existing customers and a reduction in the number of residential gas customers. Industrial and Commercial (I&C) demand is forecast to increase across the NDP period, owing to new customer connections, coupled with moderate projected economic growth.

In contrast, the development of peak day demands diverges when compared to the annual demand forecasts. Over the NDP horizon, the ROI peak day gas demand is forecast to increase for both a 1-in-50 peak day[4] and for an average winter peak day[5]. There is decoupling of peak day and annual gas demand in the power generation sector due to the growing reliance on gas-fired electricity generation to back up renewable generation on high electricity demand days with low renewable availability.

1 Energy-in-Ireland-2023.pdf (seai.ie)
2 Electricity | Monthly Energy Data For Ireland | SEAI
3 EPA-GHG-Projections-2022-2040_Finalv2.pdf
4 A severe winter peak day that is statistically likely to occur once every fifty years.
5 A winter peak day that would occur in a typical winter

1. Foreword
(continued)

The flexibility provided by gas-fired electricity generation means it is the optimal complementary energy source to intermittent renewable energy at scale and will play an important role in assisting Ireland's transition to a zero-carbon economy.

Given the scope for growth in the peak day demand, the current technical supply capacity at the Moffat Entry Point in Scotland is projected to be exceeded in the latter eight years of the forecast horizon. Gas Networks Ireland is progressing a series of incremental capacity upgrade works at both compressor stations in Scotland to meet these forecasted 1-in-50 peak day demands.

Since the Russian invasion of Ukraine in February 2022, the volume of new energy initiatives from the European Union has continued to accelerate. Building on the Fit for 55 package, the RePowerEU Plan increased the headline 2030 renewables target from 40% to 42.5%, while also including a goal to increase biomethane production to 35bcm by 2030 as well as a target of producing 10 million tons of domestic renewable hydrogen plus 10 million tonnes of hydrogen imports by 2030. The 'Hydrogen and gas markets decarbonisation package' (revising Directive 2009/73/EU and Regulation 715/2009/EU) has now been finalised, which outlines the planned formation of a new, competitive, decarbonised gas market, fit for renewable gases including biomethane and hydrogen. The recast Energy Efficiency Directive (EU) 2023/1791[6] was published in September 2023, establishing a requirement for EU Member States to collectively ensure an additional reduction of final and primary energy consumption, compared with energy consumption forecasts made in 2020. Gas Networks Ireland will continue to monitor these developments and proactively engage with EU and National stakeholders to assess the implications for the Irish gas market.

Delivering on Ireland's increased ambition for biomethane production to 5.7TWh by 2030, as set out in Climate Action Plan (CAP) 2023 and REPowerEU, is one of Gas Networks Ireland's key priorities. In September 2023, Gas Networks Ireland published the Biomethane Energy Report[7] which outlines the current and future role biomethane and the gas network will play in specific areas of Ireland's energy system, and the opportunity it provides to decarbonise sectors including agriculture, transport, industrial heating and power generation. Biomethane production is anticipated to grow substantially in the coming years and as highlighted in the report, can be scaled rapidly.

Within the time horizon of the NDP, there is a strong drive towards displacing natural gas in the network with renewable gases such as biomethane and green hydrogen. All NDP scenarios forecast that annual natural gas demand will decrease between 2022/23 and 2031/32 while conversely the volume of renewable gases is forecast to increase in all scenarios across the same period. Consequently, annual carbon emissions from the gas network also decrease in all NDP scenarios across the ten-year period.

Gas Networks Ireland has also commenced a range of work packages to ensure the gas network is ready to transport hydrogen, initially via blending and in dedicated hydrogen clusters, and ultimately scaling up to a national hydrogen network. This includes the development of a detailed hydrogen technical and safety strategy which will provide a road map for the transition to hydrogen, and the continuation of our testing and pilot projects in our Network Innovation Centre at the Gas Networks Ireland Brownsbarn site in Co. Dublin, funded by the Gas Innovation Fund.

6 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ%3AJOL_2023_231_R_0001&qid=1695186598766
7 biomethane-energy-report.pdf (gasnetworks.ie)

Gas Networks Ireland welcomes the recent policy requirement for greater energy system scenario planning integration, as called for in the National Hydrogen Strategy and in the Energy Security in Ireland to 2030 report. The Energy Security in Ireland report acknowledges the significant interdependencies between the gas and electricity networks, and that these interdependencies will become more important with the increasing penetration of both renewable electricity and renewable gases in the energy system.

Transport sector gas demand relates to the development of renewable Compressed Natural Gas (bioCNG e.g. biomethane) demand within the transport industry through the uptake of bioCNG vehicles. BioCNG is particularly suitable for heavy goods vehicles (HGVs) where electric solutions are not an economically viable option. There are currently over 100 CNG HGV vehicles operating across the country, with these vehicles operating on bioCNG. Gas Networks Ireland is developing a nationwide bioCNG fuelling network, co-located in existing forecourts, on major routes and/or close to urban centres. There are currently eight bioCNG stations in operation, four public and four private, with a further five public access stations, currently at various stages of development, to be delivered over the next two years.

Cathal Marley
Chief Executive Officer,
Gas Networks Ireland

2. Executive summary

Key Messages:

Gas Networks Ireland continued to provide uninterrupted gas supply to c. 720,000 customers throughout 2022/23 through a network of 14,725km across 22 counties in Ireland.

Gas year 2022/23 saw the highest daily gas demand ever recorded, driven by gas demand in the power generation sector. It is notable that this day did not coincide with a 1-in-50 weather event and that daily demand could have been further increased in the event of lower wind speeds and colder temperatures. Gas Networks Ireland, in our forecasting methodology, factor in these potential uplifts on gas demand to ensure the gas network has sufficient capacity to meet demand across the NDP horizon.

The ROI peak day and annual gas demand forecasts diverge over the coming 10-year NDP horizon

- ROI annual demand is forecast to decrease by 21% by 2031/32 in the Best Estimate scenario. This forecasted decline in annual gas demand arises from the increasing penetration of renewable power generation across the ten-year NDP period, displacing gas-fired power generation on an annual basis.
- In the Best Estimate demand scenario, the ROI 1-in-50 winter peak day demand[8] is predicted to grow by 18%, and for an average winter peak day[9] growth of 22% is forecast over the NDP horizon. This projected increase in peak day gas demand is driven by the requirement for gas-fired electricity generation to meet the majority of the growing electricity demand on days of low renewable generation.

The current technical supply capacity at the Moffat Entry Point in Scotland is projected to be exceeded from 2024/25 onwards. Gas Networks Ireland is actively progressing a series of incremental capacity upgrade works at both compressor stations in Scotland in order to meet the forecasted 1-in-50 peak day demands.

Within the time horizon of the NDP, renewable gases such as biomethane and green hydrogen are anticipated to play a larger role in meeting gas demand and will offset the decline in indigenous gas supply from the Corrib gas field. Biomethane and hydrogen supply sources are forecast to meet approx. 14% and 3% of ROI gas demand respectively by the end of the NDP period. By replacing natural gas with renewable gases, such as biomethane and green hydrogen, the decarbonised gas network would enable emission reductions across key sectors, including those that are traditionally difficult to decarbonise, such as transport, agriculture, industrial processes and power generation.

8 A severe winter peak day that is statistically likely to occur once every fifty years
9 A winter peak day that would occur in a typical winter

The assessment horizon of this report covers the ten-year period from gas years 2022/23 to 2031/32 inclusive. The input data and assumptions used for modelling gas supply and demand scenarios over the ten-year period were finalised by October 2023, in line with the modelling 'Data Freeze' date. Further to this modelling Data Freeze, the production of the report extended to December 2023, and hence any non-modelling information such as national and European energy policy developments, project status and other ancillary developments in the gas and wider energy industry are included up to 31st December 2023.

Given the wide scope of input assumptions, and the considerable uncertainty in the trajectory of both gas and electricity demand over the NDP horizon, three scenarios have been developed and are examined as part of the NDP: Low, Best Estimate and High gas demand scenarios. These scenarios aim to capture the potential impact on both annual and peak day gas demand with a view to ensuring adequate capacity on the gas network to meet customer demand.

In the Best Estimate scenario, annual ROI gas demand is expected to fall by 21% between 2022/23 and 2031/32. Similarly, in the Low demand scenario, a decrease in ROI gas demand is predicted over the same horizon of 34%. The High demand scenario forecasts a slight decrease in annual gas demand of 3%. The decrease in all three scenarios is primarily driven by the anticipated fall in gas demand in the Power Generation sector, followed by the projected decrease in the Residential sector. The trend in Power Generation demand is linked to the ambitious build-out target assumed for offshore wind and solar generation in Ireland coupled with changes to existing electricity system constraints designed to achieve an 80% renewable energy share in electricity generation by 2030. These factors offset any growth forecast in electrical demand in all scenarios. Assumptions for wind and solar capacity development rates in the Best Estimate scenario are based on the build-out profiles provided in the EirGrid / SONI All-Island Generation Capacity Statement (GCS) 2023-2032, reaching 17.5GW of installed renewable capacity in 2030. The High gas demand scenario assumes a two-year delay in

2. Executive summary (continued)

meeting the GCS 2023-2032 renewable capacity target for 2030 while the Low gas demand scenario meets the more ambitious CAP 2023 renewable capacity target of 22GW by 2030. Should these ambitious targets not be met as assumed in the NDP modelling, the result would be an increase in annual gas demand in all scenarios, relative to the projections presented above.

Industrial & Commercial (I&C) demand is set to increase in all three gas demand scenarios across the NDP horizon. The forecasted increase in gas demand related to new Large Energy User (LEU) connections in the I&C sectors, coupled with moderate projected economic growth, offsets the anticipated decrease in gas demand due to the implementation of energy efficiency measures along with I&C disconnections due to the uptake of heat pumps and district heating. I&C demand is forecast to increase in the Low, Best Estimate and High gas demand scenarios by 6%, 29% and 37% respectively between 2022/23 and 2031/32.

Gas demand in the Residential sector, taking account of the targets announced in updates to the Climate Action Plan to date, is projected to contract across all scenarios; this is as a result of significant reductions in new connections, coupled with an anticipated increase in disconnection rates related to the uptake of heat pumps and the introduction of district heating schemes at scale. Increasing energy efficiency is also taken into account across the NDP horizon in all scenarios. The Low, Best Estimate and

"Having received funding approval from the CRU in 2023, Gas Networks Ireland is progressing a series of incremental capacity upgrade works at both compressor stations in Scotland in order to meet the forecasted 1-in-50 peak day demands."

High scenarios forecast reductions of 25%, 19% and 5% respectively in the Residential sector gas demand across the NDP horizon.

In contrast, the development of peak day demands across the various scenarios diverges when compared to the annual demand forecasts. Over the forecast horizon, the ROI 1-in-50 peak day demand is predicted to grow by 18%, and by 22% for the average peak day in the Best Estimate demand scenario between 2022/23 and 2031/32. There is decoupling of peak day and annual gas demand in the power generation sector due to the growing reliance on gas-fired electricity generation to compensate for low renewable generation on high electricity demand days. National policy targets an 80% renewable energy share in electricity generation (RES-E), primarily 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 SEM, peak day gas demand will not be as impacted as gas-fired power generation will be required to meet the majority of Ireland's electricity requirements on days of low renewable supply. In the High scenario, 1-in-50 peak day demand and average winter peak day demand are expected to increase by 58% and 60% respectively across the NDP horizon.

Only the Low scenario is expected to decrease overall, with the 1-in-50 peak forecast falling by 14% and the average winter peak day decreasing by 11%.

Towards the end of the period, the increasing penetration of renewable generation, particularly offshore wind and solar photovoltaics (PV), combined with further electricity interconnection has a slight dampening effect on the peak day gas demand, with installed wind capacity assumed to more than double over the final four years of the NDP horizon. The high level of electrical interconnection projected to be achieved by 2028 also has an impact on the peak day gas demand; in the forecast it is assumed that the SEM will be net importing on these days. Depending on electricity market dynamics in neighbouring jurisdictions, it is possible that electricity imports may not be available to this extent on the peak day. This possibility is explored in a sensitivity included in Section 6 below where interconnector imports are limited, resulting in an increase in peak day gas demand above what is forecast in the NDP base case Best Estimate scenario.

The 1-in-50 ROI peak day forecast for the Best Estimate demand scenario is expected to reach its highest point across the NDP horizon in 2025/26, which equates to 28% growth between 2022/23 and 2025/26. Similarly, 1-in-50 system peak day forecast for the Best Estimate demand scenario is expected to reach its highest point across the NDP horizon in 2025/26, which equates to 32% growth between 2022/23 and 2025/26. Given the scope for growth, the current technical supply capacity at the Moffat Entry Point in Scotland is projected to be exceeded in the latter eight years of the forecast horizon. Capacity on the interconnector pipelines is adequate to meet all gas demand projections over the ten-year horizon; the potential constraint would arise at the associated compressor station installations in Scotland. Having received funding approval from the CRU in 2023, Gas Networks Ireland is progressing a series of incremental capacity upgrade works at both compressor stations in Scotland in order to meet the forecasted 1-in-50 peak day demands.

2. Executive summary (continued)

The Data Centre market continues to seek further growth in Ireland. New demand, which currently cannot be met solely by the electricity grid led to some Data Centres taking the decision to complement fixed capacity electricity grid connections with on-site electricity generation, specifically gas-fired engines often combined with heat recovery.

In July 2022, the Government Statement on the Role of Data Centres in Ireland's Enterprise Strategy[10] set out a series of principles to inform and guide decisions on future Data Centre development. There is a clear preference for Data Centre developments that can demonstrate the additionality of their renewable energy use in Ireland and can demonstrate a clear pathway to decarbonise and ultimately provide net zero data services. Gas Networks Ireland believes that Data Centres connecting to the gas network could meet these principles through the use of biomethane and green hydrogen while simultaneously assisting in establishing indigenous renewable gas markets in Ireland. Since the publication of the Government Statement in July 2022, new Data Centre connection enquiries to the gas network have been paused. At the time of writing of this report, the CRU had commenced a public consultation on the Large Energy Users Connections Policy (both electrical and gas) which is expected to conclude in Q1 2024 and will confirm the criteria for connecting additional large energy users or data centres to the gas network. For the purposes of this NDP horizon, all scenarios include Data Centre customers with connection agreements already in place prior to the Government Statement on the role of data centres. The Best Estimate and High scenarios also include some new connections beyond what was contracted by July 2022; these new connections are assumed to meet the principles set out on the Government Statement and represent only a portion of the enquiries received by Gas Networks Ireland to date.

By the end of the NDP horizon, Gas Networks Ireland expects to see annual bioCNG demand for HGVs in the Transport sector of circa 380 GWhyr in both the Low and Best Estimate scenarios, supported by a network of 20 CNG refuelling stations. This equates to circa 65ktCO_2-eq annual emissions savings when the bioCNG stations reach their anticipated capacity. In the High scenario, Gas Networks Ireland is expecting annual bioCNG demand of c. 1,125GWh p.a., with 64 stations in operation by the end of 2032, resulting in annual savings of c. 190ktCO_2-eq.

Within the time horizon of the NDP, there is a strong drive towards displacing natural gas in the network with renewable gases such as biomethane and green hydrogen. All three gas demand scenarios forecast that annual gas demand will decrease between 2022/23 and 2031/32. This coincides with an increase in the volume of renewable gases in all scenarios across the same period. Gas Networks Ireland commissioned the first biomethane gas grid injection facility in 2019. In calendar year 2022, 41GWh of biomethane was injected into the gas grid at this connection point, offsetting 7.5ktCO_2-eq. In the Best Estimate scenario, renewable gases are forecast to grow from 0.1% of demand in 2022/23 to account for just over 16% of demand by 2031/32, resulting in a saving of 1.4Mt CO_2-eq. Given also that total ROI gas demand is forecast to decrease by 21% across the NDP horizon, natural gas volumes in the network are forecast to decrease by 34% across the period. Hence, the share of natural gas demand within the network is forecast to fall from c. 99.9% today to just under 84% by the end of the NDP horizon.

As previously mentioned, delivering on Ireland's increased ambition for biomethane production to 5.7TWh by 2030, is one of Gas Networks Ireland's key priorities. Gas Networks Ireland 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. Led

10 government-statement-on-the-role-of-data-centres-in-irelands-enterprise-strategy.pdf

by Gas Networks Ireland, the GRAZE (Green Renewable Agricultural Zero Emissions) project will deliver the first large scale CGI facility in Ireland near Mitchelstown, collecting biomethane from plants in its catchment area and injecting it into the gas network. Biomethane suppliers can also connect directly to the transmission or distribution network, with the first transmission network connection expected to be commissioned in the coming two years. Gas Networks Ireland welcome new biomethane connection enquiries and are continually assessing their viability for connection to the gas network.

Each of the three NDP scenarios, i.e., Low, Best Estimate and High, forecasts that the biomethane production target of 5.7TWh is met, but by different target years. The High gas demand scenario almost reaches this target on time, with 5.5TWh of biomethane production expected by 2030 and production increasing to 7TWh and 7.5TWh by 2031 and 2032 respectively. The Best Estimate scenario assumes that the infrastructure is in place to support the 5.7TWh target by the end of 2030, but it is 2031 before production of 5.7TWh is realised. This trajectory reflects the volume of biomethane production plants that need to be built and connected to the gas network in the next 7 years to support the biomethane industry. Finally, the Low scenario considers a further delay to the infrastructure being in place to meet the 5.7TWh target, with production of 4 TWh expected by 2032, with a view to this production reaching 5.5TWh the following year, which is outside the scope of this NDP.

The actual trajectory of the growth in production of biomethane will be guided by the National Biomethane Strategy, which is due for publication in early 2024, and the level of support that is to be provided as part of a Renewable Heat Obligation scheme that is soon to be announced.

Gas Networks Ireland continuously undertakes detailed system modelling of the network in order to assess its capacity. The Best Estimate demand scenario 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. In 2022, 10 projects were completed, including 2 AGI Capacity Upgrades, and 8 Reinforcements of the Distribution Network. These projects were subject to the appropriate consenting and planning regimes as set out in Section 3.

3. Introduction

Key messages:

The gas network currently consists of 2,477 km of high-pressure steel transmission pipelines and 12,248 km of lower pressure polyethylene distribution pipelines.

Natural gas is available in 22 counties, serving c. 720,000 gas customers

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[11] (Internal Market in Natural Gas and Electricity) (Amendment) Regulations 2015. The Network Development Plan (NDP) is based on current gas supply and demand, projections for growth in gas consumption and development of gas supply and transportation infrastructure.

Amendments to the EU Directive 2009/73/EC (enacted under EU 2022/869 in May 2022) and proposed revisions to the Regulation revises the requirement for a Ten-Year Network Development Plan (TYNDP) from yearly to every two years. In interim years when a ten-year Network Development Plan is not requested by the CRU, a Gas Forecast Statement (GFS) will be developed, providing a view of how the gas network may develop over a ten-year period.

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[12] (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.

"The NDP is based on current gas supply and demand, projections for growth in gas consumption and development of gas supply and transportation infrastructure."

Under the Trans-European Energy Infrastructure Regulation (TEN-E), Gas Networks Ireland is obliged to confer with regional groups on relevant regional and national infrastructure plans. TEN-E provides the legislative basis for 'Projects of Common Interest' (PCI) designation, which refers to cross border energy infrastructure projects that link the energy systems of EU countries. Benefits associated with PCI status include accelerated planning, preferential regulatory treatment, and in most instances, the ability to apply for EU grant funding via the Connecting Europe Facility.

Projects of Mutual Interest (PMIs) are key cross-border energy infrastructure projects between the EU and non-EU countries, e.g. between Ireland and the UK, which contribute to the energy and climate policy objectives of the Union. This is a new category of projects that can be supported following the revision of the Trans-European Networks for Energy Regulation (TEN-E) in June 2022.

The revised TEN-E regulation (EU 2022/869) aims to re-focus TEN-E away from traditional gas infrastructure projects towards low carbon solutions such as biomethane, hydrogen and smart gas grid solutions. As a result, the 20 natural gas projects which were included in the previous 5th PCI list published by the European Commission in October 2021, have been removed from the 6th

11 European Commission
12 European Commission

3. Introduction
(continued)

PCI list published in November 2023. While Gas Networks Ireland currently has no projects on the 6th PCI list, this list includes 65 new Hydrogen projects, indicating the availability of funding opportunities for future hydrogen projects related to the gas network.

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 the NDP outlines a number of capital projects, and new technologies, which will be delivered over the coming years, 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 by 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.

3.3 Overview of the Gas Networks Ireland system

Gas Networks Ireland builds, develops and operates Ireland's world-class gas infrastructure, maintaining over 14,725km of gas pipelines and two sub-sea interconnectors.

The Gas Networks Ireland transmission network includes the onshore ROI network, two subsea interconnectors between ROI and Scotland, one of which also serves the Isle of Man (IOM) market, two compressor stations in Scotland at Beattock and Brighouse Bay and twin onshore pipelines in Scotland. The interconnector system is connected to GB's National Transmission System (NTS) at Moffat in Scotland. Gas is also supplied to the Northern Ireland (NI) market via Twynholm, Scotland.

From just 31km of transmission pipeline in 1978, the Gas Networks Ireland network has extended to 2,477km of high-pressure steel transmission pipelines and 12,248km lower pressure polyethylene distribution pipelines, as well as Above Ground Installations (AGIs), District Regulating Installations (DRIs), compressor stations, Compressed Natural Gas (CNG) stations and a biomethane injection point. 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 16barg; and
- Distribution infrastructure which operates below 16barg.

The distribution infrastructure is typically operated at 4barg and less than 100mbarg 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 prolonged sub-zero temperatures were recorded. During late 2017 and early 2018, the gas network again demonstrated its resilience through extreme weather events, storms Emma and Ophelia, with no loss of gas supply to households, businesses or the power generation sector. The gas network is available in 22 counties and there are circa 720,000 customers 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: 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 Climate Action Plan 2023.

Ireland has committed to and legislated for net-zero emissions by 2050; 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 green hydrogen.

The National Hydrogen Strategy, published in July 2023, and strongly welcomed by Gas Networks Ireland, outlines the future role green hydrogen and the gas network will play in specific areas of Ireland's energy system, enabling the decarbonisation of hard-to-abate sectors such as transport, industrial heating and power generation.

The continued roll-out of biomethane and CNG technologies will deliver immediate emissions reductions.

Gas Networks Ireland welcomes the recent policy requirement for greater energy system scenario planning integration as called for in the National Hydrogen Strategy and in the Energy Security in Ireland to 2030 report. The Energy Security in Ireland report acknowledges the significant interdependencies between the gas and electricity networks, and that these interdependencies will become more important with the increasing penetration of both renewables and renewable gases in the energy system.

Gas Networks Ireland has commenced a range of work packages to ensure the gas network will be ready to support the transport of hydrogen initially via blending and with 100% hydrogen networks in clusters, evolving to a national hydrogen network through the linking of clusters and conversion of existing pipelines as the production of hydrogen and demand increases. The development of a national hydrogen network will take due consideration the plans to develop a biomethane sector in Ireland.

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 and security of supply of the gas transportation system. 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 looks to align to the existing policy measures in place at the time of the NDP modelling Data Freeze, including, for example, the Climate Action Plan (CAP) 2023. There is a high level of ambition in some of the decarbonisation targets included in this policy document which will pose significant delivery challenges within the period to 2030. As a result, the Best Estimate NDP scenario aligns to the measures and ambition outlined in the CAP 2023, however the relevant targets that influence gas demand may not be met on-time, but are met by the end of the NDP horizon, i.e. 2032. The High NDP scenario assumes a slower decarbonisation trajectory, while the Low NDP scenario is fully aligned with the ambitious decarbonisation policy included in CAP 23.

Further to the above energy policy publications, Ireland's Programme for Government (PfG)[13] sets a commitment to reducing overall greenhouse gas emissions by 7% per annum from 2021 to 2030, with the aim of achieving net-zero emissions by 2050. The Climate Action and Low Carbon Development (Amendment) Bill 2021 also sets a commitment to net-zero emissions by 2050. These are significantly higher targets than set out in previous policy and are set to shape the Irish energy landscape into the coming decades. In 2022, a carbon budget programme comprising of three 5-year budget periods and sector-specific emissions ceilings, operating within the parameters of the carbon budgets, were approved by the Government and came into effect. The carbon budgets and sectoral emissions ceilings provide a pathway towards Ireland's 2030 and 2050 climate targets.

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

13 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 committed to achieving net-zero emissions of greenhouse gases by 2050 at the latest. The necessity to ensure the pathway to decarbonisation is underpinned by affordability and security of supply has been brought into focus in recent years through the unprecedented stress events experienced on global energy markets[14]. It is broadly acknowledged that dispatchable power generation (typically powered by natural gas, and in future powered by renewable gases such as biomethane and/or green hydrogen) will have an important role to play in underpinning security of supply throughout (and beyond) the transition of Ireland's power system to net zero emissions.

Relevant National and European policy developments are summarised in Figure 4.1.

Figure 4-1: National and European Energy Policy Developments

National policy developments

Existing	
Programme for Government	June 2020
National Energy and Climate Plan 2021 – 2030	June 2020
Climate Action and Low Carbon Development Act	July 2021
Carbon Budgets and Sectoral Emissions Ceilings	February 2022/ July 2022
Climate Action Plan 2023	December 2022
National Hydrogen Strategy	July 2023
Energy Security in Ireland to 2030	November 2023
Climate Action Plan 2024	December 2023
Draft National Energy and Climate Plan Update	December 2023
Upcoming	
National Biomethane Strategy	Expected Q1 2024

European policy developments

Existing	
European Green Deal	December 2019
EU Hydrogen Strategy	July 2020
EU Energy System Integration Strategy	July 2020
Fit for 55 Package	July 2021
REPowerEU	March 2022
EU Hydrogen and Gas market decarbonisation Package	Q4 2023
Upcoming	
Gas Demand Reduction Regulation	Q1 2024

14 Energy Security in Ireland to 2030 Energy Security Package

Programme for Government
In 2020, the Programme for Government 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 will need to consider all initiatives and technologies that would reduce emissions on a no regrets basis.

"This 51% reduction by 2030 is more than double the 23% emission reductions targeted in the 2019 Climate Action Plan."

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. NECPs determine each EU Member States contribution towards the EUs climate targets. Each NECP covers a ten-year period and provides a framework for planning national climate and energy objectives, targets, and policies. Ireland, along with all member states are now required to submit an updated NECP to the European Commission by June 2023 (draft) and June 2024 (final plan). The draft NECP will be updated to incorporate comments from the Commission, responses to a public consultation which will take place in early 2024, and any updated policies and targets.

In December 2023, Ireland submitted its draft National Energy & Climate Plan (NECP) 2021-2030 to the European Commission.

The draft Plan recognises that the increased penetration of wind and solar energy places an increased reliance on Ireland's gas network and highlights the decarbonisation opportunities that green hydrogen, biomethane, district heating, CNG and CCUS can bring.

It has been updated to include reference to the National Hydrogen Strategy and the Energy Security in Ireland to 2030 report. The Plan expects hydrogen demand to grow significantly post 2030 and is expected to play an important role as a source of dispatchable, flexible electricity, for storage of renewable energy, and in decarbonising hard to abate industrial processes. The Energy Security in Ireland to 2030 report pledges to complete a Network Transition Plan for the gas network to support long-term planning, future uses, and investment needs in line with our Sectorial Emission Ceilings.

The Climate Action Plan 2023 target of up to 5.7 TWh of indigenously produced biomethane by 2030 is included, with the Renewable Heat Obligation seen as a key support to deliver on this ambition. It highlights the need for Ireland to learn from the experience of other member states including Denmark if it is to become a leader in biomethane production.

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.

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

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. In addition to setting out a pathway to 2030, it also set out clear governance arrangements which will significantly enhance accountability and purpose in implementing the proposals. Gas Networks Ireland welcomed the strength and urgency of the ambition and the associated governance set out in the Plan.

In December 2022, the Government published the Climate Action Plan 2023 (CAP 2023), it's second annual update to the Climate Action Plan. CAP 2023 is the first to be prepared under the Climate Action and Low Carbon Development (Amendment) Act 2021 and following the introduction of the economy-wide carbon budgets and sectoral emissions ceilings in 2022. The plan implements the carbon budgets and sectoral emissions ceilings and sets a roadmap for taking decisive actions to halve Ireland's emissions by 2030 and to reach net zero no later than 2050.

Decarbonised gases such as biomethane and green hydrogen are recognised in CAP 2023 as being a critical component for Ireland's energy ecosystem, with the suitability of these gases for use in decarbonising medium and high temperature processes being acknowledged. To facilitate investment, CAP 2023 proposes to bring forward policies and regulatory frameworks to stimulate domestic biomethane production and use, and to develop a sizeable hydrogen sector.

Specific key metrics and measures relating to development of green hydrogen include:

- A target of 2GW of offshore wind dedicated to green hydrogen production to be in development by 2030 – this is in addition to the wider target for offshore wind of 5GW by 2030;
- a policy and regulatory roadmap for green hydrogen to be developed as part of the Hydrogen Strategy for Ireland;
- a target of at least 2.1TWh zero-emissions gas consumption for industrial heating, noting the significant long-term role for green hydrogen in meeting high-temperature heat demands.

Additionally, the significant long-term role for green hydrogen in sector coupling of the energy system and in minimising the overall cost of decarbonisation across all sectors was re-affirmed. Further measures potentially required in the third carbon budget period (2031 – 2035) will include:

- Policies to ensure that zero carbon gases, like hydrogen, are utilised in the electricity sector to provide zero carbon dispatchable electricity at sufficient scale; and
- Policies to support the development of inter-seasonal storage of hydrogen.

Specific key metrics and measures included in CAP 2023 relating to the development of biomethane include:

- The establishment of a Biomethane Working Group to develop a National Biomethane Strategy (to be delivered within 6 months); and
- expanding the indigenous biomethane sector through anaerobic digestion, reaching up to 1TWh of biomethane production by 2025 and up to 5.7TWh of biomethane by 2030.

Additionally, the potential role for biomethane, as a zero emissions gas is referenced across multiple sectors including electricity, agriculture, residential and industrial heating, and the petroleum refining process.

Specific key metrics and measures relating to decarbonisation of energy demand for heating across Industry and the Built Environment include:

- At least 1.2TWh consumption of zero emission gas for industrial heating by 2025, increasing to 2.1TWh by 2030;
- Up to 0.4TWh of residential heating demand to be provided by renewable gases by 2025, increasing to 0.7TWh by 2030
- Up to 0.2TWh of public and commercial heating demand to be provided by renewable gases by 2025, increasing to 0.4TWh by 2030
- Introduction of a Renewable Heat Obligation by 2024 to accelerate the introduction of renewable gases.

The role of the gas network and renewable gases in the evolution of a flexible decarbonised electricity system is established through the following metrics and measures:

- Rapid delivery of new flexible gas generation (at least 2GW) is needed at scale and in a timeframe to replace emissions from coal and oil generation before the second carbon budget period, and as a key measure to ensure security of electricity supply;
- Zero emission gas fired generation from renewable gases commencing by 2030;
- Increased zero emission gas generation in the period 2031 – 2035 to enable a net zero power system.

In December 2023, the Government published the Climate Action Plan 2024 (CAP 2024), its third annual update to the Climate Action Plan. The plan reaffirms the targets of halving Ireland's emissions by 2030 and reaching net zero by no later than 2050 through refining and updating the measures and actions introduced in CAP 2023 required to deliver the carbon budgets and sectoral emissions ceilings.

Security of energy supply

In April 2022 the Government launched the National Energy Security Framework, which provides an overarching and comprehensive response to Ireland's energy security needs in the context of the war in Ukraine. Among the actions prioritised in the framework were:

- Ensuring the framework for cooperation on natural gas supplies to Ireland are reviewed and updated in line with EU gas market and security of supply legislative proposals
- Implementation of the programme of work set out by the CRU to ensure security of supply (which includes delivery of at least 2 GW of enduring flexible gas fired generation capacity by 2030)
- Development of a National Policy Statement on Heat
- Appraisal of the introduction of supports for biomethane as a replacement for natural gas
- Development of the National Hydrogen Strategy
- Completion of the Review of the Security of Energy Supply of Ireland's Electricity and Natural Gas Systems

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

In September 2022, the Government published a consultation on its Review of the Security of Energy Supply of Ireland's Electricity and Natural Gas Systems. The report set out the requirement for affordability and security of supply to underpin the decarbonisation of Ireland's energy system. The outcome of this consultation was published in November 2023 as the Government's Energy Security Package. This Package includes the overarching report Energy Security in Ireland to 2030[15], which outlines a new strategy to ensure energy security in Ireland for this decade, while ensuring a sustainable transition to a carbon neutral energy system by 2050. The report is informed by the Government's energy security policy objectives - to ensure energy is affordable, sustainable, and secure - the review considered the risks to oil, natural gas, and electricity.

The package also includes the report Securing Ireland's Gas Supplies, which assesses the potential risks to Ireland's natural gas security of supply, to review policy options that may enhance Ireland's security of gas supply and to present recommendations to the Minister and Government based on the policy proposals presented. The report includes 'enduring measures' that will provide solutions based on Ireland's long-term future requirements, including renewable compatible large scale gas storage, increased production of renewable gas and a fit-for-purpose gas network that evolves with changing gas requirements.

The report also includes a 'transitional measure' to address any unmet demand should a significant disruption occur to Ireland's largest gas infrastructure in the medium-term. Based on a preliminary analysis the Department of the Environment, Climate and Communications has identified a floating Gas Emergency Reserve for use in the event of a disruption as an appropriate measure to address the identified risks to our gas security of supply.

Gas Networks Ireland supports the national objectives of the Energy Security Package and has been specifically tasked with developing a detailed examination and business case of the Strategic Gas Emergency Reserve, to be delivered in Q2 2024.

Carbon budgets

Ireland's carbon budget programme, comprising three 5-year budgets (2021-2025; 2026-2030; and 2031-2035), came into effect on 6 April 2022. A carbon budget represents the total amount of emissions, measured in tonnes of CO_2 equivalent, that may be emitted by a country or region during a specific period. The carbon budget for the period 2021-2025 aims to reduce emissions by 4.8% on average annually for five years, while the second budget from 2026-2030 will look to up that annual reduction to 8.3%. The budgets are further broken down into sectoral emissions ceilings, which determine how each sector of the economy contributes to the achievement of the carbon budgets.

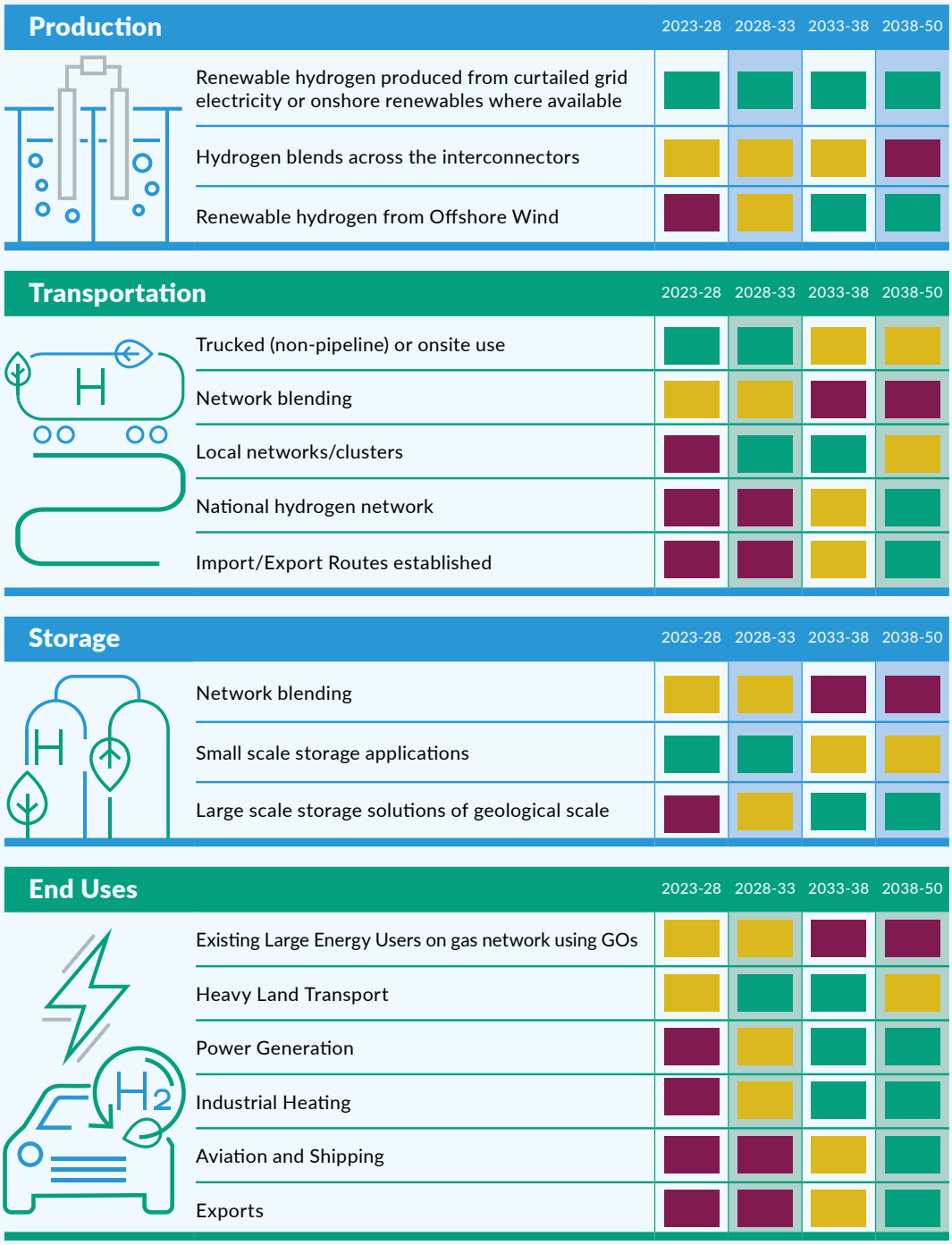
The sectoral emissions ceilings have been set for the electricity, transport, buildings, industry and agriculture sectors, with reductions in emissions ranging from 25% to 75% per sector by 2030, relative to 2018 emission levels. In addition, the agreement reached on sectoral emissions ceilings also commits additional resources for solar (more than doubling the target to 5.5 GW), off-shore wind (moving from a target of 5 GW to 7 GW), green hydrogen (produced from 2GW dedicated offshore wind capacity), agri-forestry and anaerobic digestion (up to 5.7 TWh of biomethane) – to further accelerate the reduction of overall economy-wide emissions. With the exception of solar, where the 2030 target was further increased to 8 GW, these targets were incorporated directly into CAP 2023.

Ireland's National Hydrogen Strategy

Gas Networks Ireland has strongly welcomed the publication of the Government's National Hydrogen Strategy in July 2023. The report published by the Department of Environment, Climate & Communications (DECC) is of particular relevance for Gas Networks Ireland as it outlines the future role green hydrogen and the gas network will play in specific areas of Ireland's energy system, enabling the decarbonisation of hard to abate sectors such as transport, industrial heating and power generation.

15 Energy Security in Ireland to 2030 Energy Security Package

Figure 4.2: Ireland's strategic hydrogen development timeline



The gas network will play a leading role in hydrogen transportation and will also be a key enabler in the development of a hydrogen economy across the four components of the hydrogen value chain: Production, Transportation, Storage and End Uses as presented in the strategy's hydrogen development roadmap.

Actions specifically related to the existing gas network infrastructure include:

- Action 11: Continue work to prove the technical capabilities of the gas network to transport hydrogen through the network and closely work with the network operators in neighbouring jurisdictions in respect to interoperability between the networks
- Action 12: Develop a plan for transitioning the gas network to hydrogen overtime, taking due consideration of:
    a. plans to develop a biomethane sector in Ireland,
    b. the prioritisation of end uses set out in the National Hydrogen Strategy and their likely locations where known,
    c. the need to maintain energy security through the transition,
    d. how existing end users can transition from natural gas to hydrogen, or to alternative energy solutions such as electric heating,
    e. the potential use of hydrogen blends during a transition phase, the costs associated and how the transition from blending can occur.

The plan should look to identify where the network can be repurposed, or where new pipelines may be required and provide detailed costings and a programme of works.

The strategy recognises that hydrogen offers an incredible opportunity to enable Ireland to transition to a climate neutral economy by being a zero-carbon substitute for fossil fuels. In doing so, green hydrogen will help Ireland meet its 2050 net-zero emissions targets, diversify and strengthen its security of supply, provide a pathway to energy independence, and in the long-term, potentially leading to the creation a new energy export market.

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. 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.

The proposed 'Hydrogen and gas markets decarbonisation package' (revising Directive 2009/73/EU and Regulation 715/2009/EU) was published in December 2021. This revision aims to redesign a competitive, decarbonised gas market, fit for renewable gases including hydrogen and biomethane. Gas Networks Ireland actively fed into this review via direct consultation input and representation through its various EU gas association memberships. The Trialogue discussions were completed on the 8th December 2023, with the final text being approved by

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

the European Council on the 20th December and the Committee on Industry, Research and Energy (ITRE Committee) of the Parliament on the 22nd January 2024. Approval by the Parliament is expected in April and its entry into force in May/June 2024, with the Belgian Presidency of the Council of the European Union committing to its completion in Q2, 2024.

The recast Energy Efficiency Directive (EU) 2023/1791 was published in the EU Official Journal in September 2023, with EU Member States now having two years to transpose most of the different elements of the directive into national law. The publication of this recast directive marks the final step in the legislative process that started with the Commission proposal in July 2021, as part of the 'Fit for 55' package which was supplemented by an additional proposal as part of the REPowerEU plan in May 2022. The Directive establishes an EU energy efficiency target of 11.7% for 2030, exceeding the Commission's original 'Fit for 55' proposal. It requires EU Member States to collectively ensure an additional reduction of final and primary energy consumption, compared with energy consumption forecasts made in 2020.

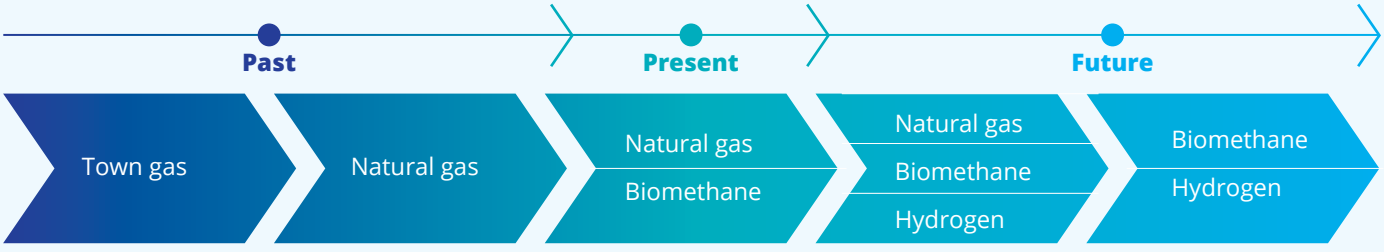
Since the Russian invasion of Ukraine in February 2022, the volume of new energy initiatives from the European Union has continued to accelerate. These include:

- The REPowerEU plan (May 2022) outlines the EU's path to energy independence from Russian fossil fuel by 2027 and plans to fast forward the green transition. The plan puts forward short, mid-term and long-term targets and measures, including demand reduction, diversification of suppliers, and acceleration of the transition to renewable energy sources. The Plan also includes a goal to increase biomethane production to 35bcm, across the EU, by 2030, as well as a target of producing 10 million tonnes of domestic and 10 million tonnes of imported renewable hydrogen by 2030.
- New gas storage rules which elevate the status of gas storage facilities to critical infrastructure. These rules were adopted in an effort to improve energy security amid Russia's invasion of Ukraine. Storage capacity fill targets have been implemented which require member states with underground gas storage facilities (Ireland is not included) to fill 90% of their storage capacity by 1st November 2023, up from 80% by 1st November 2022.
- All EU countries committed to reduce their gas consumption by at least 15% via the agreement on a regulation on gas demand reduction. Ireland have been exempted from this requirement due to our lack of direct interconnection with another member state. This gas demand reduction target was extended for an additional year in March 2023.

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; 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.

Figure 4-3: Gas Infrastructure adapting to multiple Energy Carriers



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

The gas network plays a critical role in Ireland's economy today, delivering approximately 31.1%[16] 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 47%[17] of the country's annual electricity requirement in 2023. National policy targets an 80% renewable energy share in electricity generation (RES-E), such as from wind and solar, by 2030. While Ireland has excellent renewable resources, renewable electricity generation is weather dependant and intermittent. As such, for renewable electricity generation to achieve its full potential, investment in complementary dispatchable energy systems is required. The gas network provides the optimal complementary energy source for intermittent renewable electricity generation from wind and solar; even when the optimal amount of renewable electricity production is attained, there will still be a need for some dispatchable thermal electricity generation to provide the balance of electricity supply and to ensure security of energy supply for Ireland. It is well established that achieving 80% RES-E will require a significant reliance on thermal electricity generation[18]. Gas Networks Ireland's ambition is to facilitate this thermal electricity production through renewable and carbon free gases, namely biomethane and hydrogen.

Electricity emissions have fallen by 38% between 2010 and 2022[19]. This was made possible by both the increased deployment of renewables within the electricity network and the increased use of higher-efficiency gas turbines providing a complementary balance of electricity generation in times of low wind. Natural Gas emits 40% less CO_2 than coal and 22% less CO_2 than oil[20]. It also produces negligible levels of nitrogen dioxide (NOx) and sulphur dioxide (SOx) compared to oil or coal. Switching from these higher carbon fuels to natural gas delivers immediate emissions benefits.

The existing gas network is already capable of taking on significant new energy demands. Integration of biomethane 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 through the injection and transportation of biomethane and hydrogen. For this to happen, the gas and electricity networks will need to be further integrated. An integrated energy system would deliver clean energy and encourage Ireland on track 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.

A net-zero carbon gas network supports increased decarbonisation across electricity 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

Gas Networks Ireland is the proud owner and operator of one of the most modern gas networks in Europe. However, we recognise that our network must be repurposed to transport renewable gases. Our organisation and its network are uniquely placed to deliver the necessary changes, and we're actively working towards these goals. This will also require collaboration with other energy partners to collectively ensure net zero carbon by 2050. Gas Networks Ireland has developed a series of scenarios which consider the importance and impact of policy decisions on the scale of decarbonisation that can

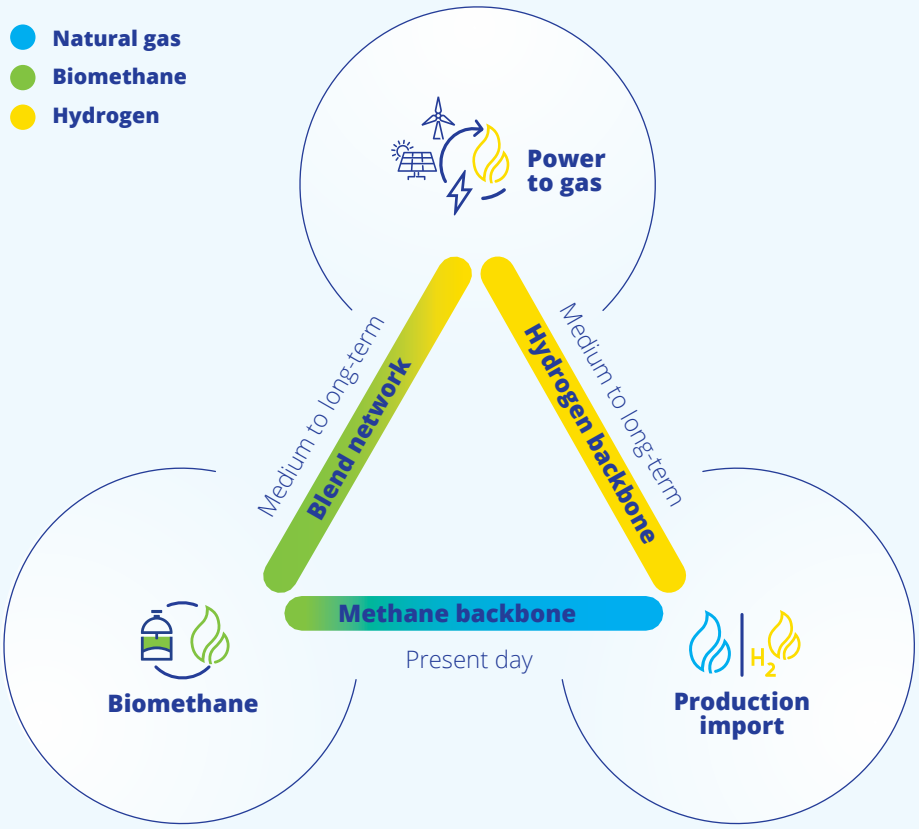
16 https://www.seai.ie/publications/Energy-in-Ireland-2023.pdf
17 Electricity | Monthly Energy Data For Ireland | SEAI
18 Energy Security in Ireland to 2030 Energy Security Package
19 https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/2023-EPA-Provisional-GHG-Report_Final_v3.pdf
20 https://www.seai.ie/publications/Energy-in-Ireland-2023.pdf

be achieved. Our ambition demonstrates how the gas network supports decarbonisation for domestic customers, industrial users, transport, agriculture and power generation.

As National and European energy policy evolves, Gas Networks Ireland is continuously reviewing and developing further potential pathways to achieve a decarbonised gas network by 2050, such as the increased role of hydrogen in the future energy system. It is likely that there will be multiple pathways to decarbonising the gas network and the wider energy system. Figure 3.3 shows how renewable gases could be transported within the gas network through a variety of emerging pathways.

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 initially connecting hydrogen clusters will be developed, through the re-purposing of existing pipelines and/or construction of new pipelines.

Figure 4-4: Principles for transportation of renewable gases



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

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).

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.

Gas Networks Ireland welcomes the recent policy requirement for greater energy system scenario planning integration as set out in the National Hydrogen Strategy and in the Energy Security in Ireland to 2030 report. In order to strengthen Gas Networks Ireland's and EirGrid's annual forecasting processes, the Energy Security in Ireland report identifies the need to be informed by a joint scenarios framework that appropriately reflects integration between energy sectors. The report also acknowledges the significant interdependencies between the gas and electricity networks, and that these interdependencies will become more important with the increasing penetration of both renewables and renewable gases in the energy system.

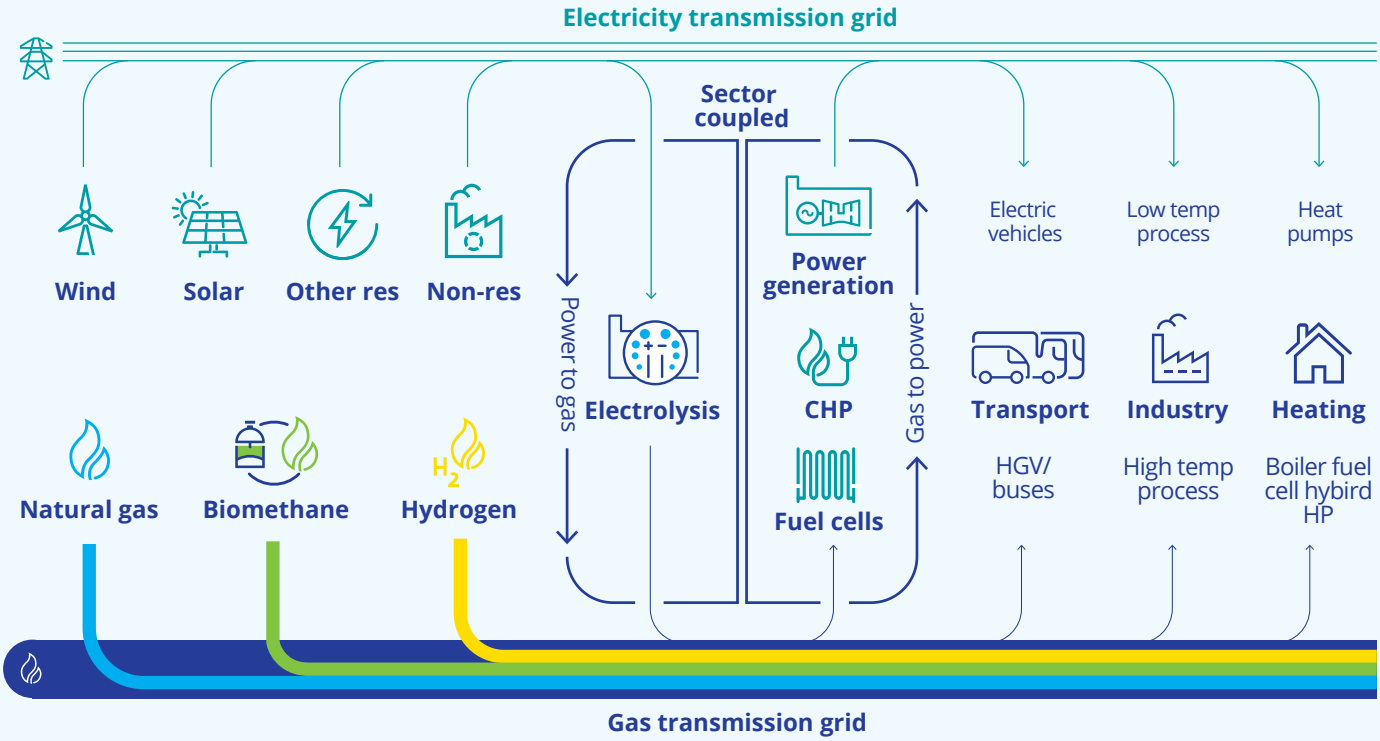


Figure 4-5: Principles for Sector Coupling

Figure 3-4 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 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 supply.

4.2.3 Key enabling technologies

While there are various pathways to delivering a net-zero gas network by 2050, there are a number of key technologies, common to each pathway, which will enable this transition to a lesser or greater extent. Technologies such as biomethane and bioCNG 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 significant growth of these existing technologies and will also require development of and investment in hydrogen at scale (as referred to in the National Hydrogen Strategy). In addition, Gas Networks Ireland notes the key metrics included on the deployment of carbon abatement technologies, within the Industrial sector in particular, in the CAP 2023. 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 and is a safe and reliable technology with over 1.4 million CNG vehicles in operation in Europe alone[21]. CNG is a cleaner, economic, proven alternative fuel to diesel, providing significant carbon emission savings alongside air quality improvements.

Heavy Goods Vehicles (HGVs) and buses are responsible for c.20% transport emissions[22] while accounting for just 4% of vehicles on the road. CNG HGVs that run on natural gas will on average save 15% in CO_2 emissions and when renewable gas (i.e. compressed biomethane or bioCNG) is consumed, it offers a pathway to net-zero carbon transport for these vehicles. CNG also contains no additives and has far less emissions of nitrogen oxide, sulphur oxide and particulates matter than diesel. 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.

21 https://alternative-fuels-observatory.ec.europa.eu/transport-mode/road/european-union-eu27
22 https://www.seai.ie/publications/Energy-in-Ireland-2023.pdf

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

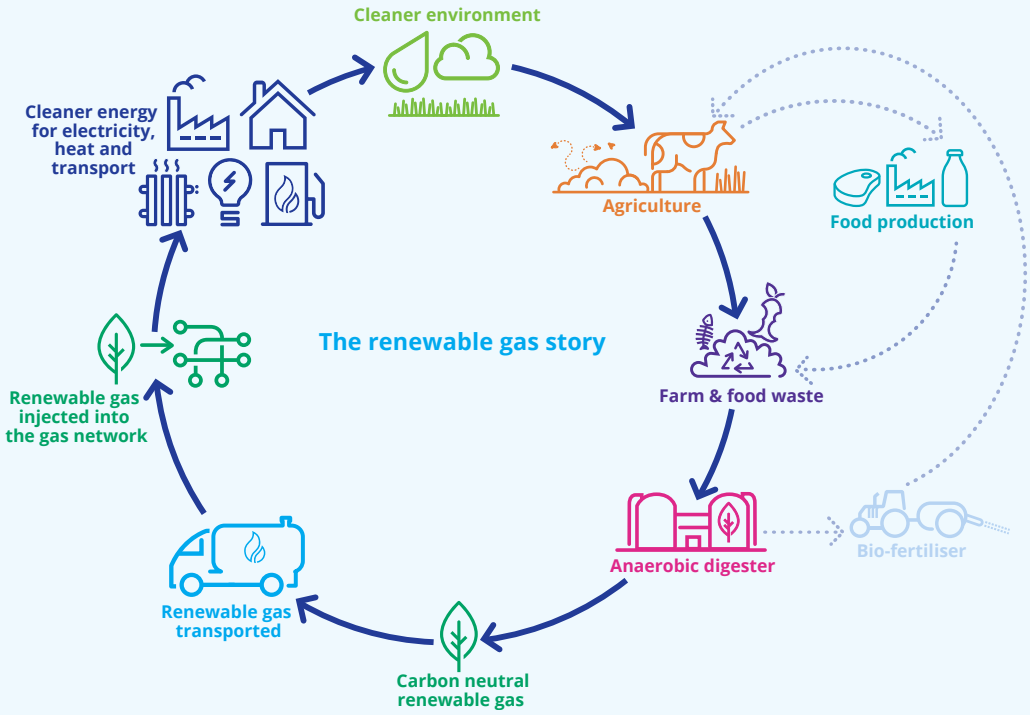


Figure 4-6: Renewable gas story

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 biomethane as alternative fuels. Our ambition is to displace all CNG with bioCNG as the biomethane industry expands. More detail on the development of this CNG network is given in Section 8.4.

Biomethane

The Irish Government has a stated ambition of 5.7TWh of biomethane production, supplying more than 10% of Ireland's annual gas demand, by 2030[23]. Biomethane is a renewable gas, structurally identical to natural gas that can be used as a direct substitute for natural gas. Biomethane is fully compatible with both the national gas network and end-use technologies such as existing appliances, industrial infrastructure and vehicles and can seamlessly replace natural gas to reduce emissions in industry, transport and power generation. As such, it is a means of reducing the consumption of fossil fuels and, thereby, contribute to the transition towards a net zero energy system.

Replacing natural gas with biomethane represents an essential step in the decarbonisation of Ireland's energy system. Biomethane will play an important role in this future system, contributing towards Ireland's transition to a climate neutral economy by being a zero-carbon substitute for natural gas. Sustainable and indigenously produced biomethane can contribute towards Ireland's 2030 emissions reduction target and sectoral emissions ceilings, while also playing a role in sustainably delivering a net zero energy system by 2050. Biomethane production also serves to diversify and strengthen security of energy supply, providing a pathway to energy independence.

Gas Networks Ireland is working towards the decarbonisation of Ireland's energy system by replacing natural gas with renewable gases, initially

biomethane, ensuring a secure and diverse energy supply for Ireland. Production of biomethane offers an immediate and localised opportunity for renewable gas production and utilisation. Delivering on Ireland's increased ambition for biomethane production to 5.7TWh by 2030, as set out in Climate Action Plan (CAP) 2023 and REPowerEU, is one of Gas Networks Ireland's key priorities. In 2023, a connection agreement was signed by Gas Networks Ireland providing for the first direct biomethane plant connection to the network, with a further five new connection offers being issued by the end of the year, signalling a genuine start to the Irish biomethane industry.

Some of the key benefits of Biomethane as a fuel source include:

- Enhancement of security of supply as the biomethane is domestically produced, dispersed throughout the country, and can, as production at Corrib continues to decline, replace the fossil gas previously produced from that gas field.
- Biomethane is produced with existing technology, and it can also be transported, stored and distributed through the existing gas network.
- Biomethane can be rapidly deployed leading to reduction of climate emissions across hard to abate energy demand sectors, such as intensive heat industries and transport. Biomethane can generate high greenhouse gas savings and can create negative emissions.
- Biomethane supports sustainable agriculture as its production supports employment in rural areas, promotes circular economy in agriculture, and can improve soil health. Digestate, a biproduct of biomethane production, can displace fossil fuel-produced fertilizer, providing further emissions savings.
- Similar to the early years of the wind industry, the biomethane gate price is currently more expensive than natural gas. However, when the full system decarbonisation alternatives are considered, biomethane represents a cost competitive solution.

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

The injection of biomethane into the gas network is aligned with both EU and individual Member State decarbonisation strategies across Europe. Several EU Member States are incentivising a move away from the use of biogas at AD sites for electricity production towards the injection of biomethane into the gas network. Italy has introduced incentives for existing AD plants to direct their biogas to biomethane production and subsequent injection into the gas grid. Other countries, such as the United Kingdom and France, have also developed policies to similarly target increasing the deployment of biomethane production for injection into the gas network. An alliance has been established amongst the French gas network companies to promote the decarbonisation of the gas network, with a 100% renewable gas target now in place for 2050. Denmark has committed to fully displacing natural gas on their gas distribution network with biomethane by 2035 and earlier this year confirmed it already produces 39% of its gas demand from biomethane.

The European Commission has identified Ireland as having the greatest potential per capita to deploy biomethane[24]. CAP 2023 sets out ambitions for production of biomethane as outlined in Section 4.1, with a target of 5.7TWh of biomethane production per annum by 2030.

Gas Networks Ireland, in preparation for this, has developed a connection policy specific to biomethane production approved by the CRU, established a Certification scheme for tracking renewable gas on the system and is currently developing standard designs for connection of future biomethane plants to the gas network. In 2023, Gas Networks Ireland signed their first direct connection contract with a biomethane producer. This is a further step on the biomethane journey which began for Gas Networks Ireland in 2020 when the first biomethane injection facility was commissioned. Biomethane has already begun replacing natural gas in the network, with 41GWh of biomethane from two domestic producers entering the network in Cush, Co. Kildare during 2022.

In September 2023, Gas Networks Ireland published the Biomethane Energy Report[25] which outlines the current and future role biomethane and the gas network will play in specific areas of Ireland's energy system, and the opportunity it provides to decarbonise sectors including agriculture, transport, industrial heating and power generation.

This report illustrates that there is significant interest and potential for biomethane production. The report also highlights that most of the biomethane can be economically connected to the low-pressure distribution system with a few exceptional connections mainly driven by their proximity to existing transmission networks. Furthermore, those production plants which are either smaller in size or are too distant from the existing network may be facilitated by transportation by road and injection via central grid injection facilities.

Over the NDP period, Gas Networks Ireland 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.

Guarantees of Origin

Gas Networks Ireland established a Renewable Gas Registry in 2019 which issues 'Certificates of Origin' to producers injecting renewable gas into the gas grid. Statutory Instrument 350 of 2020 appointed Gas Networks Ireland as the Issuing Body for Guarantees of Origin in Ireland, as described in Article 19 of the re-cast EU Renewable Energy Directive (RED II). Producers of Renewable Gas are required to hold a certificate of sustainability issued by an EU Voluntary Scheme to ensure sustainability criteria set out under RED II are met. This assurance is vital to providing confidence to consumers that the gas delivered is renewable and can be counted towards emission reduction targets. It also gives government and regulators certainty that sales of renewable gas are recorded in a transparent manner.

24 ce_delft_3g84_biogas_beyond_2020_final_report_0.pdf (europa.eu)
25 biomethane-energy-report.pdf (gasnetworks.ie

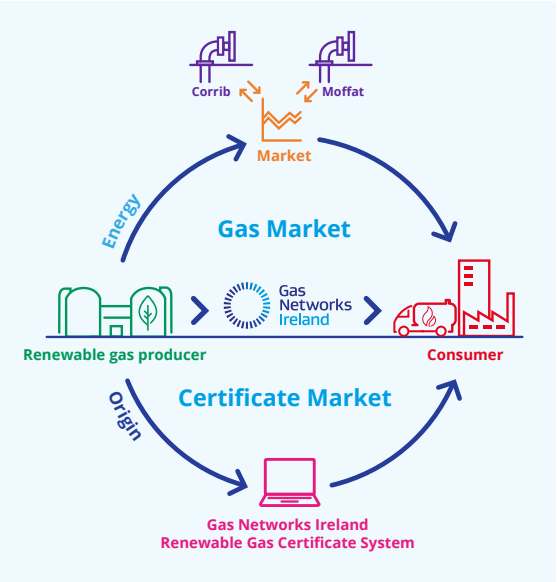


Figure 4-7: Renewable Gas Certification System

The Renewable Gas Registry is now recognised and relied upon by both NORA and the EPA for tracking deliveries of Renewable Gas to refilling stations and ETS consumers.

Green Gas Generation, which operates the biomethane injection facility at Cush, Co. Kildare, was awarded Sustainable Certification by the International Sustainability and Carbon Certification (ISCC) for biomethane production, which certifies it as renewable gas. Glenmore Generation, who produce biomethane in Donegal also inject at Cush and have also been certified by ISCC. ISCC-certified renewable gas is compliant with the Renewable Transport Fuel Obligation Scheme in both Ireland and the UK and is treated as a zero-emissions fuel under the EU ETS. In addition, the GRAZE (Green Renewable Agricultural Zero Emissions) Gas Project is led by Gas Networks Ireland and is supported by more than €8.4m in funding from the Department of Environment, Climate and Communications' (DECC) Climate Action Fund (CAF), as part of the Government's National Energy Security Framework. Key elements of the GRAZE Gas Project include:

- Central Grid Injection (CGI) point near Mitchelstown in Co. Cork
- Transportation of Renewable Gas from Anaerobic Digestors to CGI
- 2x Compressed Natural Gas (CNG) Refuelling Stations
- Vehicle funding for 74 CNG trucks

When operating at full capacity, the Mitchelstown CGI will have the potential to inject up to 700 GWh of renewable gas into the gas network annually. This represents 1.2% of total gas demand and will reduce emissions by c. 130,000tCO_2 p.a. when fully operational.

The EU's Farm to Fork Strategy highlights biomethane as a key element in decarbonising agriculture, which is a particularly important focus for Ireland. Additionally, it offers an immediate decarbonisation solution for transport, industry, heating and power generation, and the ability for businesses to power their operations via renewable gas made from their own waste in a truly sustainable circular economy.

Hydrogen

Hydrogen is considered an attractive option to decarbonise energy systems and has significant potential to drive a cleaner energy future for Ireland. Hydrogen is a gas that can be produced in various ways, including from renewable electricity, can be stored until needed and produces zero CO_2 emissions when combusted. It can also be blended with natural gas or used in its pure form. Hydrogen also demonstrates how greater integration between Ireland's gas and electricity networks can support a low-carbon economy, while also enhancing energy security and diversity.

At a national level, there is increasingly positive sentiment towards hydrogen's role in the net-zero solution. Ireland's National Hydrogen Strategy was published by the Government in July 2023 and has been strongly welcomed by Gas Networks Ireland. In CAP 2023, the Government recognises that green hydrogen will play a significant role in sector coupling and minimising overall costs of decarbonisation across all sectors and that policies are potentially required to ensure zero carbon gases, such as hydrogen, are utilised. CAP 2023 also identifies that potential policies are required to support the development of inter seasonal storage of hydrogen.

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

At a European level, the key role of hydrogen in decarbonising our energy system is widely recognised. The EU's Hydrogen and Gas Markets Decarbonisation Package aims to facilitate access of renewable and low-carbon gases to existing gas networks. The EU's REPowerEU Plan further underlines the momentum for hydrogen to diversify and decarbonise energy supply by quadrupling the previous hydrogen supply target from c. 5 to 20 million tonnes by 2030.

Over recent years, along with 30 other European Gas Transmission System Operators, Gas Networks Ireland has contributed to the European Hydrogen Backbone Initiative. By 2040, there could be almost 53,000km of 100% hydrogen pipelines throughout Europe, with the majority being re-purposed pipelines. These pipelines present a cost-effective way of transporting hydrogen to enable achievement of REPowerEU targets. Repurposing existing gas pipelines to transport 100% hydrogen has been found to incur a fraction of the cost (c. 10-35%) of a new hydrogen pipeline[26].

Internationally, hydrogen is currently primarily produced for the industrial gas market by separating it from natural gas. This is referred to as grey hydrogen. This process can be decarbonised by capturing and storing the resulting carbon dioxide, with the hydrogen produced being referred to as low carbon or blue hydrogen. Green hydrogen is produced by electrolysis powered by renewable electricity.

Green hydrogen 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 Irish Government's preferred production method in the long-term once both the production equipment and renewable electricity sources such as offshore wind scales 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. 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 and a 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:** Gas Networks Ireland is a member of Hydrogen Mobility Ireland, which is an initiative focussed on developing hydrogen refuelling infrastructure for Ireland. Hydrogen may play a long-term role in heavy use transport, 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 and;

26 https://www.ehb.eu/files/downloads/EHB-2023-20-Nov-FINAL-design.pdf

- **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.

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 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.

"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."

Furthermore, a technical and safety feasibility study published by Gas Networks Ireland in December 2022, "Injecting green hydrogen blends into Ireland's gas network"[27] examined the ability of the gas network to transport blends and 100% hydrogen by applying the evidence generated in other jurisdictions, most notably in Britain. Ireland's gas distribution network is similar to the British distribution network and is largely compatible with hydrogen blends of up to 20% and even 100% hydrogen with only some modifications required. In addition, the report determined that Ireland's gas transmission network is also compatible with hydrogen blends, however materials testing is required for around 50% of pipelines on the network to allow current maximum operating pressures to be maintained with hydrogen concentrations of greater than 10%. A materials testing programme is currently being developed with testing due to commence in 2025. Some targeted research on certain equipment contained within transmission AGIs and compressor stations will also be required. Across the UK and the EU, there are multiple studies underway testing the compatibility of transmission network equipment (e.g., National Grid HyNTS (FutureGrid), Gasunie programmes, Hydrogen in Gas Grids (HIGGS), GERG and EPRG hydrogen programmes) which will support Gas Networks Ireland in this research.

27 Hydrogen-Feasibility-Study.pdf (gasnetworks.ie)

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

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 has developed a Network Innovation Centre at the Brownsbarn AGI site in Dublin 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 hydrogen with elements of the distribution network and gas appliances used in Ireland. 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. Working in conjunction with University College Dublin, a wide range of tests are underway 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.

Technical experts from Gas Networks Ireland and the University College Dublin (UCD) Energy Institute completed a report on the impact of introducing green hydrogen with natural gas on home appliances in 2022. They found that appliances remain fully functional using a natural gas blend of up to 20% hydrogen. This means households in general will not need to make any changes to their existing domestic appliances or notice any difference.

Their research also outlines that significant reductions in emissions can be achieved by blending hydrogen with natural gas. Examples of which include the following average emissions reductions for a standard domestic gas boiler operating at maximum load:

- 12% reduction in carbon dioxide (CO_2)
- 37% reduction in carbon monoxide (CO)
- 40% reduction in nitrogen oxides (NOx)

As part of a second phase, Renewable Hydrogen and End-users' Considerations for the Transition to a Renewable Gas Network (HyEnd) was studied on a national scale. This study[28] examines the limits of Large Daily Metered (LDM) and Daily Metered (DM) Irish gas customers in using gas with a hydrogen blends up to 20%. A questionnaire was designed to survey Industrial and Commercial customers to investigate the threshold levels for hydrogen blend consumption. The survey involved a total of 42 LDM end users, consisting of 7 gas-fired power plants and 35 large industrial units, as well as 270 DM end users across the country. The DM category includes customers from the hospitality and education sectors, as well as hospitals, apartment blocks and shopping centres. The results showed that the majority of LDMs (90%) and DMs can operate using existing equipment with up to 20% hydrogen blends. The remaining 10% of LDM end-users, which operate gas turbines, can currently operate with up to 5% hydrogen blends.

Gas Networks Ireland is participating in project HyLIGHT, a 3-year project funded by Science Foundation Ireland (SFI) and an industry consortium through MaREI, the SFI Research Centre for Energy, Climate and Marine, University College Cork (UCC), Dublin City University (DCU) and University of Galway. The overall aim of HyLIGHT is to provide the knowledge, data and the necessary tools to guide the cost-effective decarbonisation and roadmaps for sustainable large-scale implementation of hydrogen technologies in Ireland to enable sector integration for a zero-carbon, secure, resilient energy system.

28 Irish Industry ready to take up to 20% blends of hydrogen

Next Generation Energy Systems (NexSys) is an all-island, multidisciplinary energy research programme. NexSys is hosted by the UCD Energy Institute in partnership with eight other leading research institutions: ESRI, DCU, Queen's University Belfast, University of Galway, Maynooth University, Trinity College Dublin, UCC, and Ulster University. Gas Networks Ireland is a co-funding industry partner, supporting and working with NexSys. By 2027, NexSys will have identified credible and accelerated pathways for a net zero energy system and have developed technologies and the resources needed for the energy transition.

Gas Networks Ireland are undertaking a joint research project with Ulster University in relation to Pre normative research on the safety of gas networks with hydrogen blends. The project will collaborate with the European Gas Research Group (GERG) to undertake research on safety aspects of the transportation of hydrogen blends on the gas transmission and distribution network with the aim of developing innovative preventive and mitigation strategies.

Renewable electricity developers are engaging with Gas Networks Ireland, exploring the potential for hydrogen production and injection into the gas network. This has resulted in several connection enquiries being received 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 is investigating the implications of hydrogen producers connecting to the network, including evaluating appropriate locations, and assessing storage requirements. Further engagement with prospective producers will further develop technical requirements and identify 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 and safety strategy which will ultimately provide a road map for the business to transition to hydrogen. 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.

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

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[29] is a hydrogen production facility being developed at St Fergus, Scotland. An update to the UK Hydrogen Strategy[30] was issued in August 2023, outlining a doubling of the ambition for Hydrogen production from 5GW to 10GW of low carbon hydrogen production capacity by 2030, a move which was first announced by the UK Government in their British Energy Security Strategy in 2022[31].

Gas Networks Ireland is also a member of the European Hydrogen Backbone (EHB) initiative which consists of a group of thirty-one energy infrastructure operators, united through a shared vision of a climate-neutral Europe enabled by a thriving renewable and low-carbon hydrogen market.

The EHB initiative aims to accelerate Europe's decarbonisation journey by defining the critical role of hydrogen infrastructure, based on existing and new pipelines, in enabling the development of a competitive, liquid, pan-European renewable and low-carbon hydrogen market. The initiative has developed detailed hydrogen pipeline network maps envisaging how Ireland could be connected to the wider European hydrogen backbone by 2040.

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.

The Climate Action Plan 2023 notes the potential need for CCS in difficult-to-abate sectors. Gas Networks Ireland will continue to monitor ongoing activity in relation to CCS in Ireland and will incorporate the outcomes into potential future decarbonisation pathways as appropriate. This includes assessing work stemming from Climate Action Plan 2023 and studies presently ongoing, including Eirgrid's Tomorrow's Energy Scenarios 2023[32] which identifies the potential role for CCS in decarbonising the power generation sector.

"Gas Networks Ireland will continue to monitor ongoing activity in relation to CCS in Ireland and will incorporate the outcomes into potential future decarbonisation pathways as appropriate."

29 Acorn | Growing Our Decarbonised Future (theacornproject.uk)
30 Hydrogen Strategy: Update to the market, August 2023 (publishing.service.gov.uk)
31 British energy security strategy - GOV.UK (www.gov.uk)
32 At the time of writing of this report, EirGrid are seeking responses as part of the Consultation on their Tomorrow's Energy Scenario's Report: https://www.eirgridgroup.com/site-files/library/EirGrid/Tomorrows-Energy-Scenarios-2023-Consultation-Report.pdf


Gas
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Ireland

5. Historic demand & supply

Key messages:

Annual ROI gas demand for 2022/23 was 4.8% lower than for 2021/22. Demand across all three main gas demand sectors, i.e. Power Generation, Industrial & Commercial and Residential, were down in 2022/23 vs. 2021/22.

The reduction in gas demand can be attributed, in part, to higher wholesale and retail gas prices in 2022/23. Gas prices increased substantially following the invasion of Ukraine by Russia and the subsequent sharp reduction in Russian gas supply to Europe. Gas Networks Ireland continues to monitor the situation and its potential impact on gas supply, and demand, in Ireland.

Warmer temperatures on average over the course of 2022/23 contributed to a 14% reduction in Residential demand compared to the same period in 2021/22; when weather-corrected, Residential demand is down 11.2% in 2022/23 vs. 2021/22

In 2022/23, 23% of ROI gas demand was met by indigenous sources of supply. The balance of supply (77%) was supplied via the Moffat Entry Point in Scotland.

Biomethane supply more than doubled in 2022/23 compared to 2021/22, increasing to 62.5GWh from 27.5GWh.

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 ROI Annual primary energy requirement

The Sustainable Energy Authority of Ireland (SEAI) reported that Ireland's Total Primary Energy Requirement (TPER) for 2022 increased by 3.7% compared to 2021.

As shown in Figure 5-1, Oil remains as the highest share of the TPER in 2022, accounting for 48.1% of total energy demand. Gas accounted for 31.1% of 2022 TPER, a decrease in the share of just 0.5% vs. 2021. Renewable energy sources accounted for 13% of TPER in 2022, increasing by 1.1% compared to 2021.

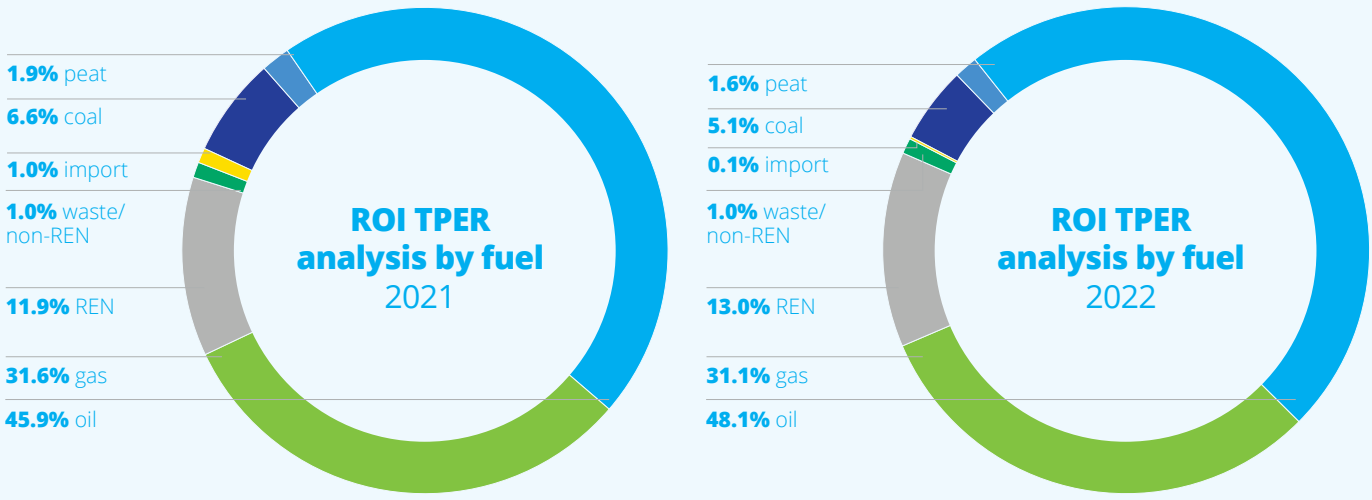
5.2 Historic annual gas demand

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 demand for 2022/23 was 4.8% lower than 2021/22 demands. This decrease continues similar trends seen in 2021/22 and 2020/21 where ROI gas demand decreased by 0.3% and 3.9% respectively year-on-year (YoY). There are a number of main drivers for the recent YoY decreases including:

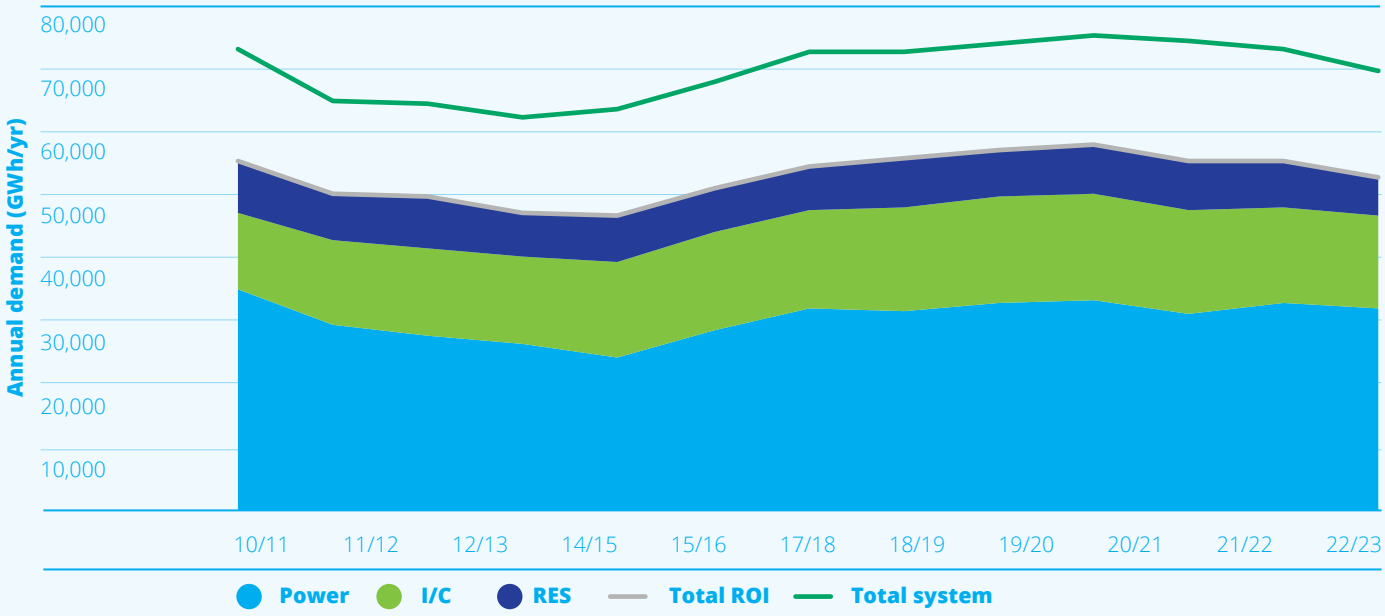
- A sharp increase in gas prices at the end of 2021, with sustained high prices throughout 2022 and;
- Warmer than average temperatures in 2022 and 2023.

Figure 5-1: ROI TPER Analysis by Fuel (2021 & 2022)



5. Historic demand and supply (continued)

Figure 5-2: Historic Annual Gas Demand



This is in contrast with increases in ROI gas demand that occurred in previous years; 1.5% higher in 2019/20 compared to 2018/19 and 2% higher in 2018/19 compared to 2017/18, as shown in Figure 5-2.

In the Power Generation sector, gas demand for 2022/23 decreased by 2.3% compared to 2021/22. This is in contrast with the 5.5% increase in gas demand observed for power generation in 2021/22, which was as a result of a number of large gas-fired generators coming back online after sustained outages in summer 2021. Consequently, power generation gas demand was down by 7.2% in 2020/21 compared to 2019/20.

Over the longer-term, Power Generation sector gas demand has increased by 33% 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, the closure of peat-fired generators, sustained outages at some other thermal plants (i.e. coal and oil) and the flexible nature of gas-fired generation. Following the introduction of the Integrated Single Electricity Market (I-SEM) 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.

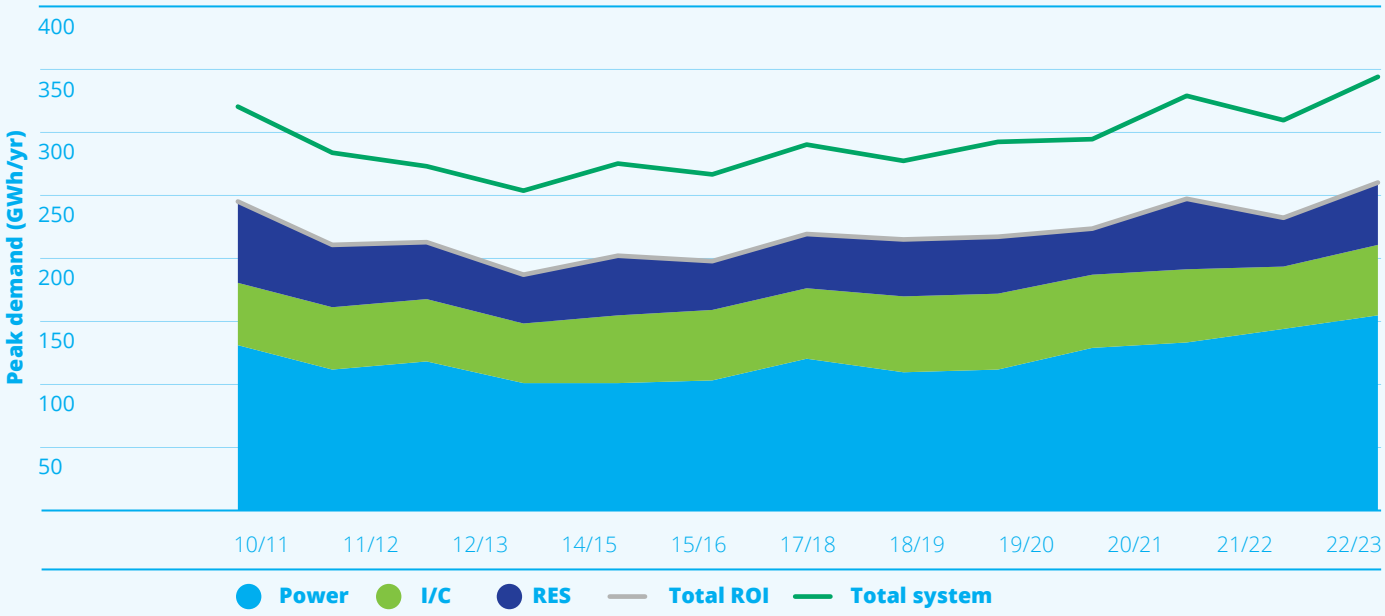
The Industrial & Commercial (I&C) sector annual gas demand for 2022/23 was 3.5% lower than 2021/22. This is following a decrease of 7% in 2021/22 compared to 2020/21.

Within the I&C sector, Daily Metered (DM)[33] demand decreased by 5.5% in 2022/23 compared to the previous year. There was a 9% reduction in Non-Daily Metered (NDM)[34] demand in 2022/23, with the I&C portion of NDM demand down by less than 1%. It is worth noting that the NDM sector is influenced

33 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

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

Figure 5-3: Historic Peak Day Gas Demand



by weather; when weather-corrected, total NDM demand was down 6.2% compared to 2021/22, while I&C NDM demand was up 2.2%.

Residential demand was down by 14% in 2022/23 compared to 2021/22; when weather-corrected, residential gas demand was 11.2% lower than for the corresponding period in 2021/22.

Transport sector gas demand increased by 9% in 2022/23, as the roll-out of a nationwide CNG fuelling network continues.

Total Gas Networks Ireland annual system gas demand for 2022/23 decreased by 5.1% compared to the previous year's gas demand. As previously mentioned above, ROI gas demand decreased by 4.8% in 2022/23 compared to the previous year. NI gas demand fell by 7.9% compared to 2021/22, while IOM demand increased by 19% YoY. The historic gas demand is presented in Figure 5-2. The overall throughput for ROI in 2022/23 was 54.3TWh or approximately 4.9bcm.

5.3 Historic peak day gas demand

The ROI peak day gas demand for 2022/23 was 261.9GWh/d, which occurred on 15th December 2022, and which also transpired to be the highest daily gas demand ever recorded. While cold weather conditions were observed on this day, it was not a 1-in-50 severe winter peak, rather the peak day was driven by gas demand in the Power Generation sector.

This peak day was 12.4% higher than the ROI peak day for gas demand observed in 2021/22.

The peak day for Power Generation gas demand also occurred on 15th December 2022, with gas-fired power generation accounting for 59% of the ROI electricity fuel mix, wind generation well below average, contributing 15% of generation, and other thermal (i.e. coal- and oil-fired, and co-fired biomass/peat) generation providing 21%. It is noted that ROI was slightly net importing on the peak day, providing less than 1% of demand.

Gas demand in the Power Generation sector, which represented 60% of the total gas demand on the peak day, increased by 7.8% in comparison to the 2021/22 peak day.

5. Historic demand and supply (continued)

Gas demand in the residential sector, representing 19% of total peak day demand, increased by 26% for the 2022/23 peak day vs. the previous year. Similarly, Industrial and Commercial demand on the peak day, representing 22% of total peak day demand, increased by 13.9% in 2022/23.

The peak day demand in the NDM sector occurred on the 16th December 2023, with gas demand reaching 75.1GWh/d. This is 7.4% higher than the corresponding NDM peak day in 2021/22, the difference being partially related to colder weather conditions.

The Gas Networks Ireland system 2022/23 peak day gas demand was 345.7GWh/d, the all-time highest daily system demand ever recorded, 10.8% higher than the 2021/22 peak. NI peak day gas demand was also up by 5.3% while the IOM peak day demand was down just 1% compared to 2021/22.

5.4 Ireland's weather

Based on a Degree Day[35] (DD) comparison, the most recent winter (October 2022 to March 2023) was approximately 3% warmer than the previous year. Relative to the long run degree day average, winter 2022/23 was approximately 10% warmer.

The coldest day in winter 2022/23, occurred on the 9th December of 2022, with an average temperature of -1.175°C, or a 17.25 DD. It is notable that gas demand on this day was not the peak gas demand day for winter 2022/23; electricity demand was 4% lower on this day compared to the peak gas demand day (15th December 2022), resulting in less gas demand in the power generation sector.

5.5 Wind powered generation

The installed all-island wind generation capacity increased by 3.4% in 2022 from the previous year, totalling 5.9GW installed capacity by end-2022, 4.5GW of which is located in ROI[36]. Wind powered generation output in ROI increased by 15.4% in 2022 compared to 2021, indicating that wind generation load factors increased in 2022 compared to the previous year.

On the peak day for wind generation in winter 2022/23, daily wind powered generation accounted for up to 87% of ROI daily electricity demand (30th October 2022). Wind accounted for only 1% of demand on the minimum day for wind generation (4th March 2023). On the 2022/23 peak day for gas demand (15th December 2022) wind accounted for c. 15% of ROI electricity generation.

5.6 Electricity interconnectors

There are two electrical interconnectors between the UK mainland and the island of Ireland – the East West Interconnector (EWIC) in ROI and the Moyle Interconnector in Northern Ireland, with import capacities of 500MW and 450MW respectively.

Up until early 2015, the prevailing market conditions on the Single Electricity Market (SEM)[37] 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. Following this, in April 2015, the carbon price floor in GB was raised to £18 per ton CO_2 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[38].

35 A Degree Day is a measure of heating or cooling, and represents a fall or rise of one degree Celsius below or above a specified average outdoor temperature
36 System and Renewable Data Summary Report – EirGrid
37 The Single Electricity Market (SEM) is the wholesale electricity market operating in the Republic of Ireland and Northern Ireland.
38 SEM committee Single Electricity Market Performance Quarterly Reports, available at https://www.semcommittee.com/publications

Carbon prices on the European Emission Trading Scheme (EU ETS) continue to rise in line with various projections[39].

With 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, with subsequent auctions being held every two weeks. The UK ETS price generally tracked the EU ETS price until March of this year, at which point the UK price began trading at a discount to the EU prices driven by the UK Government's move to increase the amount of allowances available within the cap and trade system. The change has dampened UK electricity prices, driving power prices below those in the EU, and has notably driven increased electricity imports to Ireland throughout 2023. It had been proposed that the UK ETS and EU ETS markets be linked in the future but a definitive plan for this link has not emerged.

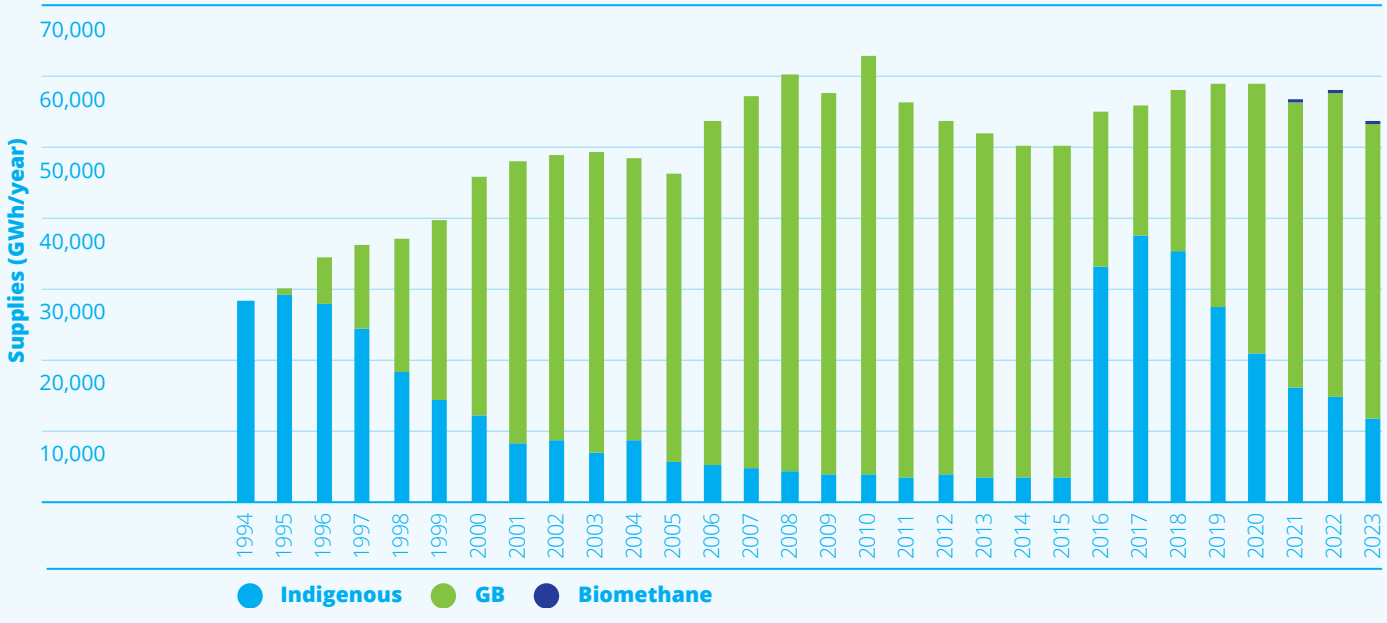
There are several proposed electrical interconnector projects at various stages of development that are seeking to connect to the Ireland and Northern Ireland transmission networks. These include the Greenlink Interconnector, linking Ireland and Wales's electricity networks, which is currently projected to be commissioned by the end of 2024, and the Celtic Interconnector, linking France's electricity network to Ireland, with a projected commissioning date in 2026.

5.7 Historic gas supply

In 2023, 22.4% of ROI gas demand was supplied from indigenous sources (Corrib and Biomethane). The balance of supply (77.6%) came through the subsea interconnectors via the Moffat Entry Point in Scotland.

The share of biomethane in the ROI supply continues to grow, more than doubling between gas years 2021/22 and 2022/23, increasing from 27.5GWh to 62.5GWh.

Figure 5-4: Historic Annual Indigenous (IND) Gas Production and Great Britain (GB) Imports



39 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 & 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 decrease by 21% between 2022/23[40] and 2031/32.

The 1-in-50 ROI peak day forecast is expected to reach its highest point across the NDP horizon in 2025/26, which equates to 27% growth between 2022/23 and 2025/26. The peak day forecast is projected to grow by 18% between 2022/23 and 2031/32.

National policy targets an 80% renewable energy share in electricity generation (RES-E) by 2030. This is supported by a significant increase in the projected amount of renewable installed capacity. While electricity demand is forecast to increase by 43% across the NDP period, annual gas demand for power generation declines across the period due to the significant uptake and penetration of renewable electricity generation.

In contrast, peak day gas demand will not be as significantly impacted; gas-fired power generation will be the dominant supply source for Ireland's electricity requirements on days of low renewable generation.

Annual gas demand in the Residential sector is forecast to decline by 19% between 2022/23 and 2031/32 due to disconnections driven by electrification of heating and district heating uptake, and energy efficiency improvements in existing customer dwellings.

Industrial and Commercial annual gas demand is forecast to increase by 29% across the NDP period. While energy efficiency measures have the effect of reducing some existing customer demand, overall, growth in these sectors is driven by new connections and growth in existing customer demand linked to economic growth.

40 12 month forecast for 2022/23 from October 2022 to September 2023

The following section presents an overview of the gas demand outlook for the period 2022/23 to 2031/32. The NDP forecasts future gas demands by examining the development of individual Power Generation, Industrial & Commercial, Residential and Transport sector gas demands.

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[41] used in producing the NDP generates a ten-year forecast for the Power Generation, Industrial & Commercial, Residential & Transport sectors, based on a series of assumptions[42] 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); and
- Annual demand forecasts i.e. the aggregate demand for each year of the forecast.

The demand forecast is a primary input for the analysis that is undertaken to assess the adequacy of the transmission network and associated assets. The network analysis identifies the areas of the network that will require future development and investment, and as such, all aspects of the analysis must be reliable and robust, particularly the 1-in-50 peak day demand forecast.

Figure 6-1: Key demand forecasting assumptions

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

41 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/docs/corporate/company/Gas-Forecasting-Methodology-Report.pdf

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

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 has been reliable and robust.

The 2009/10 and 2010/11 1-in-50 peak days were driven by cold weather conditions resulting in increased gas demand. With the increasing penetration of intermittent renewable electricity generation, and the expected commissioning of new gas-fired generators within the NDP period, the composition of the 1-in-50 peak day may be driven by high gas demand in the power sector which is compensating for low wind conditions. As described in Section 5.3, the first instance of this occurred on 15th December 2022 in line with the GFS 2022 1-in-50 peak day forecast. While cold weather conditions were observed on this day, it was not a 1-in-50 severe winter peak, rather the peak day was driven by gas demand in the Power Generation sector.

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 2022/23 to 2031/32, namely Low, Best Estimate and High demand scenarios. These scenarios are designed to represent a broad range of likely outcomes and are informed by a range of external and internal factors.

Figure 6-2: Gas demand scenarios overview

Low demand	Best estimate	High demand
EirGrid GCS 2023 low electricity demand scenario	EirGrid GCS 2023 median demand scenario	EirGrid GCS 2023 high demand scenario
New gas-fired generation as per qualified T-3/T-4 auction results	New gas-fired generation as per qualified T-3/T-4 auction results	New gas-fired generation as per qualified T-3/T-4 auction results
CAP23 renewable capacity targets	EirGrid's GCS 2023 renewable capacity targets	Delay to EirGrid's GCS 2023 renewable capacity targets
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.
CAP23 decarbonisation targets met	CAP23 decarbonisation targets partially met	CAP23 decarbonisation targets partially met and further delayed
New Connections Low	New Connections Best Estimate	New Connections High
Bio-CNG Low	Bio-CNG Low	Bio-CNG High

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

6.4 Demand forecast assumptions

This section presents an overview of the assumptions made for the gas demand outlook for the period 2022/23 to 2031/32.

6.4.1 Power generation sector

The Irish gas and electricity sectors are highly interdependent. Gas is a critical component of Ireland's electricity generation, producing 47%[43] of the country's annual electricity requirement in 2023. Gas-fired generators are the largest customer sector in the gas market, accounting for approximately 59.3% of the total ROI gas demand in 2023.

The following summarises the main assumptions regarding the changes in the SEM generation portfolio, as per the EirGrid and SONI All-Island Generation Capacity Statement (GCS) 2023-2032[44]:

- Closure notices were previously issued for the Moneypoint coal/heavy fuel oil (HFO)-fired power plants effective from October 2024. None of the three generator units have qualified for capacity from the 2024/2025 T-4 Capacity Auction through to the 2026/2027 T-4 auction. However, driven by security of electricity supply concerns, exacerbated by extended outages of gas-fired generators in 2021, and given the near-term supply deficit identified in EirGrid's adequacy assessment of the SEM, the Moneypoint generators are expected to remain available for emergency generation purposes only out to March 2029[45]. Given that the Moneypoint units will be dispatched as a generator of last resort, Gas Networks Ireland has excluded these units from our economic dispatch modelling in all three of our demand scenarios from October 2024 onwards. Furthermore, our model does not identify any unserved demand, even in the case where generator forced outages are included. In reality, if the potential for unserved demand were to materialise, this would be a trigger for the requirement of Moneypoint being dispatched.
- EirGrid assume that the Tarbert HFO-fired units (TB1, TB2, TB3, and TB4) and one of the gas-fired OCGTs at Aghada (AT1) will all close by the end of 2023. Three of the four Tarbert units TB1, TB2 and TB4 have been unavailable for all of 2023 while TB3 has been on outage since March 2023. Gas Networks Ireland assume they will close as scheduled. Regarding AT1, EirGrid note that post their GCS 2023 data freeze, the closure notice of AT1 was rescinded. Therefore, this unit remains available in all three NDP scenarios for the duration of the study period.
- In Northern Ireland, it is assumed that the two coal/HFO-fired generators at Kilroot (ST1 and ST2) retire as scheduled at the end of 2023, due to emissions restrictions resulting from the Industrial Emissions Directive (IED). The subsequent delivery of the two OCGTs (KGT6 and KGT7) at this site at the start of 2024 is crucial to replace the retiring coal plant in terms of electricity supply adequacy for the area. The OCGT units will be subject to run-hour restrictions of 1500 hours per annum. Following the planned conversion of the units to CCGTs at the start of 2027, these restrictions will no longer be applicable.
- The peat and biomass co-firing plant at Edenderry has been granted an extension to its planning permission, allowing the plant to continue operation until 2030. The Edenderry plant will cease burning peat entirely by 2024 and will operate exclusively on biomass out to 2030. On this basis, Gas Networks Ireland assumes that Edenderry will be available in all NDP scenarios.

43 Electricity | Monthly Energy Data For Ireland | SEAI
44 https://cms.eirgrid.ie/sites/default/files/publications/19035-EirGrid-Generation-Capacity-Statement-Combined-2023-V5-Jan-2024.pdf
45 https://cruie-live-96ca64acab2247eca8a850a7e54b-5b34f62.divio-media.com/documents/Security_of_Electricity_Supply_Retention_of_Moneypoint_Units_Information_Paper.pdf

6. Gas demand forecasts
(continued)

- In EirGrid's GCS, it is assumed that the new North-South interconnector is commissioned by the end of 2025 and is fully operational from 2026 onwards. Hence, Gas Networks Ireland has assumed that the North-South Interconnector is operational from 2026 in all but the High scenario where it is assumed that the commissioning of the interconnector is delayed by one year, resulting in the North-South Interconnector becoming fully operational in 2027.
- There are several proposed electrical interconnector projects linking Ireland to other jurisdictions, including the Greenlink Interconnector with Great Britain (GB) and the Celtic Interconnector with France. In EirGrid's GCS, both Greenlink and Celtic interconnectors are assumed to be commissioned and fully operational by end-2024 and 2027 respectively. Gas Networks Ireland include the Greenlink interconnector on-time in all NDP scenarios and Celtic interconnector in all scenarios, on-time in the Low scenario and delayed by one year in both the Best Estimate and High NDP scenarios to allow for potential delays to the expected delivery dates, resulting in an operational start date of 2028.
- The Low scenario assumes that one further interconnector is operational by 2030, providing another connection between SEM and GB as highlighted by the National Policy Statement Electricity Interconnection 2023.
- Gas Networks Ireland has included new entrant generators which were successful in the capacity auctions officiated by EirGrid to date. Due to the large volume of new entrants, and the associated complexity in delivering this capacity to the electricity system, Gas Networks Ireland has engaged with individual gas generation developers in order to develop a timeline for delivery of the awarded capacity. In all three NDP scenarios, the contracted T-3 and T-4 (2023/24, 2025/26 and 2026/27) capacity is anticipated to be delivered within the corresponding 18-month long stop date as defined in the Capacity Market Code. Where termination notices have been issued by entrants, and Gas Networks Ireland have also been notified of a cessation of interest in executing a gas network supply contract, the relevant project has been omitted from our scenarios.
- Similar to our approach on Moneypoint outlined above, Gas Networks Ireland has excluded any temporary emergency generation, from both gas- and distillate-fired units, which has been procured by EirGrid as part of the CRU Security of Supply Programme[46], whose availability in the short- to medium-term will seek to address the shortfall in capacity identified in recent capacity assessments until additional capacity procured in the recent T-4 2026/27 capacity auction and in the upcoming T-4 2027/28 has been commissioned. The temporary emergency generation will not participate like other market units in the I-SEM, i.e. they will not be allowed to participate in the in ex-ante markets, will not normally be available for balancing actions unless for supply risk reasons and will not participate in the capacity auctions or provide ancillary services as they are intended to be dispatched as a generator of last resort. Furthermore, there is also no unserved energy within the NDP model to trigger the dispatch of these generators, hence their exclusion from the NDP model.

The Irish Government's updated Climate Action Plan 2023 (CAP 2023) has set an ambitious target to achieve up to 80% RES-E by 2030. EirGrid has outlined in their GCS that their assumed build-out rate of renewables is compatible with an 80% RES-E target. As a result, Gas Networks Ireland target 80% RES-E for 2030 in both the Low and Best Estimate gas demand scenarios in this NDP. To reflect the significant challenge in meeting the 80% RES-E target on time, Gas Networks Ireland has not included any additional measures to reach this target in the High gas demand scenario. Instead, the resulting RES-E penetration in the High scenario illustrates the potential shortfall in meeting the target if some of the renewable capacity deployment outlined in EirGrid's GCS is delayed.

46 https://cruie-live-96ca64acab2247eca8a850a7e54b-5b34f62.divio-media.com/documents/Electricity_Security_of_Supply_Programme_of_Work_Update_October_2023.pdf

The Power Generation dispatch model of Gas Networks Ireland considers various factors such as generator technical parameters (including the maximum and minimum generator limits), level of electrical interconnection between countries, and operational constraints on the transmission system. For instance, there may be a locational constraint that requires a minimum number of generators in the Dublin area to be on-load simultaneously.

- Technical parameters for generation plant have been modelled per CRU published values[47]. Where technical parameters were unavailable for new generator entrants, Gas Network's Ireland used either information made available directly from the plant developers or CRU published values for similar type and size plants.
- Existing interconnectors have also been modelled per CRU published values, but with the added inclusion of the North-South tie-line between ROI and NI. The additional interconnector included in the Low scenario by 2030 is modelled based on existing interconnectors also per CRU published values.
- Technical operational constraints on the EirGrid system have been modelled per the existing EirGrid operational constraints[48].

In order to achieve an 80% RES-E target by 2030, it is recognised that in addition to the installed renewable capacity development rates assumed in the NDP scenarios, additional measures will be required to address existing technical constraints on the power system. To facilitate the capacity build-out profiles of renewable generation and achieve the 80% RES-E target by 2030 (in particular in order to reduce the ensuing wind curtailment rates), EirGrid outlines the measures they intend to undertake in their Shaping Our Electricity Future Roadmap v1.1[49] and EirGrid Operational Policy Roadmap 2023-2030[50] publications. These measures include:

- Reduction or elimination of technical operational constraints on the transmission system;
- Reduction of thermal generator minimum-generation thresholds and the minimum inertia limit, thereby increasing headroom for renewable generation on days of high wind;
- Increasing the System Non-Synchronous Penetration (SNSP) level from existing 75% to 80% in 2024 and to 95% by 2030 in order to allow more instantaneous penetration of non-synchronous resources (wind and solar) that would otherwise need to be curtailed; and
- Facilitation of wind export that may otherwise be curtailed on days of high wind, via electrical interconnection or alternative technologies.

47 https://www.semcommittee.com/publications/sem-21-086-sem-plexos-model-validation-2021-2029-and-backcast-report
48 EirGrid Weekly Operational Constraints Update September 2023
49 Shaping Our Electricity Future Roadmap: Version 1.1 (eirgridgroup.com)
50 Operational Policy Roadmap 2023-2030

6. Gas demand forecasts (continued)

The above operational measures have all been incorporated into the NDP scenarios in order to meet the 80% RES-E target for 2030. As a result, the Low and Best Estimate NDP scenarios meet the 80% target, with the Low scenario exceeding this target by reaching 84% by 2030, while the High scenario misses the target due to slower renewable capacity build-out rates, achieving 75% RES-E by 2030.

The outlook to 2031/32 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.
- Edenderry peat/biomass-fired power station remains high in the merit order due to priority dispatch associated with the co-firing of biomass at the plant. From 2024 onwards, following the switch of fuel source to 100% biomass, the plant will remain priority dispatch.
- In line with recent trends in electrical interconnector flow direction, it is anticipated that ROI will be net importing power for the first seven years of the NDP horizon, with EWIC, Moyle and the North-South (N-S) tie-line/interconnector all net importing across this period. While imports to ROI from NI via the N-S interconnector are forecast to remain constant and even increase in the final years of the NDP, in the Low and Best Estimate scenarios all other electrical interconnectors connected to the island are forecast to switch to net-exporting due to the high availability of renewable generation in both ROI and NI. The High gas demand scenario differs slightly in that ROI is net importing power across the whole NDP horizon driven by the higher electricity demand compared to the other two scenarios.
- Coal-fired generation remains competitive vs. gas-fired generation during the first two years of the NDP period, ahead of the last remaining coal-fired generators at Moneypoint being excluded from Gas Networks Ireland's model from October 2024. Hence, coal is on a par with some less efficient gas-fired generation in the merit order based on futures prices.
- Gas-fired plant is anticipated to meet the balance of electricity demand.
- Distillate-fired plant is also dispatched to meet the balance of electricity demand on high electricity demand days for the first half of the NDP horizon, at which point it is displaced in the merit order by other gas-fired generators which are more economically viable.

Figure 6-3 illustrates the anticipated level of generation by fuel for thermal plant in the SEM, based on the EirGrid / SONI All-Island Generation Capacity Statement 2023-2032. This is based on thermal plant capacities given for 2023 with anticipated commissioning/decommissioning dates as set out in the GCS. New gas-fired generation, which was successful in securing capacity as part of the T-3 2024/25 and T-4 2023/24, 2025/26 and 2026/27 capacity auctions in recent years, is also included in Figure 6-3. (Note that the 'other' category in Figure 6-3 includes Waste-to-Energy, Demand Side Units and Aggregated Generator Units)

The EirGrid / SONI low, median and high annual electricity demand scenarios are illustrated in Figure 6-4. These electricity demand forecasts correspond to Gas Networks Ireland's Low, Best Estimate and High gas demand scenarios respectively, driving gas demand in the power generation sector.

The Total Electricity Requirement (TER) peak demand from the GCS 2023-2032 is used directly in forecasting the average winter peak gas demand day.

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. This results in a factor being calculated, which when applied to the average winter peak day projection, gives a forecasted 1-in-50 peak electricity demand.

Figure 6-3: Forecast Single Electricity Market (SEM) thermal generation mix and interconnection capacity

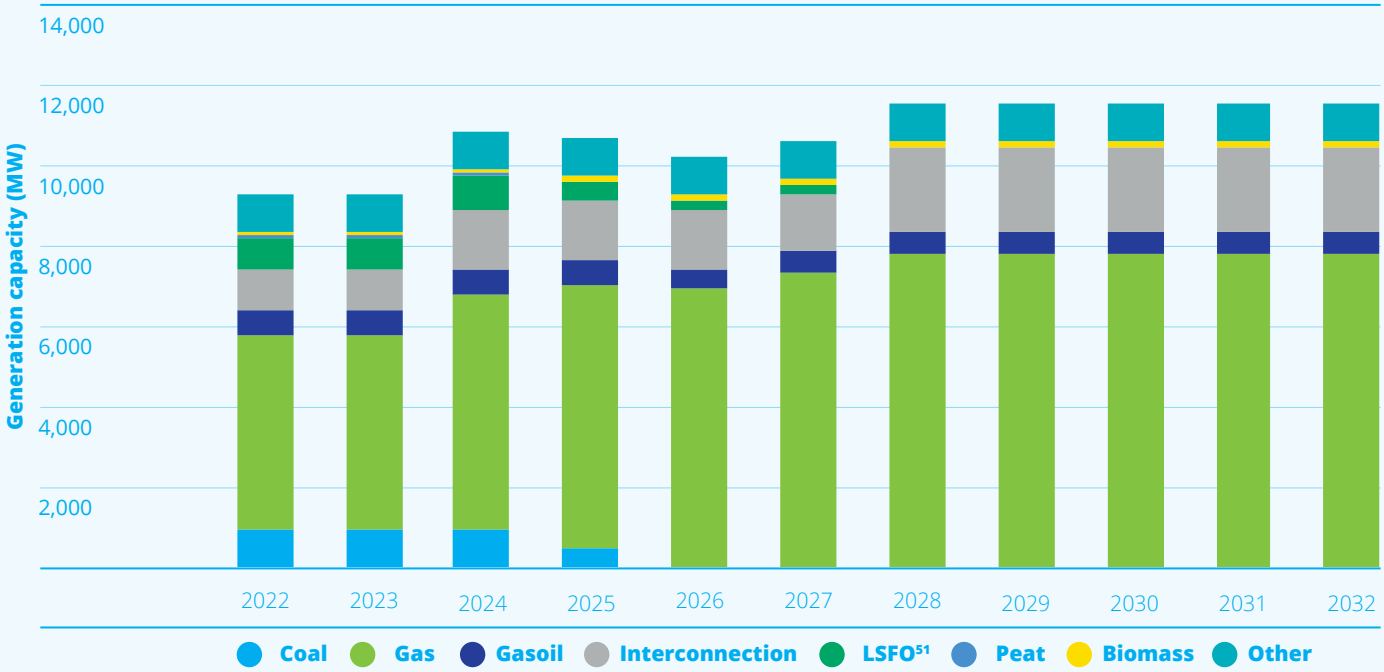
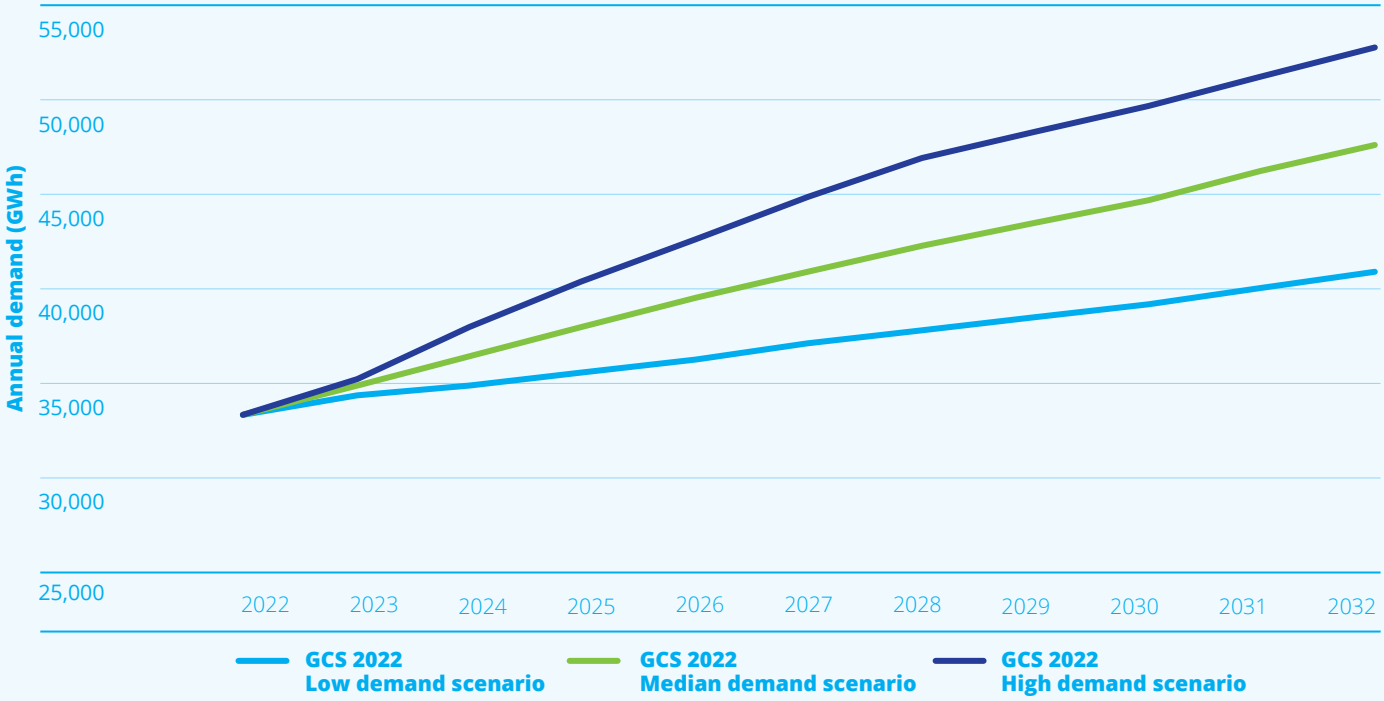


Figure 6-4: Electricity demand forecasts for ROI



51 Low Sulphur Fuel Oil (LSFO) involves distillate oil based fuels such as processed diesel or heavier low-sulphur hydrocarbons mixtures.

6. Gas demand forecasts
(continued)

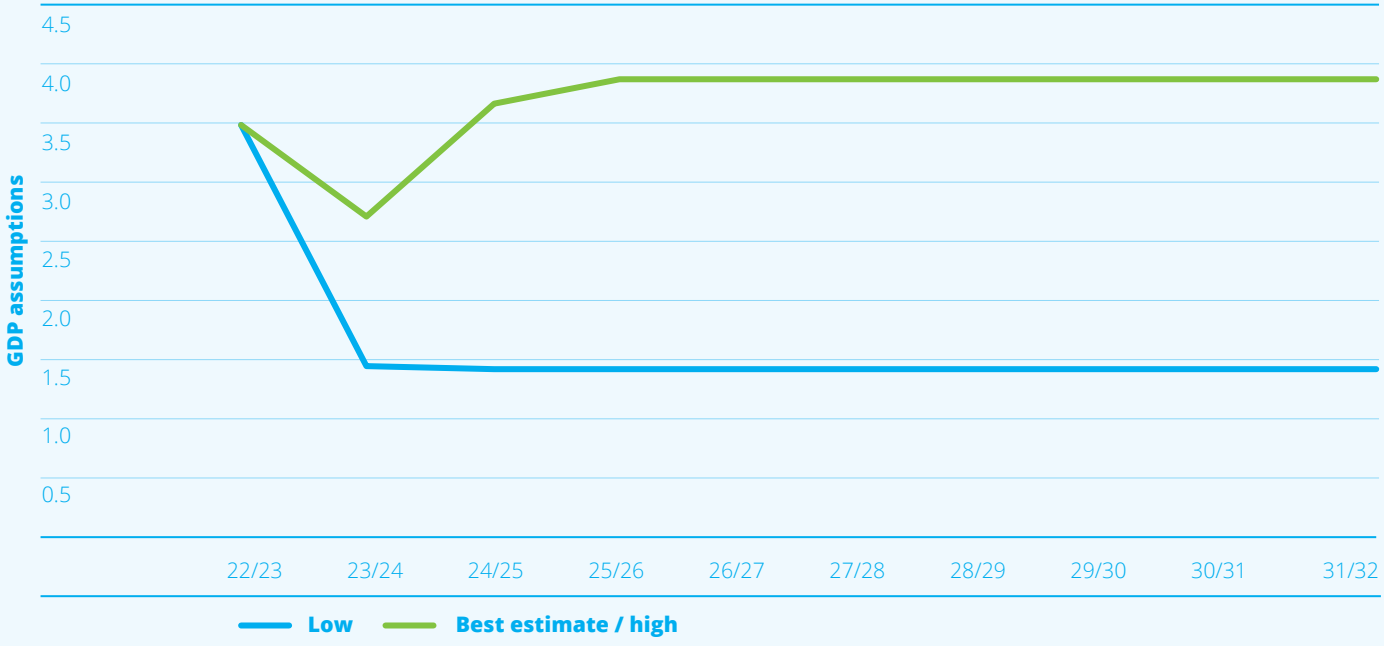
6.4.2 Industrial and commercial sector

Industrial & Commercial sector gas demand is assumed to continue to increase in proportion with Gross Domestic Product (GDP)[52] and in line with anticipated new connection numbers, with this growth being partially offset by a forecasted decline in gas demand related to some existing I&C customers disconnecting from the network and some implementing energy efficiency measures. The number of disconnections is driven by the anticipated heat pump and district heating uptake by existing gas customers as alternative sources of heat.

Figure 6-5 presents the GDP growth rate assumptions over the forecast period. The GDP forecasts are a composite of a number of short-term forecasts from the Economic & Social Research Institute (ESRI)[53], Central Bank of Ireland (CBI)[54] and Irish Business and Employers' Confederation (IBEC)[55], which are extended out in the medium-term across the NDP horizon for the Best Estimate and High gas demand scenarios. The Low demand scenario medium-term GDP projections are based on the ESRI's 2013 Medium Term Review (MTR) stagnation scenario.

The Data Centre market continues to seek further growth in Ireland. New demand, which cannot be met solely by the current electricity grid is leading to some Data Centres taking the decision to complement finite electricity grid capacity connections with on-site electricity generation. Using natural gas to generate electricity onsite provides additional flexibility for developers to alleviate demand from the electrical grid in times of low renewable generation which mitigates putting further pressure on the electrical grid from an adequacy perspective.

Figure 6-5: GDP growth assumptions



52 Industrial & Commercial sector growth rate is assumed to be 80% of GDP based on observed historical trends.
53 https://www.esri.ie/system/files/publications/QEC2023AUT_0.pdf
54 Quarterly Bulletin Q3 2023 (centralbank.ie)
55 https://www.ibec.ie/-/media/documents/influencing-for-business/economic-outlook/ibec-quarterly-economic-outlook-q2.pdf

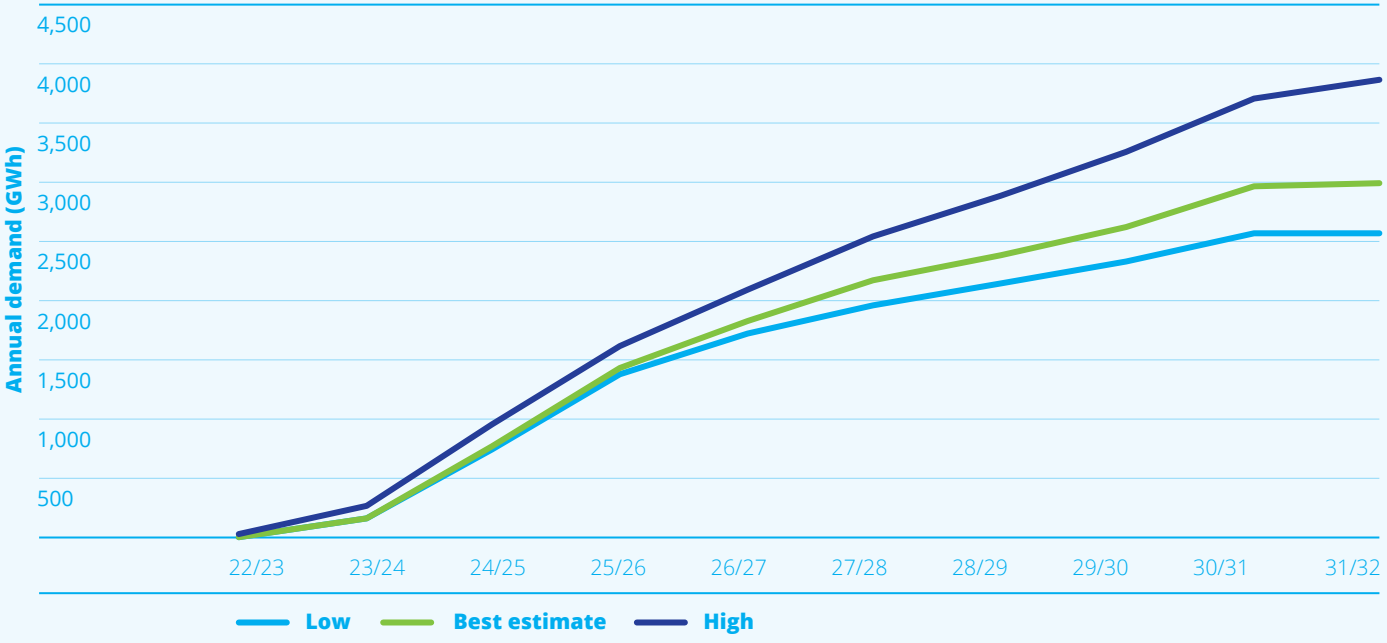
The previous Government Statement on the Role of Data Centres in Ireland's Enterprise Strategy set out a series of principles to inform and guide decisions on future Data Centre development. There is a clear preference for Data Centre developments that can demonstrate the additionality of their renewable energy use in Ireland and can demonstrate a clear pathway to decarbonise and ultimately provide net zero data services. Gas Networks Ireland believes that Data Centres connecting to the gas network could meet these principles through the increased use of biomethane and hydrogen while also assisting in establishing indigenous renewable gas markets in Ireland. At the time of writing of this report the CRU had commenced a public consultation on the Large Energy Users Connections Policy (both electrical and gas) which is expected to conclude in Q1 2024 and will confirm the criteria for connecting additional large energy users or data centres to the gas network.

For the purposes of this NDP horizon, the Low scenario has been limited to Data Centre customers with connection agreements already in place. Both the Best Estimate and High gas demand scenarios include additional new connections beyond what is currently contracted with Gas Networks Ireland. These new connections are assumed to meet the principles set out on the Government Statement and represent only a portion of the enquiries received by Gas Networks Ireland to date.

Figure 6-6 presents the additional annual demand for large new connections in the Industrial & Commercial sector over the forecast period.

Projected disconnections in the I&C sector partially offset the growth in gas demand due to increased economic activity and new Large Energy User connections. Disconnections (and their associated

Figure 6-6: Annual large new industrial & commercial loads demand forecasts



6. Gas demand forecasts
(continued)

Figure 6-7: I&C Disconnection numbers

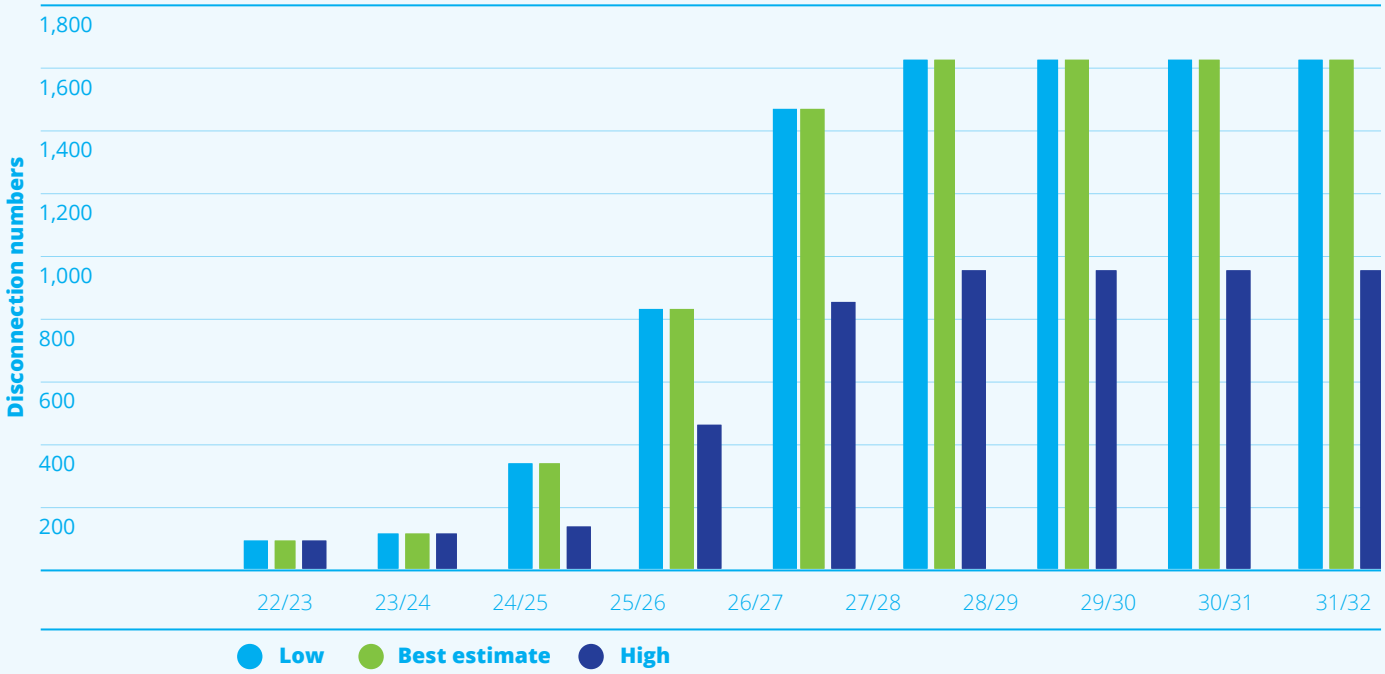
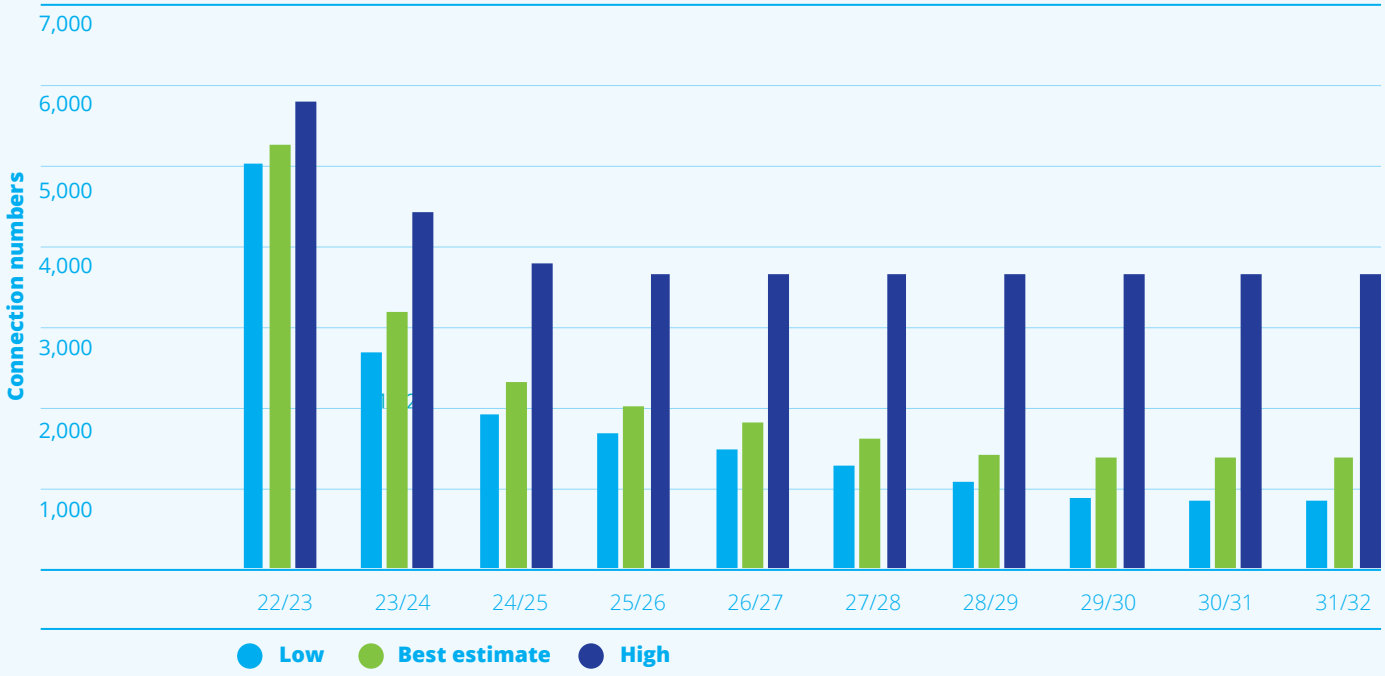


Figure 6-8: Residential new connection numbers



phasing) in the Best Estimate and Low scenarios are informed by SEAI's With Additional Measures scenario[56] which aims to model the delivery of carbon neutral heating targets set out in CAP 2023 for the Commercial and Public sectors. The High scenario deviates from SEAI 'With Existing Measures' scenario in that it omits any disconnections for district heating. Figure 6-7 below illustrates the projected no. of disconnections in the Commercial and Public sectors.

6.4.3 Residential sector

The forecast for new residential connections is shown in Figure 6-8[57]. The Government's Climate Action Plan 2021, and subsequent update (CAP 2023), propose an effective ban on the installation of natural gas boilers in new homes from 2023. However, retrofits to the mature housing stock, typically to convert from oil or solid fuel to natural gas, are still allowed and can provide an immediate reduction in emissions. All new housing developments are now being designed with electrical heating solutions, e.g. heat pumps, and without a natural gas supply. Apartments may continue to be developed with natural gas central boiler solutions and potentially Combined Heat and Power (CHP) technology, however this market is also challenged by the heat pump offerings (exhaust air heat pumps) and by district heating solutions. Gas Networks Ireland will continue to support the building and developer community with natural gas solutions for existing dwellings and will promote renewable gases as a pathway for these existing homes to decarbonise.

In addition to considering the measures in the CAP 2023 on new residential connections, Gas Networks Ireland has incorporated the plan's electrification of residential heat targets and district heating uptake on existing customers. The plan targets an additional 680,000 heat pumps in residential buildings, of which 400,000 are to be installed in existing buildings.

Currently gas boilers represent approximately a 28% share of primary energy source by building stock. Gas Networks Ireland advocate prioritising the most carbon intensive and the least efficient sources of residential heating (i.e. oil, solid fuel and electric (non-heat pump)), for replacement with heat pumps. The Best Estimate scenario assumes that by 2030, 75% of the CAP 2023 targets related to installation of heat pumps in existing houses will be met, which is in line with SEAI's With Additional Measures[58] scenario projections. The SEAI modelling indicates that gas disconnections ramp quickly between 2025 and 2030, with relatively fewer gas consumers switching in the short-term. This results in c. 95,000 residential gas customer disconnections by 2031/32, calculated on the basis of the percentage share gas currently holds in the residential heating market, and assuming that the heat pump adoption rate continues on a similar trajectory beyond 2030. This scenario assumes that existing oil and solid fuel customers are the first to switch to heat pumps in significant numbers such that the level of gas disconnections significantly increases in the latter half of the NDP horizon. The Low scenario assumes that 100% of the heat pump target for existing dwellings is met, while the High gas demand assumes that the uptake of heat pumps in existing dwellings is limited due to lack of financial incentives and/or low public buy in, resulting in c. 25% of the target being met on time.

In Irish climate policy, widespread deployment of district heating is planned as a key technology vector for decarbonisation of Ireland's residential heating sector. Realising this potential is dependent on whether it can be delivered at a cost, scale and speed that is competitive against alternative options. CAP 2023 includes a target for the built environment of 2.7TWh of installed district heating capacity by 2030, 1.2TWh of which Gas Networks Ireland has assumed will be targeted to be provided by the residential sector. This in contrast to the current and planned level of deployment in Ireland, with only two district heating schemes currently under development that could produce 0.07TWh by 2030.

56 EPA-GHG-Projections-2022-2040_Finalv2.pdf
57 On average a central boiler will service 167 apartment units. The connection numbers shown in Figure 6-8 include new houses, mature houses and apartment units.
58 In line with SEAI's With Additional Measures scenario: EPA-GHG-Projections-2022-2040_Finalv2.pdf

6. Gas demand forecasts
(continued)

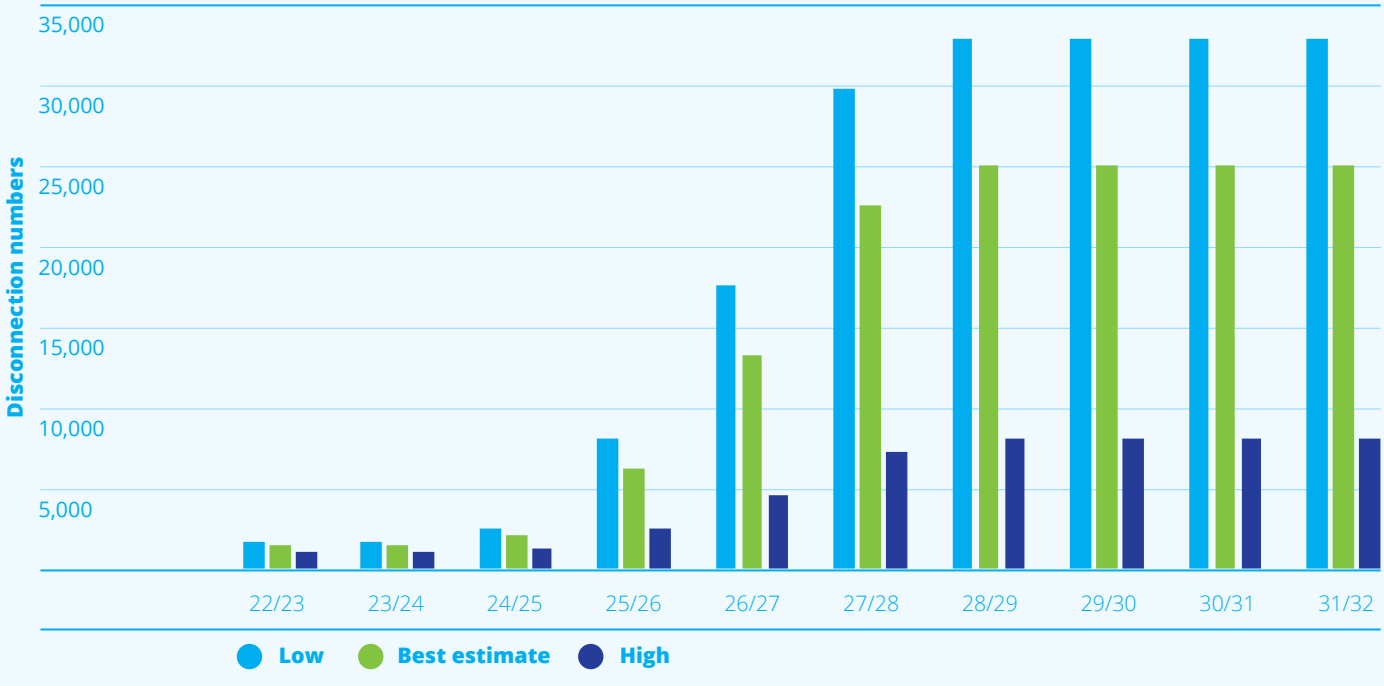
In the Best Estimate, it is assumed that 75% of the district heating target is met on time and that existing natural gas customers switching to district heat account for 28% of the target, in line with the current percentage share of primary energy source by building stock. This results in a total of c. 39,000 gas disconnections by 2031/32 due to switching to district heating schemes. The Low gas demand scenario assumes that 100% of the district heating target is met while the High gas demand scenario assumes that the uptake of district heating schemes out to 2030 is limited to the projects currently in development/completed to date.

The forecast for total non-cumulative residential disconnections, which includes a projection of business as usual disconnections which are not specifically CAP-related, is shown in Figure 6-9.

6.4.4 Energy efficiency

Energy efficiency savings impacting on residential and I&C gas demands are derived from potential average savings identified in the SEAI National Heat Study[59]. Energy efficiency savings in the residential gas demand sector consider the type of dwelling and the average potential savings identified by dwelling type. Similarly, savings in the I&C sector due to energy efficiency measures examine current demand by sub-sector and apply the average potential savings identified by the Study. It is assumed that 50% of Gas Networks Ireland's existing customers in both the Residential and Industrial and Commercial sectors achieve these average energy efficiency savings by 2030, and that the trajectory of these savings continues at the same pace for the final two years of the NDP horizon, out to 2031/32.

Figure 6-9: Residential Disconnection Numbers



59 https://www.seai.ie/publications/Heating-and-Cooling-in-Ireland-Today.pdf

A forecast of the Energy Efficiency Directive (EU) 2023/1791[60] was published in the EU Official Journal in September 2023, taking effect on the 3rd October 2023. EU Member States now have two years to transpose most of the different elements of the directive into national law.

The Directive establishes an EU energy efficiency target of 11.7% for 2030. It requires EU Member States to collectively ensure an additional reduction of final and primary energy consumption, compared with energy consumption forecasts made in 2020. EU countries will now be required to achieve new savings each year of 1.49% of final energy consumption on average, from 2024 to 2030, up from the current level of 0.8%. They will gradually have to reach 1.9% by the end of 2030.

Once the Directive is adopted into National Policy, Gas Networks Ireland will assess the implications for gas demand across the different sectors and include the associated targets in the three NDP scenarios accordingly. The current level of energy efficiencies applied to existing Industrial & Commercial customers in this NDP is estimated to be 50% of the potential energy efficiency target by energy to be set under the Directive.

6.4.5 Transport sector

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 uptake of CNG vehicles. CNG is particularly suitable for heavy goods vehicles (HGVs) where electric solutions are not an economically viable option. There are currently over 100 CNG HGV vehicles operating across the country, with these vehicles operating on BioCNG (i.e. CNG formed from renewable gas, e.g. biomethane) purchased from the Cush Injection facility in Co. Kildare.

"Gas Networks Ireland will continue to monitor ongoing activity in relation to CCS in Ireland and will incorporate the outcomes into potential future decarbonisation pathways as appropriate."

Gas Networks Ireland is developing a nationwide CNG fuelling network, co-located in existing forecourts, on major routes and/or close to urban centres. There are currently eight CNG stations in operation, four public and four private, with a further five public access stations, currently at various stages of development, to be delivered over the next two years.

The delivery of private CNG refuelling stations represents another element of Gas Networks Ireland's wider CNG strategy. Gas Networks Ireland delivers CNG infrastructure to private fleet operators and hauliers, allowing those who require more control over their refuelling patterns to do so in their own locations. There are currently four medium-sized private CNG stations operational in Ireland. These are located on Gas Networks Ireland's Gas Works Road and Finglas sites, Clean Ireland Recycling's Shannon operation and Virginia International Logistics in Dublin. Last year, Gas Networks Ireland also installed a second CNG refuelling station for Virginia International Logistics, a public access station, in Virginia Co. Cavan.

60 Directive (EU) 2023/... of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast) (europa.eu)

6. Gas demand forecasts
(continued)

Looking ahead, the potential for CNG vehicles to be fuelled by indigenously produced biomethane offers a significant opportunity to fully decarbonise HGV transport, widely recognised as one of the hardest to abate sectors. Biomethane in transport will also contribute to the achievement of Ireland's emissions reduction targets and targets for the share of renewable energy. CAP 2023 supports the development of Project Causeway and Green Connect CNG refuelling infrastructure in action "TR/23/65". Progress on this action is already evident, with CNG vehicles on the road, refuelling infrastructure operational and indigenous biomethane being injected into the national gas network.

As part of the NDP Low and Best Estimate scenarios, Gas Networks Ireland plans to install 20 CNG refuelling stations by 2031/32. An, annual CNG demand of c. 356GWh p.a. is forecast when the CNG station portfolio has reached its anticipated operating capacity. In the High scenario, Gas Networks Ireland is expecting annual CNG demand of c. 1,125GWh p.a., with 64 stations in operation by the end of 2032. Utilising bio-CNG to power HGVs, offers a real solution to decarbonising the HGV fleet. When powered 100% by BioCNG, this equates to c. 65ktCO_2-eq annual savings in the Best Estimate scenario when the CNG stations reach their anticipated capacity. Table 6-2 gives the projected transport sector demand for each scenario.

6.5 The demand outlook

This section presents an overview of the gas demand outlook for the period 2022/23 to 2031/32.

6.5.1 Power generation sector gas demand

Over the previous decade, increased Power Generation sector gas demand has been driven by growing electricity demand, coal- and oil-fired generators being on outage and/or falling in the merit order and the retirement of peat-fired units.

Electrical interconnector behaviour generally operates efficiently 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[61]. Imports to ROI in 2022/23 to date have far out-weighed exports due, in part, to the electricity price differential with GB. The forecasted net import/export position for ROI is dependent on futures fuel prices and on the renewable capacity trajectory in each NDP scenario. In the short- to medium-term, it is anticipated that ROI will remain in a net-import position in all three NDP scenarios.

With the addition of two new interconnectors during the NDP period, connecting Ireland to France via the Celtic interconnector and Ireland to Wales via the Greenlink interconnector, it is more difficult to predict future electricity import/export trends. This is particularly relevant for Celtic given there is no precedent for electricity import/export trends with

Table 6-2: Annual CNG demand forecasts

GWh/yr	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32
Low	24	32	58	121	204	272	302	320	338	356
Best Estimate	24	32	58	121	204	272	302	320	338	356
High	36	55	86	211	423	633	779	891	1,013	1,125

61 SEM committee Single Electricity Market Performance Quarterly Reports, available at https://www.semcommittee.com/publications

France. However, with the increased penetration of renewable power on the island toward the end of the NDP horizon, it is envisaged that the SEM will be net exporting by 2031/32 in both the Low and Best Estimate scenarios, while the High scenario is expected to remain net importing throughout the NDP horizon.

Figure 6-10 below illustrates the trajectory of annual gas demand in the power generation sector for each of the three NDP scenarios. In the Best Estimate demand scenario, Power Generation sector annual gas demand is expected to decrease by 47% across the NDP horizon. The key driver of this projected decrease is the inclusion of the RES-E target of 80%, which is achieved by 2030. In order to reach this target, some operational constraints on the electricity grid have been relaxed, in line with Eirgrid's Operational Policy Roadmap 2023-2030, resulting in less gas-fired generation being constrained on by the end of the decade. The model includes EirGrid's latest forecast of wind and solar generation build-out rates where, in total, installed renewable capacities are projected to be 43% higher by 2030 than previously outlined in EirGrid's Generation Capacity Statement 2022-2031[62], reaching a total installed renewable capacity of 22.9GW by 2032. In addition, it is assumed that onshore wind capacity factors increase over the second half of the NDP horizon with the repowering of older turbines and due to the continual increase in the size of new turbines.

This fall in gas demand is in contrast to the strong growth in electricity demand with EirGrid predicting growth of 43% in their median electricity demand scenario. As previously mentioned, the penetration of renewable generation and relaxation of operational constraints to meet 80% RES-E target, coupled with the impact of increased interconnection with GB and France, is eliminating any growth in gas demand for Power Generation due to this increased electricity demand.

The High demand scenario uses similar inputs and assumptions, with the exception of the following:

- taking EirGrid High electricity demand forecast,
- the RES-E target of 80% not being met due to slower renewable generation capacity roll-out, with 17.5GW of capacity installed by 2032, compared to 22.9GW in both the Best Estimate and High scenarios;
- the completion of the North-South Interconnector is delayed by one year, coming into operation in January 2027.

Power generation gas demand in the High demand scenario is projected to decrease by 24% across the NDP horizon.

The Low demand scenario inputs and assumptions deviate from the Best Estimate scenario as follows:

- taking EirGrid Low electricity demand forecast;
- Faster build-out rate of new renewable installed capacity;
- Celtic interconnector available on-time, i.e. January 2027, in line with EirGrid's Generation Capacity Statement;
- One further electrical interconnector connecting Ireland and GB operational in 2030 (750MW capacity)

Power generation gas demand in the Low demand scenario is projected to decrease by 56% across the NDP horizon.

There are a number of step changes within the electricity sector with large impacts on demand across all three scenarios:

- Increased electrical imports from NI to ROI between 2025/26 and 2026/27. This is driven by the combination of both the Kilroot CCGTs coming into operation, displacing older, less efficient gas-fired units in the ROI network, and the availability of the second North-South interconnector, essentially removing any electricity capacity flow constraint between NI and ROI from the start of 2026. This results in in the model favouring imports to ROI to meet electricity demand growth rather than dispatching more gas-fired generation.

62 EirGrid_SONI_2022_Generation_Capacity_Statement_2022-2031.pdf

6. Gas demand forecasts (continued)

- A large increase in installed offshore wind capacity between 2028/2029 and 2029/30. This is more prominent in the Low and Best Estimate scenarios, with delayed growth in the High scenario. Gas demand in the power sector continues to decline out to 2031/32 in line with further offshore wind roll-out.

The High scenario exhibits a sharp increase in annual gas demand between 2024/25 and 2025/26, which is driven by a 6% increase in SEM electricity demand which cannot be met by electricity imports or generation other than gas-fired generation.

Finally, as regards meeting the 80% RES-E target:

- The Best Estimate meets this target in 2030, with 84% RES-E by the end of the period;
- The Low scenario exceeds this target and hits almost 84% by 2030, with 86% RES-E by the end of the period;
- The High scenario misses this target due to slower roll-out of renewable capacity compared to the other scenarios, and achieves a 75% RES-E in 2030, with 77% RES-E by the end of the period.

6.5.2 Industrial and commercial sector gas demand

In the Industrial and Commercial sector, all three scenarios are forecasting growth across the NDP period, as illustrated in Figure 6-11 below. Both the Best Estimate and High demand scenarios are forecasting strong growth of 29% and 38% respectively. In the Low demand scenario, Industrial & Commercial sector gas demand is expected to increase more modestly by 6% by 2031/32.

Anticipated growth in this sector is linked to economic performance; as noted in Section 6.4.2, moderate GDP growth is assumed in the short to medium-term in both the Best Estimate and High scenarios. In the Low scenario, moderate GDP growth is projected for 2022/23 but this is anticipated to decrease to 1.4% for the remainder of the NDP horizon.

In addition to GDP growth, an increase in the projected number of additional (one-off) connections from Large Energy Users is also driving growth in the Industrial and Commercial sector.

Figure 6-10: Power generation sector gas demand

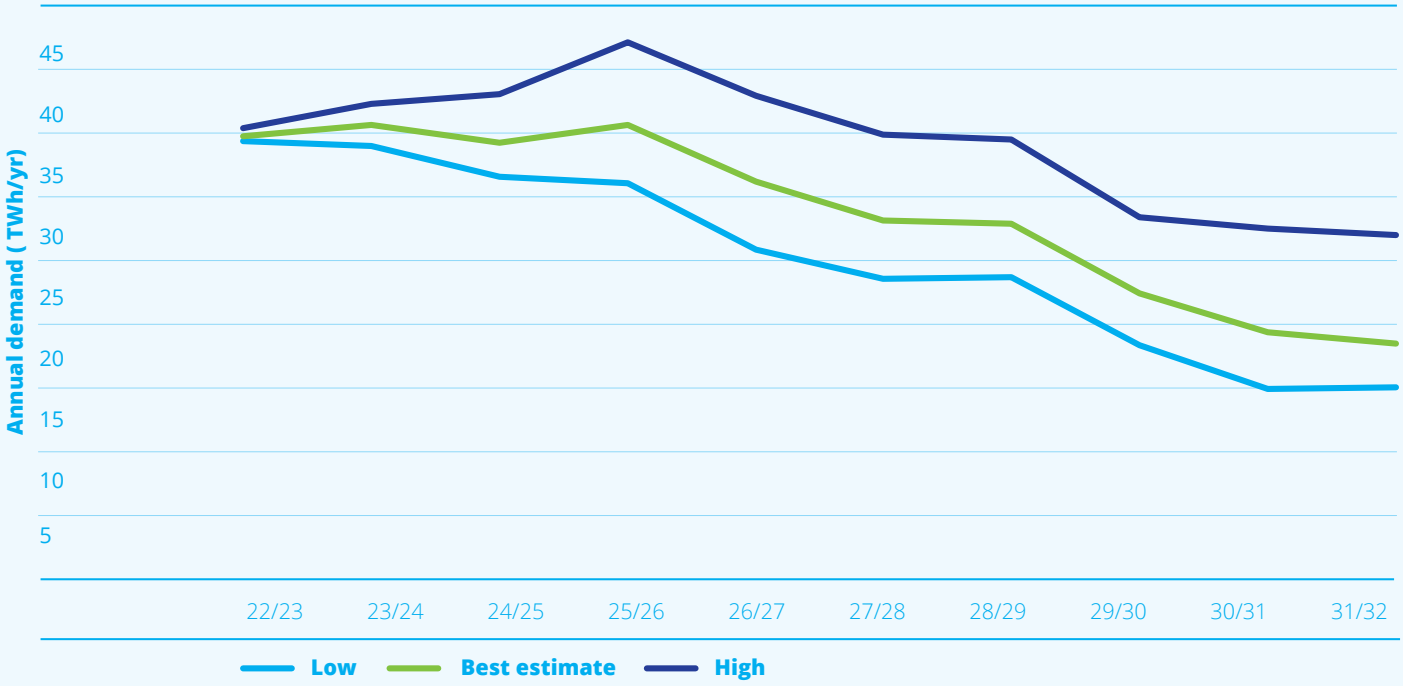
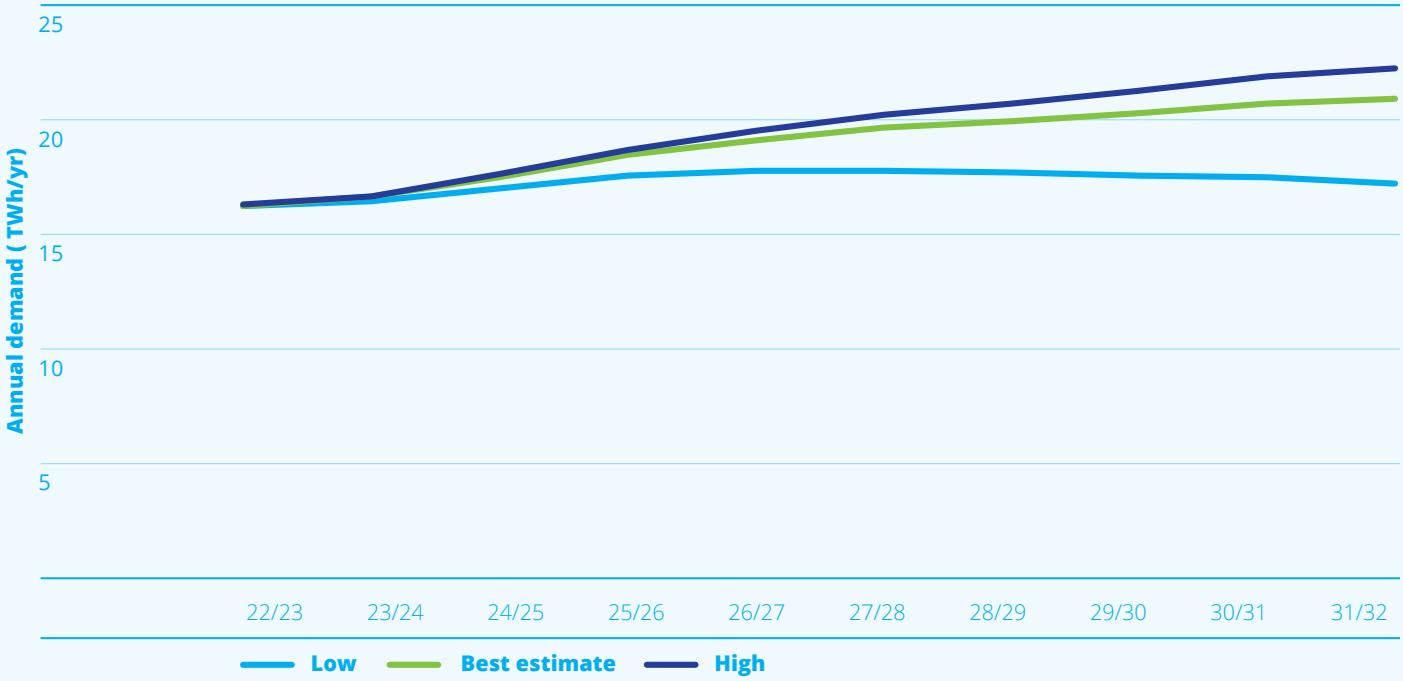


Figure 6-11: Industrial & commercial sector gas demand



6. Gas demand forecasts
(continued)

Figure 6-12: Residential sector gas demand

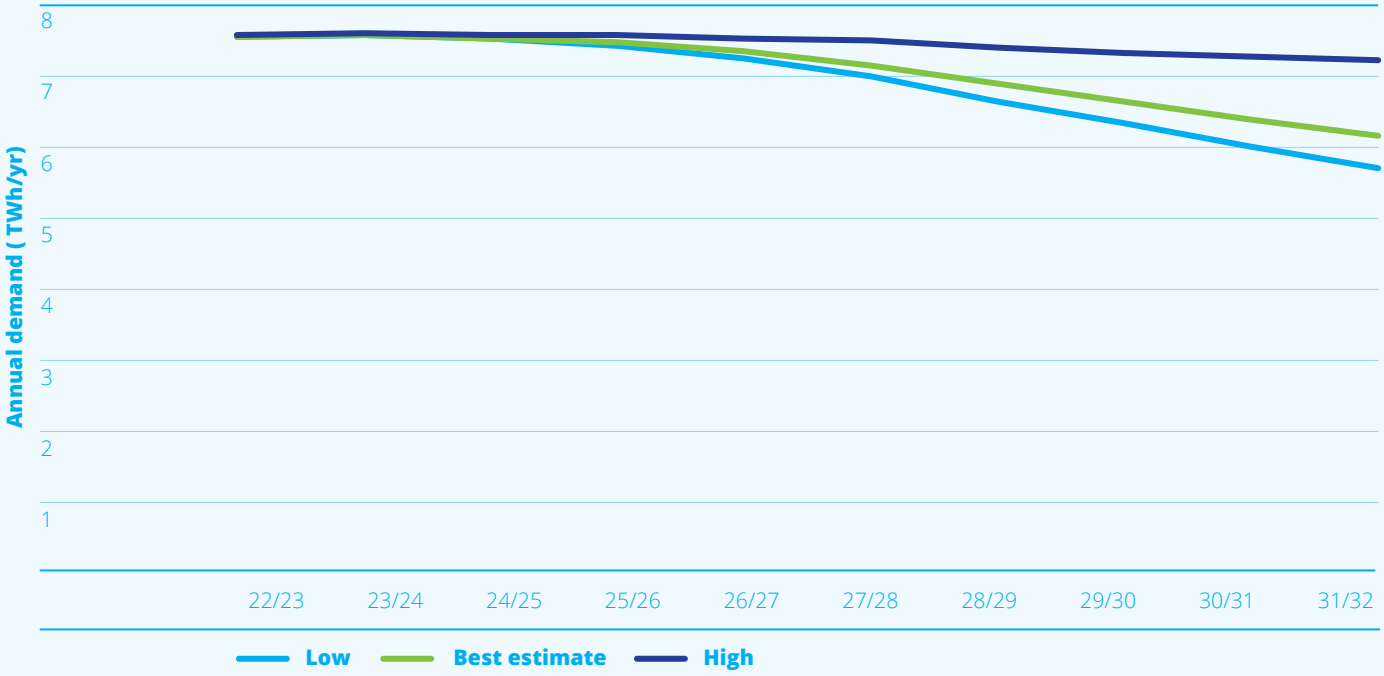
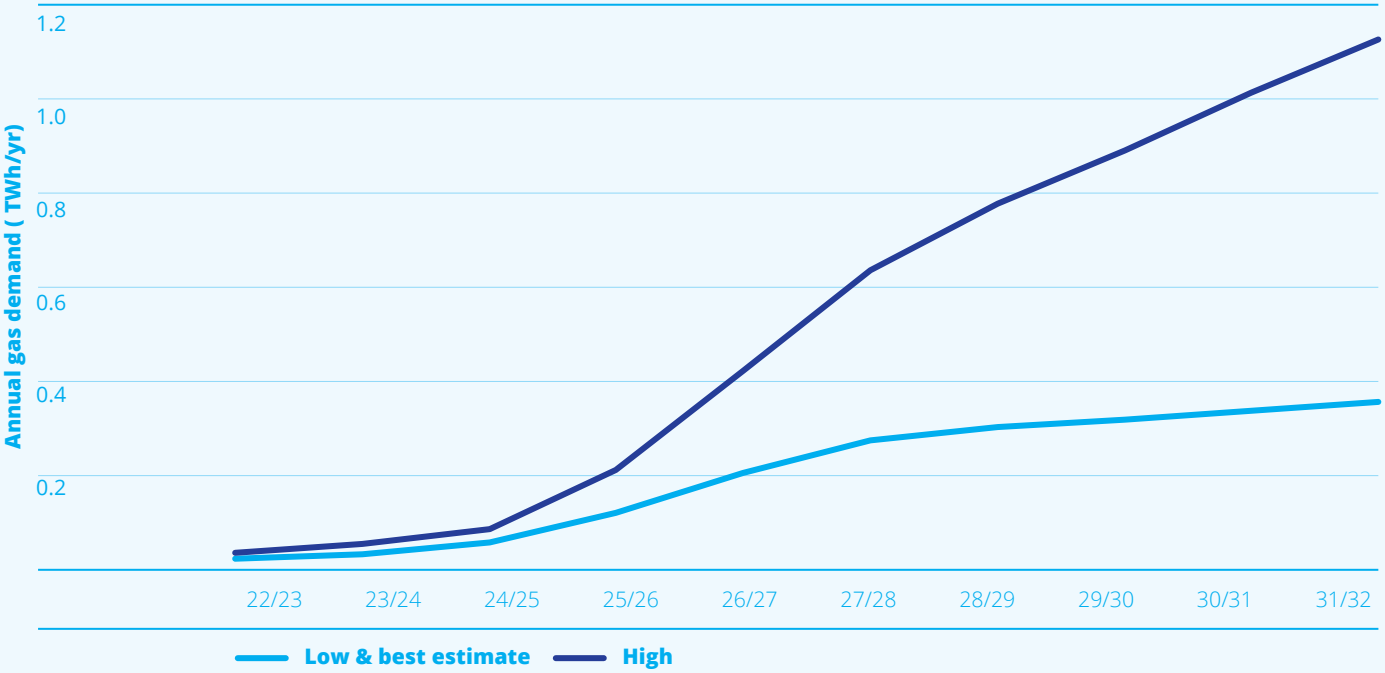


Figure 6-13: Transport sector gas demand



Growth in the I/C sector as mentioned above is partially offset by the following:

- The adoption of energy efficiency measures as described in Section 6.4.4 above;
- Disconnection of gas customers from the network in the I&C sector due to uptake of either heat pumps or district heating schemes as alternative sources of heat.

6.5.3 Residential sector gas demand

In the Residential sector, a contraction in demand is projected across all scenarios, as illustrated in Figure 6-12 below. This is as a result of declining new connection numbers, coupled with an anticipated increase in disconnection rates in this sector as a result of a migration of residential heating systems to heat pumps and district heating at scale. Energy efficiency improvements in existing dwellings are also expected to reduce residential gas demand in all three scenarios, as referenced above in section 6.4.4.

The Best Estimate scenario projects a reduction of 19% in the Residential gas demand sector across the forecast horizon. In the High and Low demand scenarios, 5% and 25% reductions in demand are predicted respectively.

6.5.4 Transport sector gas demand

In the Transport sector, growth is projected across all scenarios, as shown in Figure 6-13 below. Gas Networks Ireland has successfully developed both public and private BioCNG stations on the distribution gas network with new connections expected to continue and increase across the ten-year NDP period. The growth trajectory in this sector has declined in the Best Estimate scenario compared to the Gas Forecast Statement 2022; hence, demand of 356 GWh/yr is expected in 2031/32 in both the Low and Best Estimate NDP 2023 scenarios. The High scenario forecasts demand of 1,128 GWh/yr in 2031/32.

6.5.5 Total annual gas demand

Annual ROI gas demand is expected to (i) peak in 2025/26 in the Best Estimate and High scenarios and (ii) remain flat to 2025/26 in the Low scenario, then decline for the remaining years of the period in all three scenarios.

In the Best Estimate demand scenario, annual ROI gas demand is expected to fall by 21% between 2022/23 and 2031/32. Similarly, in the Low demand scenario, a decrease in ROI gas demand is predicted over the same horizon of 34% and a slight drop in annual gas demand of 3% is projected in the High demand scenario. The decrease in all three scenarios is driven by the anticipated fall in both Power Generation and Residential sector gas demands as outlined above. In contrast, growth in I&C demand in all three scenarios partially offsets the overall decline in ROI demand.

The aggregate ROI demands for the three NDP scenarios are presented in Figure 6-14. Figure 6-15 gives the breakdown of each sector over the forecast period for the Best Estimate demand scenario.

6. Gas demand forecasts
(continued)

Figure 6-14: Total annual ROI gas demands

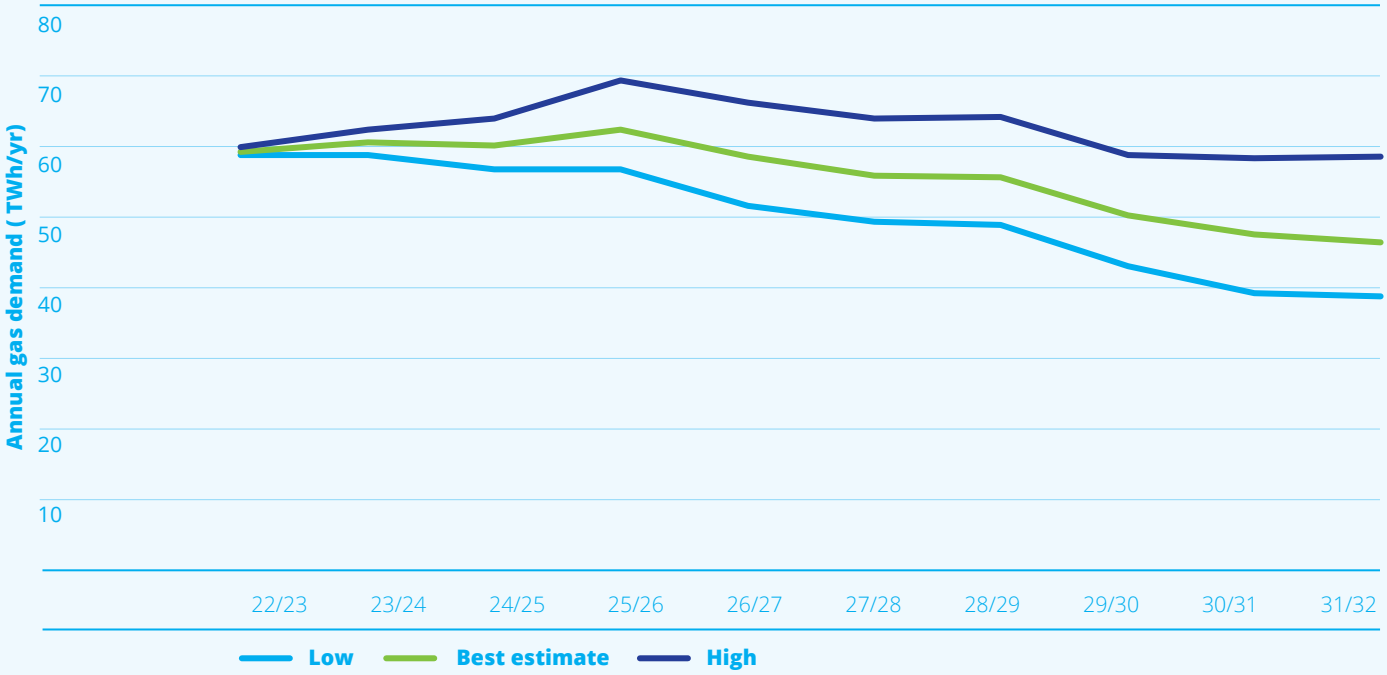


Figure 6-15: Best estimate scenario annual ROI demand by sector

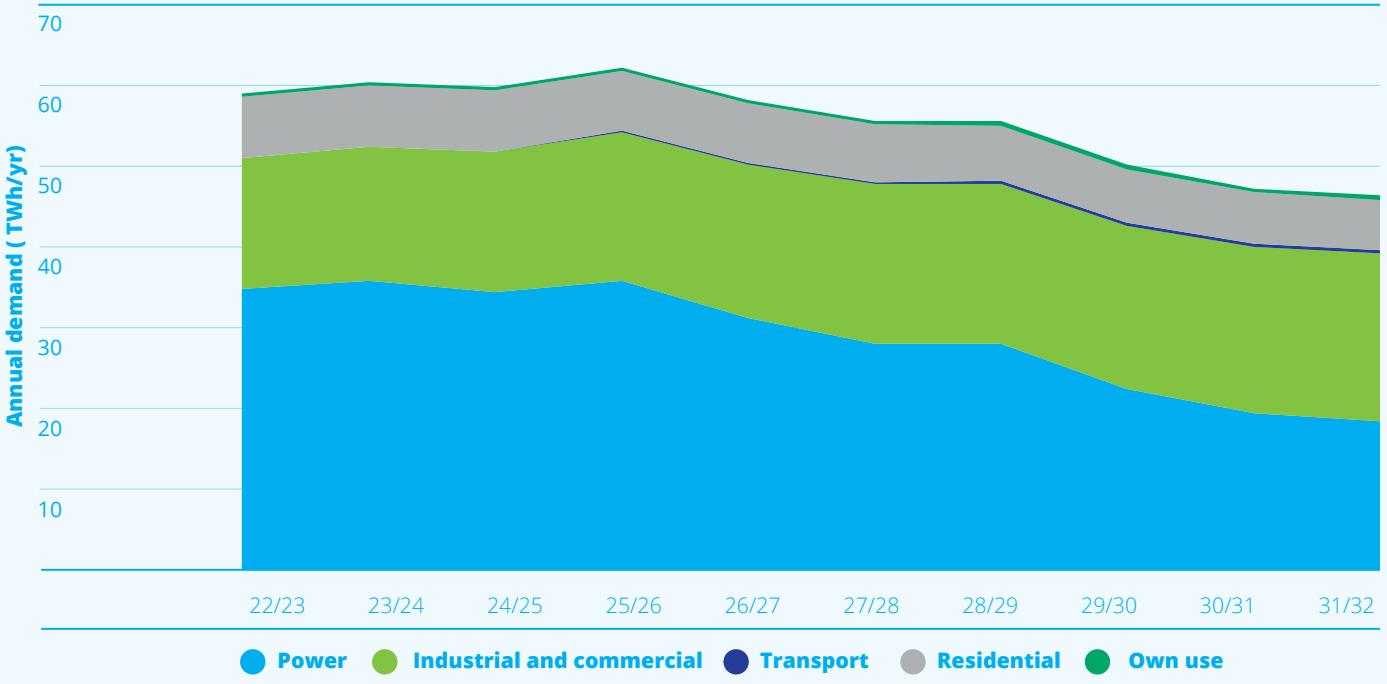


Figure 6-16: ROI 1-in-50 winter peak day gas demand forecast

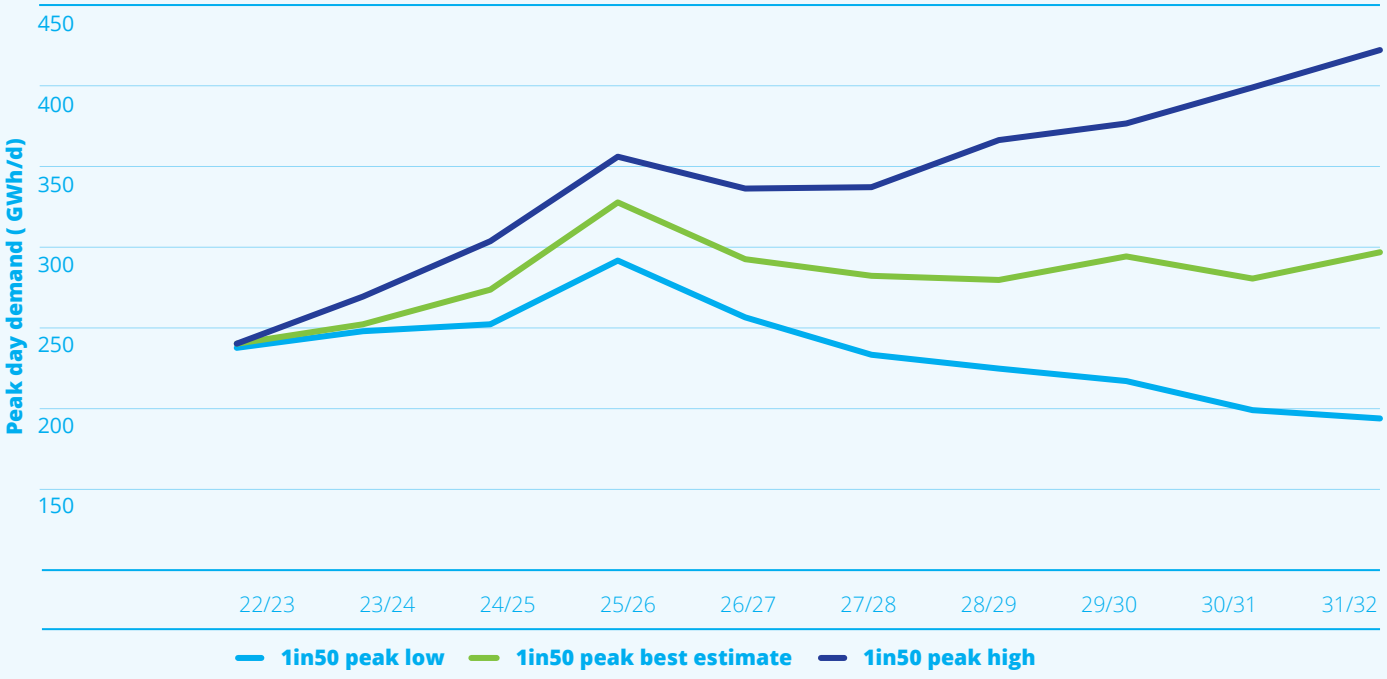
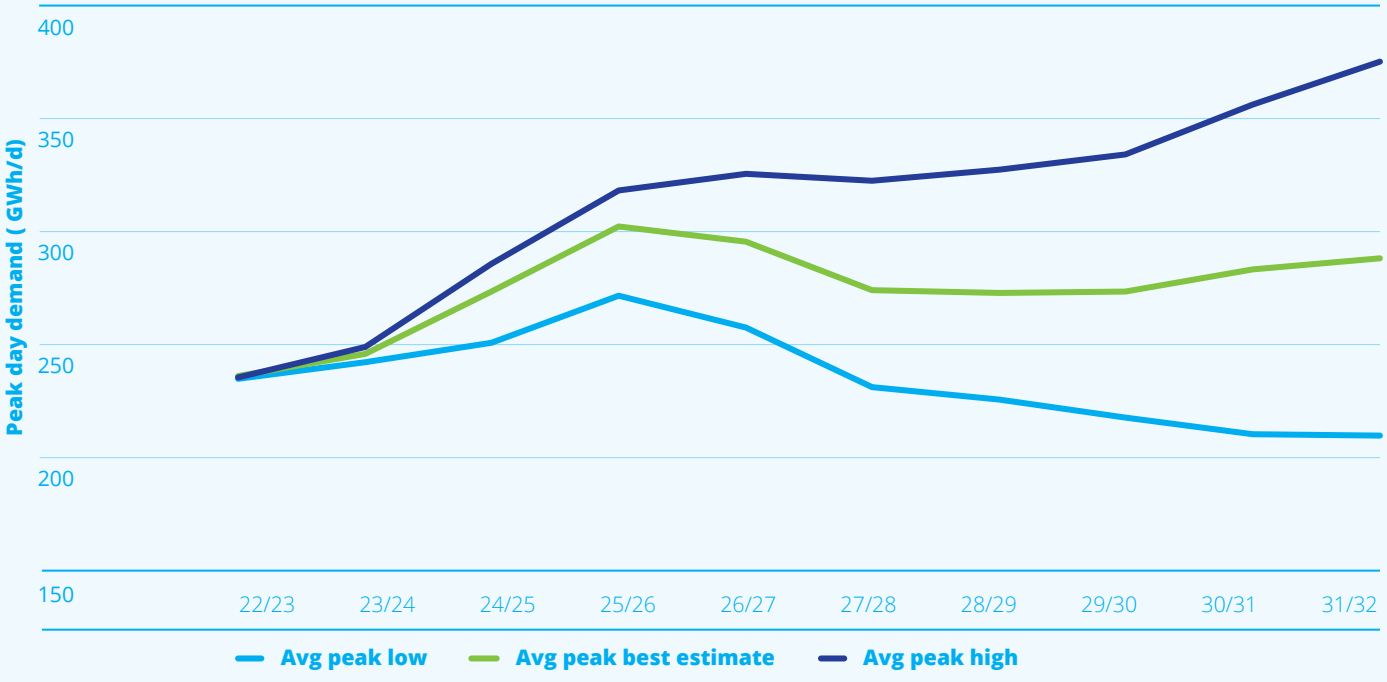


Figure 6-17: ROI average winter peak day gas demand forecast



6. Gas demand forecasts
(continued)

6.5.6 Peak day gas demand

The 1-in-50 and average year peak day gas demands for ROI are given in Figure 6-16 and Figure 6-17 respectively. The 1-in-50 peak day gas demand is expected to grow by 18% in the Best Estimate and 57% in the High demand scenarios, while the Low is expected to decline by 14%. Average winter peak day demands are expected to grow by 22% and 58% in the Best Estimate and High demand scenarios respectively and fall by 11% in the Low scenario.

The annual and peak day gas demand forecasts are decoupled as a result of the changing landscape of the power generation sector. Annual gas demand projections are impacted by the increased roll-out of renewable generation, which directly displaces dispatchable thermal generation, i.e. gas-fired generation, when available. In contrast, non-dispatchable renewable generation is assumed to have little impact on the peak gas demand day. 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.

Furthermore, peak electricity demand is expected to grow by 31% across the NDP time horizon[63]. Hence, gas-fired electricity generation is both compensating for low renewable generation on the peak day for gas demand while also meeting the growing peak electricity demand year-on-year.

The increasing penetration of renewable generation, particularly of offshore wind and solar PV, does have a slight dampening effect on the peak day gas demand, with installed renewable capacity projected to more than double over the final five years of the NDP forecast horizon.

The high level of electrical interconnection achieved by 2028 also has an impact on the power generation peak day gas demand; in the forecast, the SEM is anticipated to be net importing on these days, thereby displacing some of the OCGTs that would have been the marginal plants in the merit order. 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 imports may be lower or flow across the day may be neutral, thus increasing the peak day gas requirement over and above that shown in Figure 6-15 and Figure 6-16.

The forecasted increase in peak day demand, despite the anticipated decrease in annual demand, results in a requirement for Gas Networks Ireland to assess how the operation of the network is likely to change in the future, given that gas demand may fluctuate from day-to-day by greater margins. This is already becoming evident during periods where wind conditions change abruptly, causing a significant swing in the daily gas demand for power generation.

6.5.7 Role of gas in power generation

Ireland's portfolio of CCGT power plants are significantly more efficient than other thermal generator types and provide the responsiveness and flexibility required to support wind generation and other renewables. Gas-fired generation accounted for 47% of Ireland's electricity generation in 2023[64]. 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 720,000 customers in Ireland, including some of Ireland's largest multinational and indigenous industries.

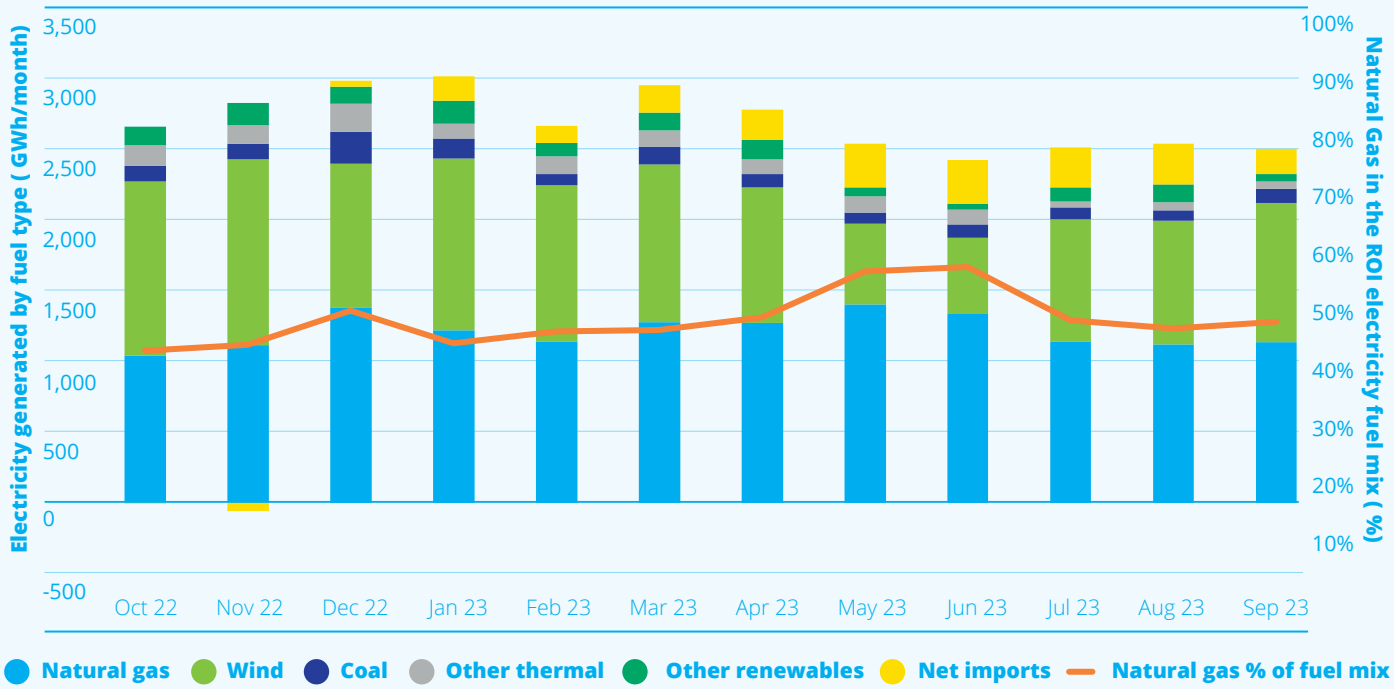
63 https://cms.eirgrid.ie/sites/default/files/publications/19035-EirGrid-Generation-Capacity-Statement-Combined-2023-V5-Jan-2024.pdf
64 System and Renewable Data Summary Report

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 6-18 demonstrates the contribution of natural gas fired generation to the ROI electricity fuel mix for the 12 months up to September 2023. This figure illustrates how gas-fired power generation complements intermittent renewable sources. The partnership between these two is crucial for achieving Ireland's renewable integration goal.

As noted in Section 6.4.1, 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:

- Retirement of the oil-fired plants at Tarbert by end-2023;
- Target commissioning dates of the North-South, Celtic and Greenlink interconnectors, and any further new interconnection;
- Continued build-out of renewable generation towards the 80% by 2030 RES-E target;
- New generator entrants to the SEM (both gas-fired and other energy sources), coming online between 2023 and 2028, aligning to T-3 and T-4 capacity auction results;
- Fuel and carbon prices and;
- Operational constraints on the electricity network, including, for example, inertia and SNSP restrictions.

Figure 6-18: Natural Gas in the Electricity Fuel Mix[65]



65 Based on SEAI Monthly Electricity Data https://www.seai.ie/data-and-insights/seai-statistics/monthly-energy-data/electricity/

6. Gas demand forecasts
(continued)

"Gas Networks Ireland have modelled Greenlink as being entirely unavailable for imports on the peak day to approximate the approach taken by EirGrid."

All the above considerations have been factored into NDP 2023 modelling assumptions as part of the base case scenarios

A sensitivity (S1) was identified and carried out on the Best Estimate 1-in-50 winter peak day scenario examining the case where some electricity interconnection is derated. On the peak day, ROI is forecasted to be net importing electricity to meet demand. In reality, market conditions on the peak day could result in different interconnector flows, i.e. lower levels of imports or a neutral net import position. The resultant effect of these different market conditions is approximated by de-rating the interconnectors, which reduces the maximum potential imports available.

Table 6-3 shows the results of the Sensitivity in terms of growth in the ROI 1-in-50 peak day demand across the NDP horizon

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

6.5.8 Best estimate with electricity interconnectors derated

This sensitivity considers the case where all interconnectors between Ireland and GB and France are de-rated by a designated External Market De-Rating Factor, in line with EirGrid's assumptions as part of their generation adequacy assessment in the GCS 2023. Hence, the EWIC, Moyle and Celtic interconnectors are all derated by 60% on the peak day vs. the base case, resulting in less electricity imports being available. EirGrid also detail in their GCS that Greenlink does not contribute towards system adequacy and hence its capacity is not included, either rated or derated, in the generation adequacy assessment. Hence, Gas Networks Ireland have modelled Greenlink as being entirely unavailable for imports on the peak day to approximate the approach taken by EirGrid.

In the base case Best Estimate 1-in-50 peak day forecast, there are considerable imports on the peak day, providing up to 31GWh on the peak day by 2031/32. As gas-fired generators are typically the marginal plant, these electricity imports have a direct dampening effect on gas demand for power generation.

A comparison between ROI 1-in-50 peak day demand for the base case Best Estimate and for S1 is shown in Figure 6-19 below, which illustrates the impact of the interconnectors being derated on the peak day, resulting in a direct increase to gas demand across the NDP horizon. The increase in gas demand on the

Table 6-3: Sensitivity analysis results vs. best estimate (base case)

Scenario	2022/23 -> Peak Year in Horizon (% Growth) (ROI 1-in-50 Peak Day)	vs. base case	2022/23 -> 2031/32 (% Growth) (ROI 1-in-50 Peak Day)	vs. base case
Base case: best estimate	27.9%		18.1%	
S1: best estimate with electricity interconnectors derated	28.3%	↑	26.3%	↑

peak day ranges from 7GWh/day in the early part of the NDP horizon, up to 31GWh in 2031/32, the final year of the NDP forecast.

Overall, across the NDP horizon, in this sensitivity with derated interconnectors ROI 1-in-50 peak day gas demand grows by 27% in comparison to growth of 18% in the base case Best Estimate scenario. Furthermore, the highest peak demand day across the whole NDP horizon occurs in 2025/26 in the base case, exhibiting growth of 27.9% vs. year 1 of the forecast, 2022/23. In this sensitivity, that growth increases slightly by 0.4% to 28.3% between 2022/23 and 2025/26.

In conclusion, this sensitivity attempts to summarise the possible uplift on 1-in-50 peak day gas demand in the event of a decrease in available electricity imports, which may occur due to differing market conditions in SEM and GB than what is assumed in the model or may be due to an outage on an interconnector(s) on the peak day.

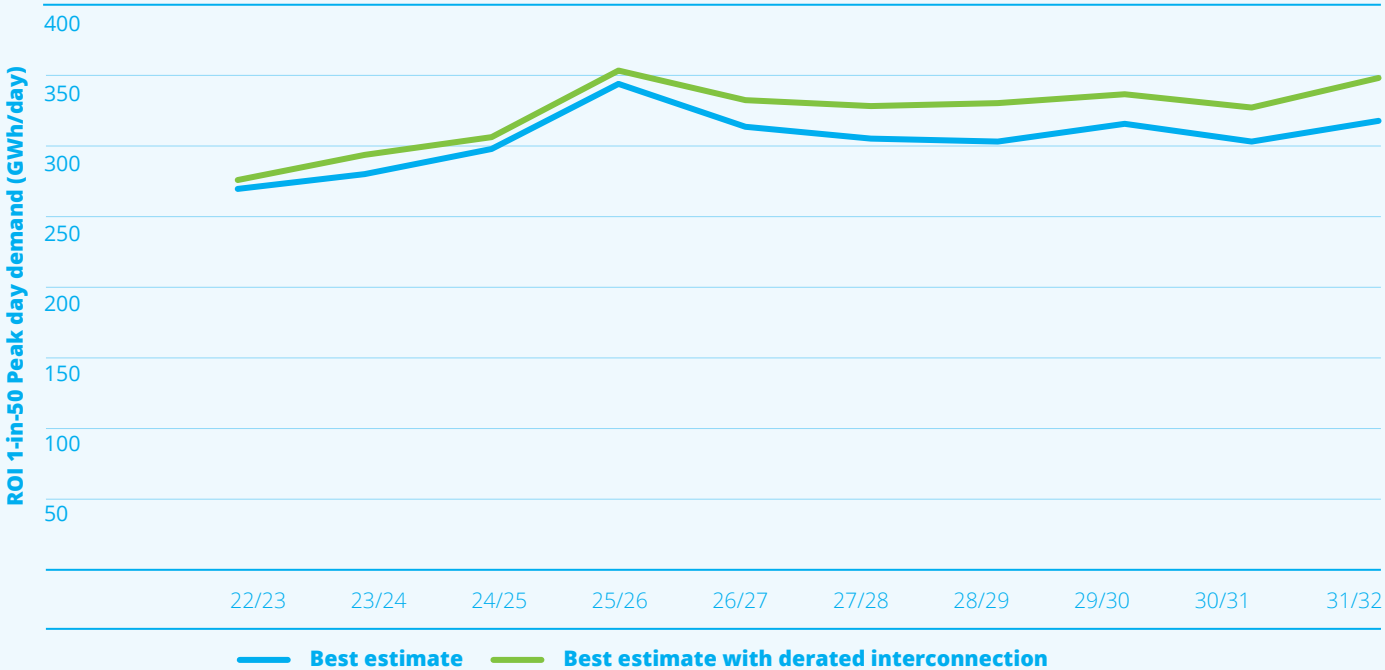
6.5.9 Carbon emissions

As discussed in Section 4.1, Ireland's carbon budget programme, comprising three 5-year budgets covering periods out to 2035, came into effect in April 2022. The budgets are further broken down into sectoral emissions ceilings, namely for the electricity, transport, buildings, industry, and agriculture sectors, with reductions in emissions ranging from 25% to 75% per sector by 2030, relative to 2018 emission levels.

Gas Networks Ireland recognises the importance of these targets as a method of reducing the use of fuels with the highest carbon emission rates, and also in promoting the uptake of energy efficiency measures.

In reporting on Ireland's anticipated capability in meeting these carbon budgets and annual targets, Gas Networks Ireland is limited as the NDP does not model the whole energy system, rather it

Figure 6-19: ROI 1-in-50 peak day demand for the base case best estimate vs. sensitivity 1



6. Gas demand forecasts
(continued)

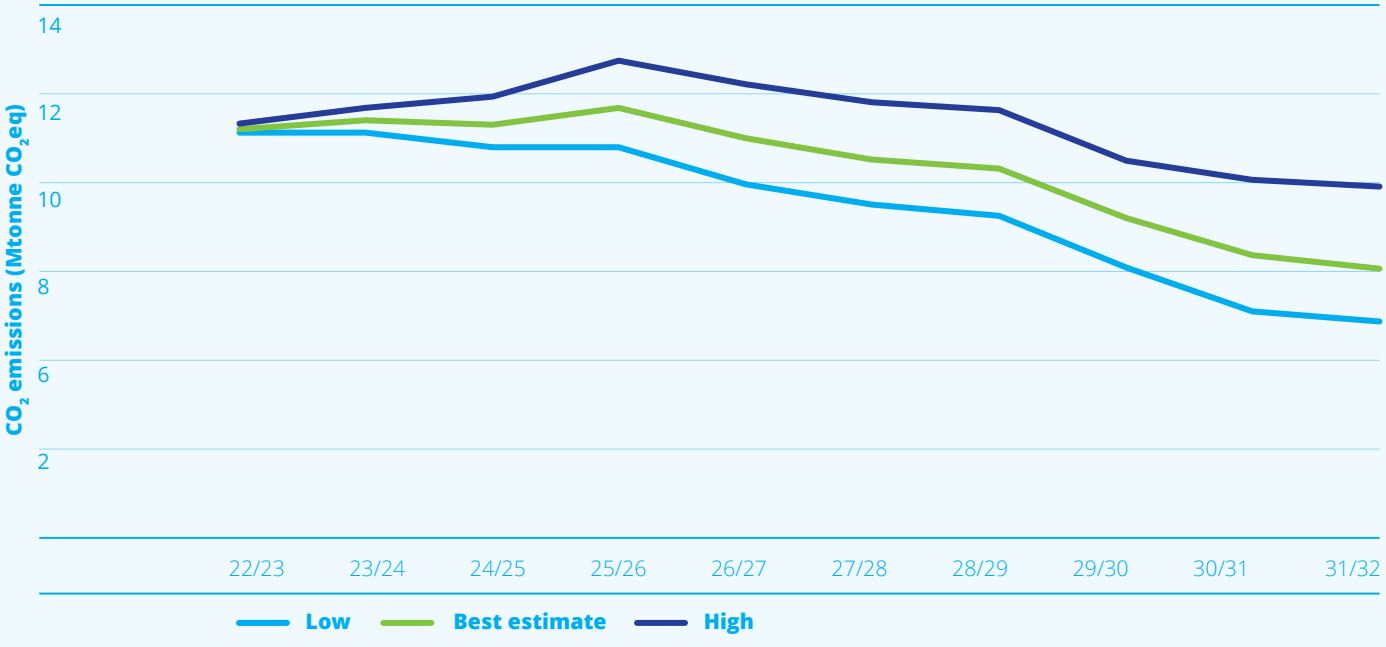
focuses on gas demand, i.e. natural gas, biomethane and hydrogen. The outputs from the Residential, Industrial and Commercial and Transport models include gas demand forecasts across these sectors, however, in producing these results, other fuel use in these sectors is not modelled. In contrast, the whole electricity system is modelled in the NDP; electricity generation forecasts by fuel type are output from the model. It is well recognised, by EirGrid themselves, that there are unprecedented and wide-ranging challenges in achieving the 80% RES-E target[66], not limited to operational complexities in managing the power system, e.g. substantial levels of surplus renewable generation, and that change is required across the entire electricity sector and beyond in order to deliver on this ambition. Hence, the whole of system electricity NDP model reflects only the planned electricity infrastructure upgrade works and/or innovation identified to date, and not the additional requirements whose delivery has yet to be detailed explicitly in order for the targets to be achievable.

Due to the limitations described above, Gas Networks Ireland has calculated total emissions associated with gas demand supplied via the gas network, as opposed to commenting on each sectoral emission target included in the carbon budget programme. Unless a whole of energy system model is developed as part of the NDP process, it is very challenging to comment on each sector separately.

Figure 6-20 below illustrates the projected carbon emissions from the gas network across the 10-year NDP horizon. The forecasts account for emissions savings resulting from displacing natural gas use with biomethane and hydrogen. Details of the annual supply forecast are included in Section 7.

The Best Estimate scenario is projecting a 34% decrease in carbon emissions relating to gas demand supplied by the gas network by 2031/32 relative to 2022/23. The Low and High gas demand scenarios forecast a 47% and 15% decrease in carbon emissions associated with the gas network associated.

Figure 6-20: ROI forecast annual carbon emissions from the gas network



66 EirGrid/SONI Generation Capacity Statement 2023-2032

6.5.10 Gas Networks Ireland's decarbonisation plan

Gas Networks Ireland is taking steps to decarbonise how we operate our gas transportation business while facilitating the network's transition to renewable gases. Working groups were established to assess and implement emission reduction initiatives across the business. In 2022 Gas Networks Ireland achieved a climate change score of 'B' through the Carbon Disclosure Project (CDP), exceeding the average CDP rating for the oil and gas storage and transportation sector. In addition, we are also signatories of the Business in the Community Ireland (BITCI) Low Carbon Pledge. This BITCI initiative encourages Irish businesses to invest time and resources into creating more sustainable operations, by being more energy efficient and reducing their carbon footprint; this includes a pledge to reduce carbon emission intensity by 50% by 2030.

Gas Networks Ireland's direct emissions fall into three categories: network gas consumption and losses, electricity consumption and service provider energy consumption. The following summarises three categories and the ongoing and planned initiatives in order to reduce our operational GHG emissions intensity by 50% by 2030.

- Operational fuel gas consumption and / or gas losses (both fugitive and from essential venting) generates the vast majority of our overall emissions. Gas transported via the Moffat Entry Point requires the use of compression facilities at Beattock and Brighouse Bay in order to raise the pressure of the gas for onward transportation to Northern Ireland, Isle of Man and the Republic of Ireland and to maintain pressures throughout the system. We plan to further reduce and improve reporting of fugitive emissions (ongoing), increase own use of biomethane for gas heating, install electric drive compressors operating on renewable electricity (by 2030), and reduce operational venting (ongoing, including recompression units installation in our compressor stations by 2027).

"Gas Networks Ireland achieved a climate change score of 'B' through the Carbon Disclosure Project (CDP), exceeding the average CDP rating for the oil and gas storage and transportation sector."

- Our electricity consumption including the electricity used for pressure reduction and in compressor stations on our network, and also in our offices We plan to reduce emissions associated with electricity production by upgrading our buildings (the recent refurbishment of our Cork office moved the BER rating from C3 to B1) and through more efficient operational installations. Our office energy performance, and also that of our vehicle fleet, are tracked by Energy Performance Indicators (EnPIs), which are energy intensity metrics. These EnPIs are reported to the SEAI annually. In 2022, Gas Networks Ireland's target EnPI was 732kWh/m^2, with our actual score improving on this target at 522kWh/m^2.
- Service provider energy consumption is the 'indirect' emissions generated by 3rd party service providers working on behalf of Gas Networks Ireland such as those produced by our main contractors or by our staff grey fleet. These can vary each year depending on the amount of pipeline laid in a year or the emissions reported by our main period contractors. Gas Networks Ireland's main third-party contracts have been designed to deliver sustainability and environmental best practice throughout the relevant project's lifecycle. This includes KPIs related to waste reduction, carbon and energy emissions, and also biodiversity enhancements. We plan to reduce these emissions through better sustainable procurement and stronger supplier management.

7. Gas supply

Key messages:

- The Corrib gas field met 17.6% of annual Gas Networks Ireland system demands (23% of ROI demand) in 2022/23, with the Moffat Entry Point providing the remaining 82.4%.
- The Corrib gas field supplied approximately 11% of Gas Networks Ireland system peak day demand (14.5% of ROI demand) in 2022/23.
- The Moffat Entry Point in Scotland will remain key in terms of energy security as Corrib production declines in the medium-term.
- Moffat is anticipated to meet 91% and 94% of ROI and Gas Networks Ireland system peak day demands respectively in 2031/32.
- Biomethane is forecast to meet 13.6% of ROI annual demand and 5% of ROI peak day demand in 2031/32. This is based on achieving 6.3 TWh/year of indigenous biomethane by the end of the NDP period.
- The NDP forecast includes low level blends of hydrogen in the network up to 2.1% of annual system demand by 2031/32 supplied both indigenously and through the interconnectors with GB.

This section presents an overview of the gas supply outlook for the period 2022/2023 to 2031/32.

For 2022/23, the Corrib gas field met 17.6% of annual Gas Networks Ireland system demands (23% of ROI demand), with the Moffat Entry Point providing the remaining 82.4%. Biomethane made a small contribution towards supply of c. 0.1% of ROI demand.

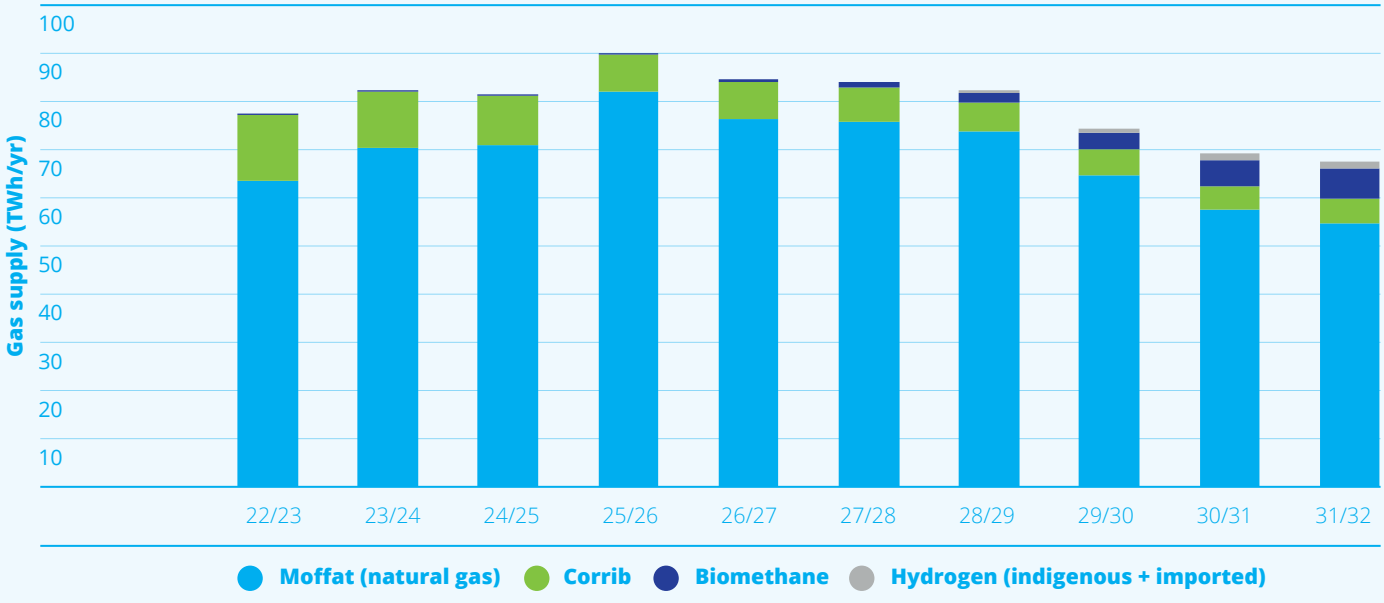
In the future, Corrib is projected to decline in its share of supply; in 2023/24 Corrib is anticipated to meet up to 14% of annual Gas Networks Ireland system[67] demands (19% of ROI demand), with the Moffat Entry Point providing the remaining 86%. By 2031/32, Corrib gas supplies will have declined to less than 12% of initial peak production levels, and is anticipated to supply 11% of ROI demand. By the end of the forecast horizon, Moffat will account for approximately 82% of annual Gas Networks Ireland system demands (73.3% of ROI demand, of which 0.7% is a blend of hydrogen).

Renewable gases, i.e. biomethane and hydrogen, are anticipated to play a larger role in system supply by 2031/32 and will offset the decline in indigenous gas supply from Corrib. Biomethane supply is forecast to meet 13.6% of ROI demand while hydrogen is projected to meet 2.1% of system demand, 31% of which is supplied through Moffat (2.8% of ROI demand, 23% of which is through Moffat).

Figure 7-1 presents the forecasted Gas Networks Ireland system annual gas supply for the period to 2031/32 for the Best Estimate demand scenario.

The Corrib gas field supplied approximately 11% of Gas Networks Ireland system peak demand (14.5% of ROI demand) in 2022/23 with the balance of system demand of 89% met via imports from Moffat (86% of ROI demand). Moffat is anticipated to meet 93.8% (of which 0.2% is Hydrogen) and 90.8% (of which 0.3% is hydrogen) of Gas Networks Ireland and ROI system peak day demands respectively in 2031/32.

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



67 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)

Biomethane is forecast to meet 5% of ROI demand by 2031/32 while hydrogen is forecast to meet 0.8% of system peak day demand, 31% of which is supplied through Moffat (1.1% of ROI demand, 23% of which through Moffat). The balance of peak day supply is forecast to be met by Corrib, contributing 2.3% and 3.4% to Gas Networks Ireland system and ROI peak day demands respectively.

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 current technical entry capacity at the Moffat Entry Point (386.9GWh/d) would be exceeded on a 1-in-50 peak day in the last eight years of the forecast horizon, and for the last seven years in the average peak day forecast. A series of capacity upgrade works at both compressor stations in Scotland are being progressed to meet the forecasted 1-in-50 peak day demands. These are outlined in greater detail within Section 10.

7.1 Moffat Entry Point

The Moffat Entry point in southwest Scotland supplies gas to ROI, NI and IOM. The Moffat Entry Point has reliably met the systems energy demand requirements for Ireland since the construction and commissioning of the first interconnector (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 worldwide via LNG imports.

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. National Grid considers a hydrogen blend at

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

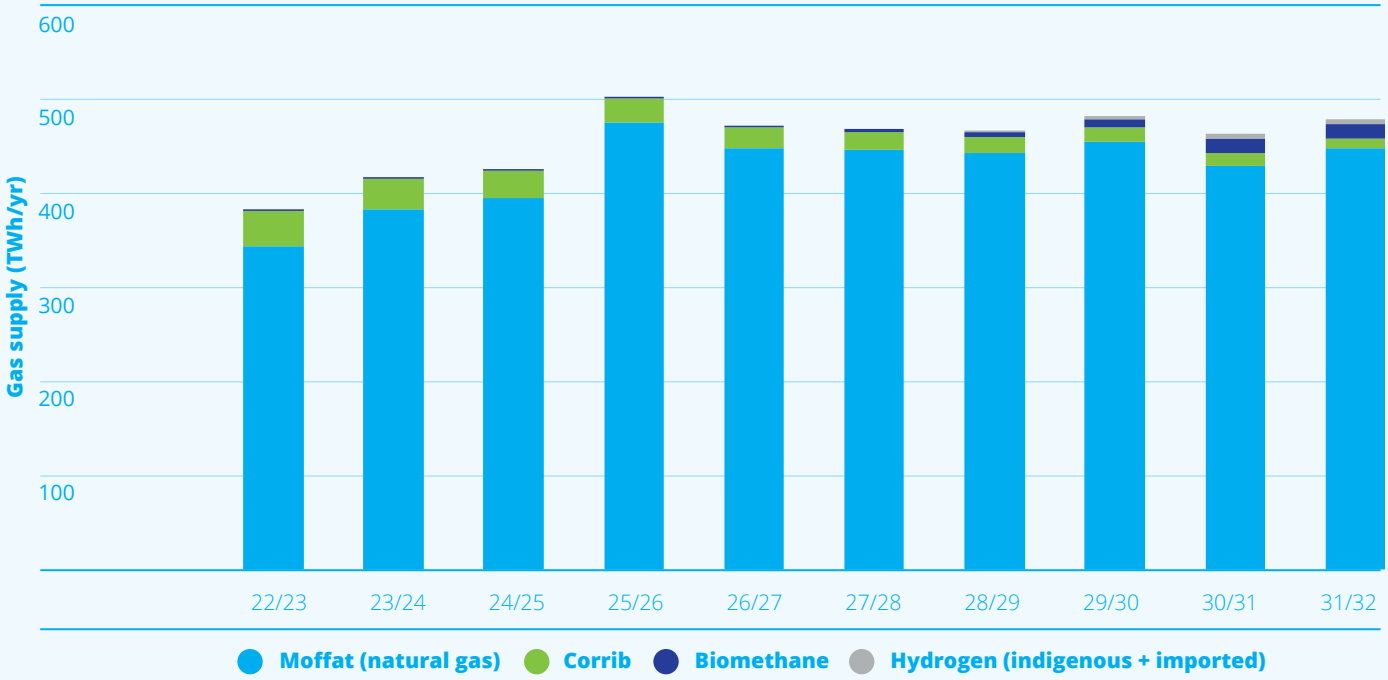


Table 7-1: Corrib Forecasts Maximum Daily Supply

	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
Daily Supply (mscm/d)	3.9	3.7	3.1	3.0	2.6	2.3	2.0	1.7	1.5	1.4
Daily Supply (GWh/d)	40.6	34.0	30.3	26.6	23.3	20.0	18.2	15.9	15.6	12.3

Moffat a distinct possibility before 2030 pending a decision by the UK government regarding the inclusion of support for blending in the UK hydrogen business model. Hence, the NDP supply forecasts include a blend of 2% hydrogen by volume at Moffat from 2029/30 onwards.

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 received in June 2023.

7.3 Biomethane

Energy from biomethane has the potential to contribute significantly to Ireland's renewable energy targets. In particular, biomethane 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, biomethane production can also deliver significant greenhouse gas mitigations for the Agriculture sector, offsetting Green House Gas (GHG) emissions from current slurry storage, slurry land spreading practices, and crop residue emissions.

As with other renewable energy technologies, biomethane requires national policy and incentive supports to allow the 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 biomethane gas production scenarios (Low, Best Estimate and High).

As mentioned previously in Section 4.1, both national policy, directly in the CAP 2023, and EU policy, indirectly in the form of a collective EU biomethane target in RePowerEU, support a target of 5.7TWh of biomethane production by 2030. This target is further supported by the sectoral greenhouse gas emissions ceilings incorporated into the CAP 2023, particularly regarding the commitment to deliver a 25 per cent reduction from the agriculture sector by 2030.

7. Gas supply
(continued)

Table 7-2: Biomethane gas supply forecast

TWh/yr	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
Low	0.1	0.1	0.1	0.2	0.3	0.6	0.9	1.4	2.4	3.6
Best Estimate	0.1	0.1	0.2	0.3	0.6	1.0	1.9	3.3	5.3	6.3
High	0.1	0.1	0.2	0.4	0.8	1.4	2.7	4.8	6.8	7.4

The High gas demand scenario almost reaches this target with 5.5TWh of biomethane production expected by 2030. The target of 5.7TWh is exceeded in 2031 and 2032 with forecast production of 7TWh and 7.5TWh respectively.

The Best Estimate scenario assumes that the infrastructure is in place to support the 5.7TWh target by the end of 2030, but it is 2031 before production of 5.7TWh is realised. This trajectory reflects the volume of biomethane production plants that need to be built and connected to the gas network in the next 7 years to support the biomethane industry.

The Low scenario considers a further delay to the infrastructure being in place to meet the 5.7TWh target, with production of 4 TWh expected by 2032, with a view to this production reaching 5.5TWh the following year, which is outside the scope of this NDP.

Table 7-2 below summaries Gas Networks Ireland's biomethane production forecast.

7.4 Hydrogen

Gas Networks Ireland welcomes new sources of gas supply and is actively engaging with prospective renewable hydrogen producers on their connection enquiries. Gas Networks Ireland has an excellent track record in delivering infrastructure projects and 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 biomethane and hydrogen. In the interim it is likely that hydrogen will begin to enter the network within the forecast horizon of the NDP, in low blended volumes on the Transmission gas network and with the potential for higher blends in parts of the Distribution gas network. 100% hydrogen clusters based around large hydrogen customers may also begin to emerge within the period of the NDP.

The publication of the REPowerEU Plan in May 2022 confirmed the EU's plans to end its dependency on Russian fossil fuels through energy saving and diversification of supplies and to accelerate the roll-out of renewable energy. The Plan includes a target of producing 10 million tonnes of domestic renewable hydrogen plus 10 million tonnes of hydrogen imports by 2030.

Both CAP 2023 and the National Hydrogen Strategy include a target of 2GW of offshore wind dedicated to the production of green hydrogen to be in development by 2030, with a level of the hydrogen produced anticipated to be injected into the gas network. Hence, the NDP forecasts include:

- A blend of hydrogen in the supply via the interconnectors with GB of 2% by volume of annual system demand by 2029/30 and
- Low levels of indigenous green hydrogen production of 0.5TWh by 2028/29, rising to 1TWh by 2030/31. In addition to some blending within the ROI network, indigenous production is expected to be in the form of a Hydrogen cluster, connecting to the gas network.


GREEN POWER CNG
Logistica e Trasporti
MECAR
GREEN POWER CNG
IVECO
CNG 1
HT22

8. Gas customer evolution

Key messages:

The gas network continues to play an important role in Ireland's economy, delivering over 30% of the country's primary energy needs[68], serving homes, businesses and electricity generation. In total, there are over 720,000 gas customers in Ireland.

Gas Networks Ireland plans to fully decarbonise the Irish gas network by 2050 to ensure it continues to serve Ireland's energy needs while also playing a significant role in supporting Ireland's climate change and emissions targets.

The evolution of the gas network to the point of full decarbonisation will develop over the coming 26 years and across a set of distinct phases. Over the next ten years, the network will continue to predominantly transport natural gas, with the volume of renewable gases in the network set to increase year-on-year.

In 2023, almost half of total electricity produced in Ireland was generated using natural gas. Gas-fired generation provides essential dispatchable energy to meet demand surges and provide back-up flexibility for the electricity grid when renewable sources of electricity are not available, an increasingly important capability as the share of renewable electricity generation continues to grow.

The industrial and commercial sectors in Ireland rely heavily on networked gas with 31% of final energy coming from the gas network in 2022. Renewable gas provides these sectors with a pathway to decarbonisation.

Gas Networks Ireland currently provides a safe, reliable and secure supply of natural gas to almost 690,000 residential customers throughout Ireland. Home energy efficiency measures and a higher uptake of heat pumps and deployment of district heating schemes will see a decline in gas demand in the domestic sector over the NDP period.

Combining networked gas with district heating technology, CHP and other renewable technologies has proven to be an effective energy solution for multi-occupancy buildings and apartment block developments and these options may be explored as policy develops over the NDP period.

There are currently four public access bioCNG stations and four private stations in operation with further public and private stations planned during the NDP period.

The first biomethane injection facility became operational in 2020, with production increasing year-on-year, reaching 41GWh in 2022 and with a projected 69GWh of biomethane supply in 2023. Significant growth in this sector is expected to reach the Government's Climate Action target of 5.7TWh by 2030. The further consultation on the Renewable Heat Obligation proposal, published in August 2023 in addition to the new Biomethane Strategy, which is currently being developed, are timely and welcome in supporting biomethane market development.

Ireland's gas network is among the most modern in Europe and it provides a safe, secure and reliable energy supply. Our national gas network infrastructure is 14,725km long and connects towns and villages in 22 counties across the country. The gas network is a substantial core component of Irish electricity generation with almost half of total electricity produced in Ireland generated using natural gas[69]. Gas-fired generation provides essential dispatchable energy to meet demand surges and provide back-up flexibility for the electricity grid when renewable sources of electricity are not available, an increasingly important capability as renewable electricity generation continues to grow. The capacity and reliability of the gas network means it can continue delivering energy to customers and provide additional fuel for electricity generation when required. The energy density of natural gas means it is uniquely placed to serve the needs of high-heat processing and heavy-load transportation. Natural gas provides a cleaner alternative to coal, peat, oil and diesel and replacing these fuels with natural gas or compressed natural gas can provide immediate emissions reduction. By transporting increasing volumes of renewable gases (biomethane and green hydrogen) in the network, as these become available, the gas network will realise even greater emissions savings over time. Bio-Compressed Natural Gas (bioCNG) is a carbon neutral fuel that can be used to decarbonise parts of the transport sector. BioCNG is biomethane that has been compressed to be injected into a gas vehicle's tank and it is particularly suitable for use in commercial vehicles where electric solutions are not a viable option.

8.1 Electricity Sector

The electricity sector in Ireland is facing a dual challenge of decarbonisation while also meeting customer demand in a period of unprecedented growth. Given the intermittent nature of renewable electricity sources such as wind and solar, the challenge of maintaining electricity grid stability and matching supply with demand grows as the share of electricity generation increases. Consequently, on occasions of supply shortfall, the electricity system needs a reliable, dispatchable and complementary fuel source to fall back on. Today, networked gas is the primary dispatchable fuel source in Ireland's electricity generation mix, fuelling c. 50% of all electricity generated each year and delivering much higher proportions (up to 90%) in times of peak electricity demand while still meeting heating demands.

As Ireland's reliance on intermittent renewable generation increases, the gas network's role in providing electricity system stability and security becomes even more critical. While annual gas demand for power generation is expected to fall by c.47% by 2031/32, the peak day power generation gas demand is predicted to grow by c.34% within the same period and Ireland's electricity generators and system operators will rely increasingly on the capacity, resilience, and responsiveness of the gas network to meet these peaks.

68 Energy-in-Ireland-2023.pdf (seai.ie)
69 System and Renewable Data Summary Report.

In their annual All-Island Generation Capacity Statement 2022-2032, 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 electricity supply and demand. The SEM Capacity Market is designed to procure enough generation capacity to meet the EirGrid/SONI adequacy requirement. These annual capacity auctions have resulted in capacity contracts being awarded to a number of technology types, including flexible gas-fired peaking power generation plants.

The continuing annual capacity auctions 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 gas-fired solutions requiring gas connections to the Gas Networks Ireland network.

8.2 Industrial and commercial customers

The Industrial and Commercial (I&C) sector is of vital economic importance to Ireland and the gas network provides a crucial source of reliable, versatile, competitive and convenient energy, powering over 30% of industry in Ireland. While the majority of the c. 30,000 I&C customers comprise Small and Medium Enterprises (SMEs) and public buildings, most of the gas demand comes from Industrial and Large Energy Users (LEUs).

In line with the Climate Action Plan, Gas Networks Ireland expects to see a decline in the number of SMEs and public buildings connecting to the gas network during the NDP period as district heating, retrofitting and heat pumps become more prevalent in this sector. However, networked gas will continue to be the fuel of choice for Industrial customers. Many of these businesses, both national and multinational, are dependent on gas as the energy solution they need to provide the high temperatures required to operate their key processing facilities (especially those in the pharmaceutical and food & beverage processing sectors). For some I&C customers, such as those in the IT and data sector, energy reliability is critical and networked gas is a preferred energy source reflecting the very high

8. Gas customer evolution
(continued)

reliability our network offers with the risk of an unplanned outage being on average 1 in every 40 years. Some industrial operations require both electricity and high temperature processes, however, given the propensity for occasional outages on the electricity grid, as well as its unit cost, a dedicated, on-site source of electricity is often preferred. Often this is provided via the installation of Combined Heat & Power (CHP) technology, typically a gas-fired turbine or engine operating to provide a secure and reliable source of electricity together with high temperature heat output captured from the turbine or engine (waste heat recovery process). The electricity generated on-site can be primary or secondary to grid supply but offers a more reliable, competitive and often more sustainable source of electricity when considered in combination with the useful heat captured from the CHP process (efficiencies of up to 90% are achievable using well-designed CHP solutions).

Beyond these traditional business needs, all commercial customers are increasingly focused on the need to operate more sustainably, meet their corporate social responsibility obligations and reduce their carbon footprint. Recently, almost 70 companies, including Gas Networks Ireland and large manufacturing and agri-food companies in Ireland, have signed a carbon pledge to significantly reduce their emissions footprint between now and 2030[70]. This desire to decarbonise is not only influencing companies' strategies on procuring their own source of energy (their scope 1 & 2 emissions), but also seeking to decarbonise supply chain emissions (scope 3 emissions).

While networked gas is particularly valued by many companies for its high-heat, high reliability characteristics and the network's ability to flex supply to meet their needs as they grow and evolve, the natural gas supplied through our network today, whilst cleaner than many other fuels, is a fossil fuel. Over time fossil fuel consumption increasingly runs counter to the I&C sectors' sustainability and decarbonisation obligations, however, the emergence and scaling up of renewable gases (biomethane currently and green hydrogen into the future) offers the potential for the commercial sector to retain the unique benefits of networked gas while still decarbonising their core processes and broader supporting operations.

Renewable gas is emerging as an important factor in securing ongoing and future investment in Ireland and a clear roadmap for the availability of low carbon gases is becoming a key requirement for many of these companies in choosing to locate or expand in Ireland. The existing gas network and customer on site utility applications are fully compatible with biomethane which provides a near-term effective, less intrusive pathway to decarbonising their operations and typically requires no additional gas consumer capital investment. Gas Networks Ireland has established a Renewable Gas Registry which allows end users to purchase renewable gas with confidence, as well as giving government and regulators the certainty that sales of renewable gas are transparent and are fully accounted. This is essential to supporting the growth of a renewable gas industry in Ireland and enables companies to verify renewable gas origin and sustainability credentials. The Renewable Gas Registry is also recognised by the EPA for use in the ETS sector. Gas Networks Ireland is working in partnership with industry, highlighting and facilitating the routes to procure indigenous biomethane. Section 4.2 contains further information on biomethane and the Renewable Gas Registry.

In the medium to long-term, indigenous green hydrogen is expected to provide an even more significant route for Industrial and Commercial companies to decarbonise via networked gas either as part of a hydrogen "cluster", via blended hydrogen or from dedicated segments of the national gas network dedicated to hydrogen transportation.

70 https://www.bitc.ie/the-leaders-group-on-sustainability/low-carbon-pledge/

8. Gas customer evolution
(continued)

8.3 Residential customers

Gas Networks Ireland currently provides a safe, reliable and secure supply of natural gas to almost 690,000 residential customers throughout Ireland. The first iteration of the Climate Action Plan, published in 2019, signalled a major shift in domestic heating with a clear focus on heat pumps and a phase-out of oil and gas boilers. This has been reaffirmed in subsequent updates to the Climate Action Plan in 2021 and 2022. Gas heating systems, in combination with solar technology gas can achieve current building regulation energy requirements (2019 NZEB) for new homes, however, the 2023 Climate Action Plan has recommended these requirements be updated to completely replace gas heating systems. Gas Networks Ireland has therefore assumed no new homes will connect to the gas network from 2025 onwards.

For mature housing, the Climate Action Plan has also set out ambitious retrofit and heat pump targets. Gas Networks Ireland therefore expects the number of homes converting from oil to gas to continue on its downward trajectory over the course of the NDP period, with no new connections expected beyond 2030 in the Low gas demand scenario and a limited number connecting each year in the Best Estimate.

Multi-occupancy buildings and large-scale apartment blocks often require tailored energy solutions. Combining networked gas with district heating technology, CHP and other renewable technologies has proven to be an effective and efficient solution for these buildings. Gas Networks Ireland has published case studies demonstrating the use of high efficiency condensing gas boilers in conjunction with Combined Heat and Power (CHP) and either electric heat pumps (Bridgefield Case Study)[71] or solar PV (Griffith Woods Case Study)[72] and how these solutions can meet the BER A-Rated requirements of new developments of this type. Both solutions incorporate district heating systems with a central boiler contained within a single boiler house and one gas meter providing gas to the CHP unit and back-up boiler. The CHP provides the electricity to the electric heat pump (Bridgefield Case Study)[71], or to the public lighting units (Griffith Woods Case Study)[72]. 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 gas boilers. In the case of the Griffith Wood development, the electricity output from the solar PV panels provides 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.

71 https://www.gasnetworks.ie/home/gas-benefits/case-studies/bridgefield/
72 https://www.gasnetworks.ie/home/gas-benefits/case-studies/griffith-wood/

Finally, all of these central boiler multi-occupancy buildings will be District Heating (DH) system ready if such a DH network was to be developed in close proximity to these buildings. This is a significant benefit of the existing solution as hot water is already supplied to all units within the building from the central boiler and can be readily converted to facilitate a DH system without the need for significant upgrade works. This is particularly important in areas where District Heating enabled requirements are already placed on new developments (e.g. Ringsend/ Poolbeg area of Dublin).

8.4 Transport

The challenge of reducing transport emissions in Ireland requires immediate action. Using Compressed Natural Gas (CNG) technology to power trucks and buses offers a real solution to eliminating emissions from diesel-fuelled heavy vehicles. CNG involves the deployment of technologies which deliver gas that has been compressed to high pressures (over 200 bar) for use in transport. It is compatible with both natural gas and biomethane and is particularly suitable for heavy goods vehicles (HGVs) where electric solutions are not a viable option. This is important considering that HGVs account for approximately 19.7% of all energy related carbon dioxide (CO_2) emissions in the road transport sector[73]. CNG is a safe and reliable technology with over 1.4 million CNG vehicles in use in Europe[74]. The provision of bioCNG has rapidly expanded in recent years with more than a quarter of the gas used in road transport in Europe being renewable[75]. There are currently over 100 bioCNG HGVs operating across the country providing transportation and logistics services to multiple sectors. All biomethane injected into the gas network designated for transport is used by these vehicles as bioCNG. This bioCNG is purchased by Gas Suppliers and sold to the market using the Irish Green Gas Certification Scheme administered by Gas Networks Ireland. The combination of bioCNG and an extensive national network of refuelling stations connected to the gas network provides a practical and cost-effective option for decarbonising HGVs.

In order to provide an affordable carbon neutral alternative fuel to diesel in the Irish market, Gas Networks Ireland is developing a nationwide bioCNG 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 bioCNG

73 Source SEAI: Emissions from transport excluding International Aviation: 11,553kTCO_2. Emissions from road freight: 2281 kTCO_2
74 EC European Alternative Fuels Observatory <https://alternative-fuels-observatory.ec.europa.eu/transport-mode/road/european-union-eu27>
75 NGVA Europe | 25,10% bioCNG in 2020: New data proves rapid growth of biomethane in transport

8. Gas customer evolution
(continued)

refuelling facilities along the TEN-T[76] Core Road Network. It is also in line with the National Policy Framework for Alternative Fuels Infrastructure[77]. This refuelling station network allows a transition to bioCNG as an alternative fuel. The existing natural gas network can be utilised as a national vehicle refuelling network, giving the commercial transport sector access to a cleaner, more economical fuel with a similar operational performance to diesel.

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 CNG 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. There are currently eight bioCNG stations in operation – four public stations and four private stations. The public stations have been developed as part of the Causeway Study which is funded by the Commission for Regulation of Utilities (CRU) and the Connecting Europe Facility (CEF) Transport Fund. The public stations are operated by Circle K in their forecourts in Dublin, Cashel and Limerick. A further five public access stations are at various stages of development and will be delivered over the next two years.

The second phase of rolling out bioCNG infrastructure across the country is the Green Connect project, also funded by CEF. This project includes a bioCNG mobile refuelling unit which will act as a back-up solution to the bioCNG stations and a bioCNG Vehicle Grant Scheme which supports the purchase of bioCNG vehicles across Ireland, with grants of up to €5,000 per vehicle. The grant scheme is due to close in December 2023.

By the end of the current NDP period, Gas Networks Ireland is expecting to see annual bio-CNG demand of c. 360GWh/yr, leading to annual emission savings of more than 73,000tCO_2.

Recent policy and regulatory developments clearly show that the potential offered by the gas network and bioCNG to Ireland's transport sector is recognised and understood. The Climate Action Plan 2023 emphasised the role for renewable gases and the rollout of planned bioCNG refuelling infrastructure such as Project Causeway and Green Connect. The gas network can provide even greater support to the transport sector in future but only with further policy, planning and stakeholder support.

There is a need to build out the bioCNG infrastructure from a pilot network to a robust national network ensuring an adequate coverage of refuelling stations and mobile units across the country to serve the transport sector and build confidence in the sector. There is a need for Irish planning to recognise the sustainability of bioCNG and facilitate the fast-tracking of bioCNG projects. The National Biomethane Strategy, currently under development and expected to be finalised later in 2023, is anticipated to encourage increased biomethane production and consequently to make more bioCNG available to the sector.

Demand for bio-CNG refuelling stations is growing. To develop the market for gas as a transport fuel we need to continuously engage and collaborate with all stakeholders in the sector from HGV fleet operators to forecourt operators. An important policy requirement could include a support scheme for bioCNG forecourt operators to support the business model for bioCNG infrastructure and reduce investment risk.

76 TEN-T – Trans-European Transport Network. https://ec.europa.eu/transport/themes/infrastructure/ten-t_en
77 gov.ie - National Policy Framework on Alternative Fuels Infrastructure for Transport in Ireland (www.gov.ie)


ESB Networks Ireland
1800 20 50 50

9. Commercial market arrangements

Key messages:

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

At EU level, full implementation by Gas Networks Ireland of the EU Network Codes has been completed.

The focus has moved to the European Green Deal, finalising the Hydrogen and Gas Markets Decarbonisation Package and most recently the REPowerEU Plan, which seeks to accelerate the move away from Russian fossil fuels with increased targets for biomethane and hydrogen production as part of the path to net zero.

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 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;
- Maintain, and enhance where necessary, market rules which are included in the Code of Operations;
- 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;
- Manage the contracts of the companies licensed to ship gas through the transportation system; and
- Drive market change initiatives to deliver on decarbonisation targets.

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. Our role in this regard has never been more important following Brexit which resulted in Ireland's gas network no longer being directly connected to that of another EU Member State. As a result, strong collaboration and engagement is required to minimise and issues that may arise as a result of Ireland being directly connected to a third country (GB) and the potential for divergence in legislative and regulatory regimes. Against this backdrop, and being cognisant of the potential associated challenges, Gas Networks Ireland will continue to ensure that a resilient, robust and safe gas network is maintained to customers through appropriate and efficient investment.

9.2 European developments

The EU Green Deal (published in December 2019) presented a high-level roadmap of key policies and measures to frame the EU's plans for decarbonisation and its ambition to become net zero by 2050. It has resulted in more ambitious targets and increased pressure to decarbonise, at both EU and national levels. Of particular interest to Gas Networks Ireland and the European energy industry were the 2020 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 a key step in delivering on the Green Deal, the European Commission's 'Fit for 55 Package', published on 14th July 2021 set binding targets of achieving climate neutrality by 2050 and a commitment to cut carbon emissions by at least 55% by 2030 (compared to 1990 levels). This series of 13 cross-cutting legislative proposals included eight revisions of existing legislation and five brand new proposals. 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.

"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."

9. Commercial market arrangements (continued)

The proposed 'Hydrogen and gas markets decarbonisation package' (revising Directive 2009/73/EU and Regulation 715/2009/EU) was published in December 2021. This revision aims to redesign a competitive, decarbonised gas market, fit for renewable gases including hydrogen and biomethane. Gas Networks Ireland actively fed into this review via direct consultation input and representation through its various EU gas association memberships. The Trialogue discussions were completed on the 8th December 2023, with the final text being approved by the European Council on the 20th December and the Committee on Industry, Research and Energy (ITRE Committee) of the Parliament on the 22nd January 2024. Approval by the Parliament is expected in April and its entry into force in May/June 2024, with the Belgian Presidency of the Council of the European Union committing to its completion in Q2, 2024.

Since the Russian invasion of Ukraine in February 2022, the volume of new energy initiatives from the European Union has continued to accelerate:

- The publication of the REPowerEU Plan in May 2022 confirmed the EU's plans to end its dependency on Russian fossil fuels through energy saving and diversification of supplies and to accelerate the roll-out of renewable energy. Building on the Fit for 55 package, the Plan included a proposal to increase the headline 2030 renewables target from 40%. On the 30th March 2023, the European Parliament and Council reached a provisional agreement to raise the binding target to at least 42.5% by 2030. The REPowerEU Plan also includes a goal to increase biomethane production to 35bcm by 2030 as well as a target of producing 10 million tonnes of domestic renewable hydrogen plus 10 million tonnes of hydrogen imports by 2030.
- New gas storage rules which elevate the status of gas storage facilities to critical infrastructure and put in place storage fill requirements on Member States with underground gas storage facilities (Ireland is exempt due to there being no large-scale gas storage on the island) have been implemented. These rules were first adopted on 27th June 2022 in an effort to improve energy security amid Russia's invasion of Ukraine and were instrumental in ensuring that storage levels exceeded 80% ahead of winter 2022/23. The storage fill target for winter 2023/24 was subsequently raised to 90% and was exceeded, hitting 96% on average by October 2023.
- All EU countries committed to reduce their gas consumption by at least 15% from August 2022 onwards, with Ireland have been exempted from this requirement due to our lack of direct interconnection with an EU Member State. The introduction of this gas demand reduction target was extended for an additional year in March 2023, following its success to date, albeit amid warmer than average weather conditions to date.

As we move to a low carbon society the role that the gas networks plays have come under the spotlight with new European regulations shaping Ireland's energy landscape. The Energy Performance of Buildings Directive (EPBD) and the Methane Emissions Reduction Regulation are two such

legislative proposals that have been progressed in 2023. The EPBD aims to decarbonise the EU's building stock by 2050 and includes proposals to phase out oil and gas boilers in existing dwellings. The first trialogue took place in June 2023 and there is no clear timeline for completion at this stage. The proposal for a regulation aimed at reducing methane emissions in the energy sector seeks to improve the measurement, reporting and verification of energy sector methane emissions as well as enhance leak detection and repair. The first trialogue took place on the 30th of August 2023 and there is no formal date for completion yet.

Gas Networks Ireland continues to proactively engage with EU Institutions, wider European policymakers and key EU gas associations as well as national stakeholders in the context of identifying implications of these developments for our business and the wider Irish gas and energy market.

"As we move to a low carbon society the role that the gas networks plays have come under the spotlight with new European regulations shaping Ireland's energy landscape."

10. Gas network capacity

Key messages:

As part of the forecast modelling, Gas Networks Ireland compares the forecasted demands, outlined in Section 6, and the forecasted supplies, detailed in Section 7 of this report. The NDP 2023 highlights that the Best Estimate 1-in-50 peak day demand is forecasted to surpass the existing combined system entry capacity during the NDP 2023 study period.

Gas Networks Ireland submitted a proposal to the CRU in 2022 to undertake permanent capacity upgrade works as part of price control period (PC5) in order to increase system entry capacity to meet the projected 1-in-50 peak day demands. This proposal was subsequently approved with planning for these works now underway. The upgrade works will increase capacity at both compressor stations in Scotland, at Brighouse Bay and Beattock, allowing increased gas flow rates through the two sub-sea interconnectors connecting Ireland and GB.

In 2022, 10 projects were completed including 2 AGI Capacity Upgrades, and 8 Reinforcements of the Distribution Network.

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 Investment planning

Gas Networks Ireland's planning and design 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 projects is on matters of proper planning and sustainable development having due regard for the environment. This process has been outlined in Section 2, 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.

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 2. 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**: these details how asset risk is assessed for, and how an asset risk score is assigned to, the assets, including Asset Health (probability-of-failure), Asset Criticality (consequence-of-failure) and failure modes (for each of the primary components); and
- **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.

10.2 Regulatory Capital Allowance

The CRU approves capital allowance for Gas Networks Ireland which fund the required investment on the network. Gas Networks Ireland is at the end of the first year of five of the fifth regulatory Price Control period (PC5).

Gas Networks Ireland's business plan for the price control period (PC5) was submitted to the CRU in September 2022. This plan sets 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. The process was delayed due to the changed economic landscape that prevailed at the start of 2022. The CRU published its final determination in respect of PC5 in December 2023[78].

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.

78 CRU2023140_CRU_Decision_on_the_PC5_Regulatory_Framework_380056.PDF (divio-media.com)

10. Gas network capacity
(continued)

Future investment proposals outside of the initial determination 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.

10.3 Completed capital programmes

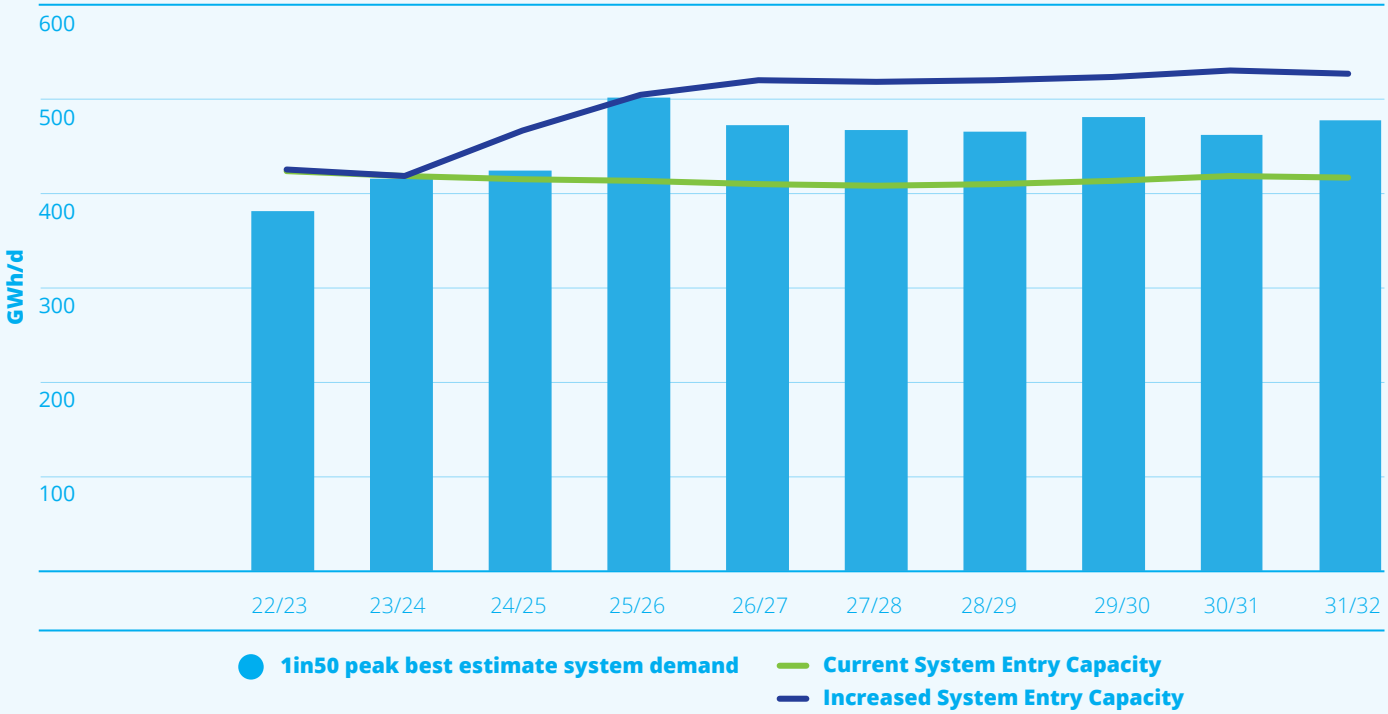
Capacity limitations are identified on the network and addressed through appropriate capital investment programmes in order to ensure continuity of supply to all customers. In 2022, 10 projects were completed including 2 AGI Capacity Upgrades, and 8 Reinforcements of the Distribution Network. These projects were subject to the appropriate consenting and planning regimes as set out in Section 3.

10.4 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. These constraints are typically capacity upgrades to Above Ground Installations (AGIs) and reinforcement of the distribution network. These works are completed under a capital investment programme.

As part of the forecast modelling, Gas Networks Ireland compares the forecasted demands in Section 6 and the forecasted supplies in Section 7. In line with previous forecasts, the NDP 2023 highlights that the Best Estimate 1-in-50 peak demand is forecasted to surpass the current combined system entry capacity over the NDP period as shown in Figure 10-1.

Figure 10-1: Combined system entry capacity versus peak day gas demand



Capacity on the interconnector pipelines is adequate to meet all gas demand projections over the ten-year horizon, the potential constraint would arise at the associated compressor station installations in Scotland. Having received funding approval from the CRU in 2023, Gas Networks Ireland is progressing a series of incremental capacity upgrades at both compressor stations which include filter and meter upgrades, gas compressor rebundling and reconfiguration of Brighouse Bay compressor station to give greater operational flexibility. The upgrade projects are proceeding to plan and will be constructed in phases over 2024, 2025 and 2026 with each phase providing additional capacity to meet the projected demands over the coming years as indicated in Figure 10-1.

Gas Networks Ireland will keep this potential constraint under review in subsequent Network Development Plans. Temporary operational measures have been identified to mitigate the constraint while the permanent capacity upgrades are put in place should a 1-in-50 event occur. Such measures, which include management of gas inventory storage in the subsea interconnectors, and changes to the operating regimes at the compressor stations will be sufficient to mitigate the constraint in the short to medium term while the permanent capacity upgrades are put in place.

11. CRU Commentary

This document has been developed through a process of engagement initially between Gas Networks Ireland and CRU where the system operator presented its draft modelling to CRU. The initial draft plan was submitted to the CRU for analysis and comments on the text of the report. A further draft was submitted taking the CRU comments into consideration and was then approved, by the CRU, for publication for the consultation which took place between 4 April 2024 and 3 May 2024. Gas Networks Ireland drafted and submitted their consultation report and having analysed the submissions, the CRU are satisfied that the consultation report prepared by the system operator is a reasonable response to the submissions by consultees.

The 2021 Ten-Year Network Development Plan (TYNDP) was finalised in 2022 in the context of the then recent Russian invasion of Ukraine and the subsequent measures taken by the EU Commission in response to the resulting energy crisis. These measures, which included the 'RePowerEU Plan' and updates to the 'Fit for 55 Package' focused greater attention on the gas demand and supply requirement throughout the EU.

The energy crisis instilled a renewed focus across Europe and in Ireland on energy security and diversification of supply as the EU and the country moves towards decarbonisation. It is now almost mid-decade and, with a range of renewable energy and climate targets due to be completed by 2030, there is increased focus on the TYNDP in relation to decarbonisation and assessing and forecasting Ireland's gas supply and demand to maintain security of supply.

The Government published its Energy Security in Ireland to 2030 package in November 2023 which outlines the strategy for a secure energy system in Ireland this decade while ensuring a sustainable transition to a carbon neutral system by 2050. The package contains a resilience work programme with specific actions for the gas sector which will be a factor in the development of the network. A key aspect of this package is Action 17 which sets out to create a strategic gas emergency reserve, with the Government to approve a detailed proposal which will be prepared by Gas Networks Ireland. The Government have also set out a related action, Action 14, which outlines plans to finalise studies to inform the development of long-term gas storage solutions.

The Commission for Regulation of Utilities (CRU) would like to highlight the following elements of the TYNDP 2023 that would be expected to feed into the future role of a secure and decarbonised gas network in Ireland.

The results of Gas Networks Ireland's gas demand forecasting across their low demand, high demand and best estimate scenarios shows a decrease in total annual gas demand in the Republic of Ireland between 2022/23 and 2031/32. The best estimate forecasts a 21% fall in demand between those years with the peak in demand expected to arrive in 2025/26 in that scenario and the high demand scenario, falling thereafter. Gas demand is expected to remain stable in the low demand scenario out to 2025/26 and then fall. The observed decreases across the three scenarios are driven by the anticipated fall in both power generation and residential gas demand due to increased renewable generation, energy efficiency measures, electrification of home heating and uptake of district heating schemes.

"Gas Networks Ireland have forecast a 34% decrease in carbon emissions relating to gas demand by 2031/32 in their best estimate scenario, the low and high gas demand scenarios also project decreases of 47% and 15% respectively."

The Moffat Entry Point will remain the key supply point for Ireland in the future, particularly in the context of the declining output from the Corrib Gas Field in the coming years. The TYNDP forecast 14% of annual Gas Networks Ireland supply to come from Corrib with the remaining 86% coming from Moffat in gas year 2023/24. At the end of the forecast period Moffat is expected to account for 82% of system demand with biomethane and hydrogen becoming a larger part of overall supply to offset the decline in Corrib.

The CRU would like to highlight that, based on the Best Estimate scenario, the current technical network capacity is expected to be exceeded on a 1-in-50 peak day of demand from 2024/25 and for each of the remaining years in the forecast period. The Best Estimate scenario has also forecast that peak day demand for an average year will also exceed this capacity from 2025/26 out to the end of the study period. As part of the CRU Price Control 5 decision, Gas Networks Ireland have received funding approval, to progress incremental capacity upgrades at both compressor stations in Scotland which is expected to be completed by 2026. The CRU will continue to monitor and review this forecast shortfall in subsequent TYNDPs.

Gas Networks Ireland have forecast a 34% decrease in carbon emissions relating to gas demand by 2031/32 (relative to 2022/23) in their best estimate scenario, the low and high gas demand scenarios also project decreases of 47% and 15% respectively. Further decreases in carbon emissions from the network are observed beyond 2030 as more biomethane and hydrogen is incorporated into the system. The CRU look forward to a move towards a more sectoral breakdown of carbon emissions in future TYNDPs and further consideration of the sectoral emission ceilings and carbon budgets.

With a continuing reliance on gas imported from Great Britain, the CRU is working closely with Department of the Environment, Climate and Communications (DECC), Gas Networks Ireland and the European Commission to ensure that Ireland's energy security is maintained. The CRU would like to take this opportunity to thank Gas Networks Ireland for producing the TYNDP, while acknowledging the work done maintaining Ireland's security of supply.

Appendices

Appendix 1: Historic demand

Historic Daily Demand by Metering Type

The historic demand data in Section 5 is presented by sector (i.e. residential, 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 57GWh 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 5.55GWh and less than 57GWh, and includes the medium Industrial and Commercial sites, hospitals and large colleges etc.
- Non-Daily Metered (NDM) with an annual demand of 5.55GWh 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)[79]

GWh/yr	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23
ROI	50,435	50,072	47,582	47,136	51,478	55,070	56,348	57,481	58,354	56,050	55,900	53,470
NI & IOM	15,142	15,031	15,132	16,970	16,992	18,168	16,984	17,005	17,693	18,798	17,748	16,722
Total	**65,577**	**65,103**	**62,714**	**64,106**	**68,470**	**73,237**	**73,332**	**74,485**	**76,046**	**74,848**	**73,647**	**70,193**

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

GWh/d	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23
ROI	211.7	213.2	187	203.8	199.4	221.8	215.9	218.5	225.4	248.5	233.0	261.9
NI & IOM	74.1	62.7	68.2	72.8	69.9	70.1	63.1	75.9	70.6	82.3	79.1	83.7
Total	**285.8**	**275.9**	**255.2**	**276.6**	**269.2**	**291.9**	**279**	**294.4**	**295.9**	**330.9**	**312.1**	**345.7**

79 Actual demands shown (not weather corrected) with residential estimated as % of NDM

Appendices
(continued)

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

GWh/yr	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23
Power[80]	29,864	28,156	26,910	24,708	29,061	32,181	31,936	33,050	33,772	31,349	33,071	32,306
I/C	13,244	13,700	13,682	15,013	15,581	15,835	16,485	17,149	16,879	16,797	15,728	15,022
Residential	7,326	8,216	6,991	7,414	6,835	7,054	7,927	7,282	7,693	7,905	7,078	6,119
Transport	-	-	-	-	-	-	-	-	10	20	23	24
Total	**50,435**	**50,072**	**47,582**	**47,136**	**51,478**	**55,070**	**56,348**	**57,481**	**58,344**	**56,052**	**55,877**	**53,470**

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

GWh/d	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23
Power	114.1	119.9	102	102.4	104.7	121.6	110.1	113	129.4	134.3	144.7	156.1
I/C	49.4	50.4	46.8	54.8	54.9	56.6	61	60.2	58.8	59.3	49.7	56.6
Residential	48.2	44.2	39.9	46.6	40.1	43.6	44.8	45.3	37.2	55	39.0	49.2
Total	**211.7**	**214.4**	**188.7**	**203.8**	**199.7**	**221.8**	**215.9**	**218.5**	**225.4**	**248.5**	**233.5**	**261.9**

The transmission connected demand, Figure A1-1, does not appear to be sensitive to seasonal changes in weather. The gas demand of the power sector is driven by relative fuel-prices rather than seasonal changes in 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 Gas Networks Ireland's system.

Table A1-5: Historic Annual Supplies through Moffat, Inch and Corrib

GWh/yr	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23
Moffat[81]	64,103	64,148	62,549	63,132	45,731	35,494	39,060	46,544	54,216	59,417	59,188	57,873
Inch	3,952	4,014	3,339	3,724	3,674	3,872	3,696	2,784	1,571	3	0	0
Corrib	-	-	-	-	20,470	34,659	32,612	26,747	21,217	16,520	15,494	12,320
Total	**68,055**	**68,162**	**65,888**	**66,856**	**69,876**	**74,025**	**75,368**	**76,074**	**77,004**	**75,940**	**74,682**	**70,193**

Table A1-6: Historic Peak Day Supplies through Moffat, Inch and Corrib

GWh/d	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23
Moffat	255.7	251.2	232.7	248.3	189.5	172.9	171.4	213.2	233.9	280.8	269.6	306.9
Inch	32	26.7	26.4	28	19.6	16.8	11.2	9.7	5.7	-	-	-
Corrib	-	-	-	-	60.1	103.7	97.1	78.5	61.9	52.3	45.4	37.9
Total	**287.6**	**277.9**	**259.1**	**276.3**	**269.3**	**293.4**	**279.7**	**301.4**	**301.4**	**333.1**	**315.0**	**344.8**

80 Power sector gas demand is amended to account for those I/C connections which generate electricity for their own use less process gas
81 Table shows total Moffat supplies including ROI, NI and IOM

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

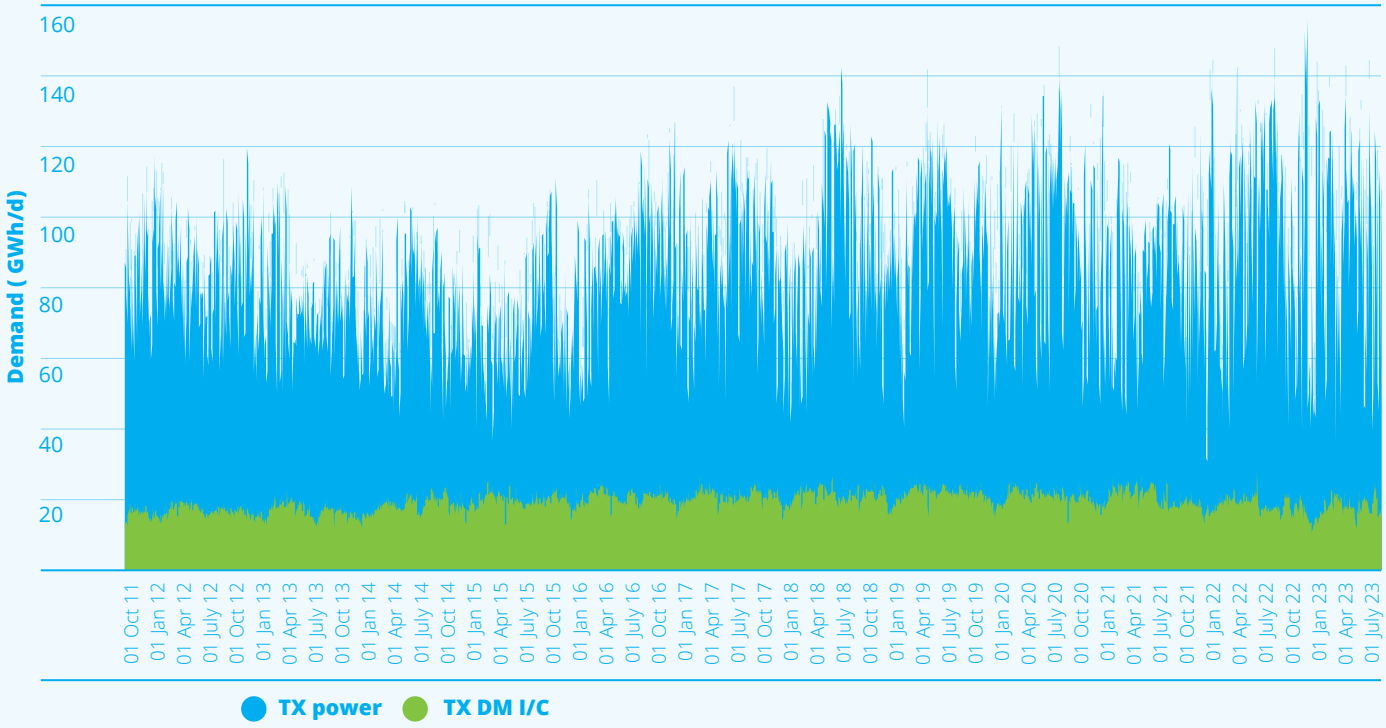
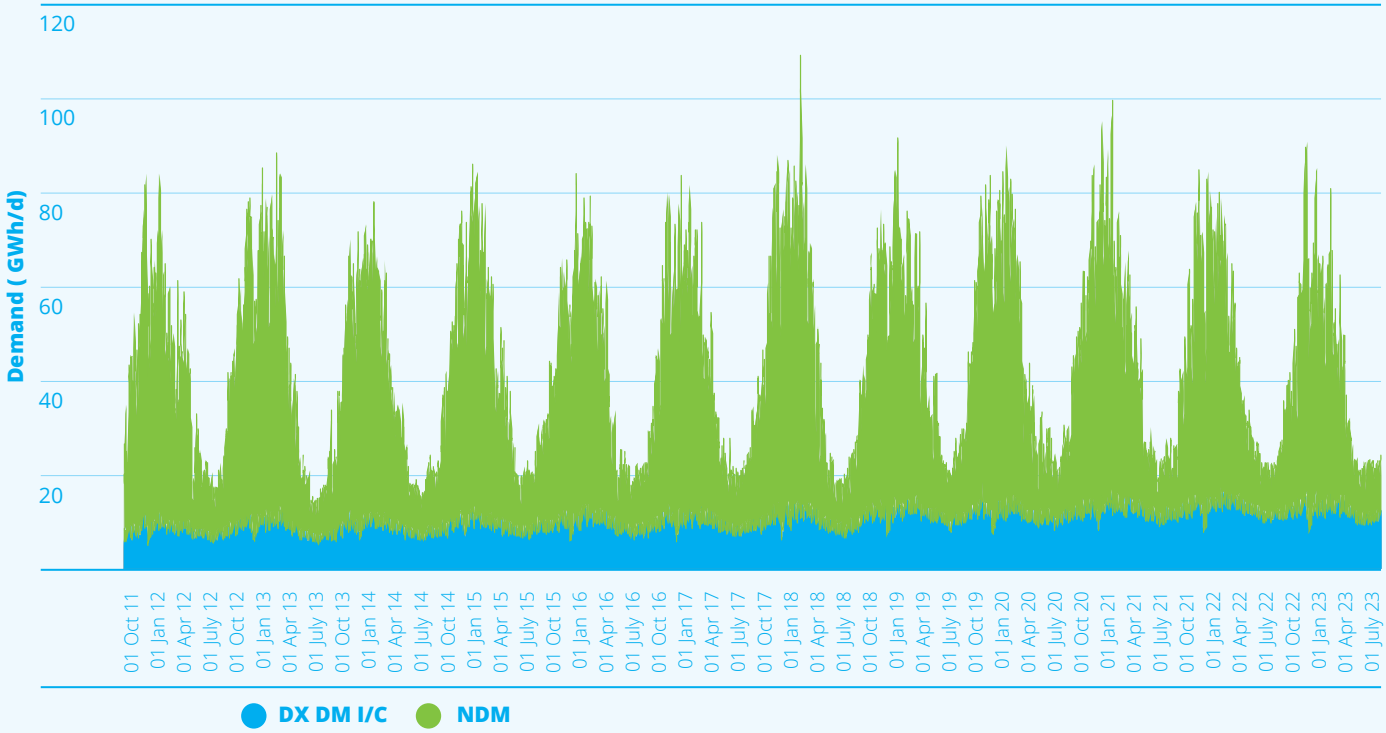


Figure A1-2: Historic ROI daily demand of distribution connected sites



Appendices
(continued)

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	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23
TX Power	114.1	119.9	102	102.4	104.7	123.8	106.1	113	129.4	134.3	144.7	156.1
TX DM I/C	17.7	17.8	16.1	18.8	21.1	20	21.7	20.3	23.1	18.7	16.8	14.6
DX DM I/C	11.9	12.2	12.6	13.3	13.5	13.6	14	15.5	15.5	15.8	14.8	16.6
DX NDM	68	64.6	57.9	69.4	60.4	61.2	68.4	69.7	57.4	79.8	57.2	74.7
Total ROI	**211.7**	**214.4**	**188.7**	**203.8**	**199.7**	**218.6**	**210.1**	**218.5**	**225.4**	**248.5**	**233.5**	**261.9**
Annual												
TX Power	29,864	28,156	26,910	24,708	29,061	32,181	31,936	33,050	33,772	32,389	33,071	32,306
TX DM I/C	6,147	6,088	6,439	7,085	7,455	7,562	7,642	7,888	7,659	7,699	6,760	6,338
DX DM I/C	3,235	3,419	3,432	3,593	3,776	3,842	4,038	4,494	4,570	4,754	4,903	4,705
DX NDM	11,188	12,409	10,802	11,749	11,184	11,485	12,733	12,049	12,343	12,563	11,143	10,121
Total ROI	**50,435**	**50,072**	**47,582**	**47,136**	**51,478**	**55,070**	**56,348**	**57,481**	**58,344**	**57,405**	**55,877**	**53,470**

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

GWh/d Peak Day	11/12	12/13	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23
TX Power	117.4	119.9	108.7	103.2	123.2	127.3	142.2	141.5	148.4	136.5	147.7	156.1
TX DM I/C	20.4	22.9	23.1	25.1	25.4	26.3	26.4	26	25.2	26.5	28.7	25.0
DX DM I/C	12.7	13.7	12.8	13.8	14.1	14	15.8	15.9	18.7	17.3	17.7	17.5
DX NDM	73	75.5	65.8	73.5	71.5	71	97.2	76.4	74.8	83.2	69.9	75.1
Total ROI	**223.5**	**231.9**	**210.4**	**215.6**	**234.1**	**238.6**	**281.7**	**259.8**	**267.1**	**263.5**	**264.0**	**273.7**
Power	117.4	119.9	108.7	103.2	123.2	127.3	142.2	141.5	148.4	136.5	147.7	156.1
I/C	53.7	59.1	56.5	62.7	63.4	64.3	74.4	68.6	69.2	70.4	68.5	63.3
Residential	52.4	52.9	45.2	49.7	47.6	47	65	49.6	49.5	56.6	47.8	54.4
Total ROI	**223.5**	**231.9**	**210.4**	**215.6**	**234.1**	**238.6**	**281.7**	**259.8**	**267.1**	**263.5**	**264.0**	**273. 7**

Appendix 2: Demand forecasts[82]

Assumptions

As outlined in Section 5 assumptions are made regarding a number of key demand drivers. These are summarised in Table A2-1 to Table A2-3.

Table A2-1: Future GDP annual growth

GDP Growth (%)	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
Low	3.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Best Estimate	3.5	2.7	3.7	3.9	3.9	3.9	3.9	3.9	3.9	3.9
High	3.5	2.7	3.7	3.9	3.9	3.9	3.9	3.9	3.9	3.9

Table A2-2: Residential new connections

	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
Low	5,027	2,678	1,921	1,683	1,483	1,283	1,083	883	833	833
Best Estimate	5,247	3,188	2,317	2,017	1,817	1,617	1,417	1,367	1,367	1,367
High	5,796	4,421	3,792	3,667	3,667	3,667	3,667	3,667	3,667	3,667

Table A2-3: Residential new disconnections

	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
Low	1,792	1,792	2,592	8,049	17,597	29,864	33,084	33,084	33,084	33,084
Best Estimate	1,567	1,567	2,167	6,260	13,421	22,621	25,036	25,036	25,036	25,036
High	1,108	1,108	1,300	2,452	4,612	7,372	8,093	8,093	8,093	8,093

Forecast

The demand forecasts are summarised in Tables A2-4 to A2-12. Table A2-13 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 A2-4, A2-5 & A2-6: Peak-day gas demand under severe 1-in-50 weather conditions, i.e. weather so severe that it is statistically likely to occur once every 50 years;
- Tables A2-7, A2-8 & A2-9: Peak-day gas demand under 'average year' weather conditions, i.e. the weather conditions that typically occur each year; and
- Tables A2-10, A2-11 & A2-12: 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[83]. The IOM peak-day is based on information provided by the Manx Electricity Authority (MEA).

82 The timing of the modelling Data Freeze has the result that the ten-year forecast is based on forecasted 2022/23 demand, given that the gas year extends from October to September each year. Hence, forecasted 2022/23 data is included in tables A2-1 through to A2-14.

83 NIGCS 23.24 Report (gmo-ni.com)

Appendices
(continued)

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 the peat, coal and oil-fired power stations. If there is a forced outage of one or more of the non-gas fired thermal power stations, then the peak-day gas demand of the sector may be higher than indicated in the above forecasts.

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

GWh/d	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
Power	128.1	136.0	128.7	189.1	175.8	114.2	111.3	140.9	98.9	99.0
IC	73.3	74.2	85.2	74.5	70.1	87.5	85.8	69.4	82.0	79.8
Residential	63.3	63.2	62.9	47.5	35.1	58.3	55.6	36.6	50.1	47.4
Transport	0.1	0.1	0.2	0.3	0.6	0.7	0.8	0.9	0.9	1.0
Own Use	3.1	3.2	3.2	2.5	2.1	3.2	3.1	2.2	2.8	2.7
Sub total	**267.8**	**276.6**	**280.1**	**313.9**	**283.6**	**263.9**	**256.6**	**249.9**	**234.9**	**229.9**
IOM	6.9	6.9	6.9	6.9	6.7	6.7	5.6	5.5	2.0	2.0
NI	105.06	128.87	119.22	150.17	151.37	155.24	157.22	159.98	156.89	157.77
Total	**379.7**	**412.4**	**406.2**	**470.9**	**441.8**	**425.9**	**419.5**	**415.4**	**393.7**	**389.6**

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

GWh/d	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
Power	130.2	138.1	143.6	215.1	192.4	192.3	183.5	189.1	169.1	195.8
IC	73.3	75.1	88.1	78.9	76.7	76.2	80.7	85.0	93.3	89.6
Residential	63.2	63.2	63.0	47.8	42.0	34.4	35.9	38.4	38.2	29.7
Transport	0.1	0.1	0.2	0.3	0.6	0.7	0.8	0.9	0.9	1.0
Own Use	3.1	3.7	3.8	3.2	2.9	2.7	2.8	2.9	2.9	2.7
Sub total	**270.0**	**280.2**	**298.8**	**345.3**	**314.6**	**306.4**	**303.8**	**316.3**	**304.4**	**318.7**
IOM	6.9	6.9	6.9	6.9	6.7	6.7	5.6	5.5	2.0	2.0
NI	105.1	128.9	119.2	150.2	151.4	155.2	157.2	160.0	156.9	157.8
Total	**381.9**	**416.0**	**424.9**	**502.4**	**472.7**	**468.3**	**466.6**	**481.8**	**463.3**	**478.5**

Table A2-6: 1-in-50 Peak day demand – high demand scenario

GWh/d	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
Power	130.1	153.3	168.3	205.4	176.1	224.4	189.2	191.5	205.0	218.7
IC	67.7	69.6	83.3	90.9	103.2	87.7	116.1	122.6	129.2	135.5
Residential	68.9	69.0	68.9	68.8	68.5	36.9	67.3	66.7	66.0	65.4
Transport	0.1	0.2	0.2	0.6	1.2	1.7	2.1	2.4	2.8	3.1
Own Use	3.1	3.2	3.3	3.5	3.5	2.3	3.5	3.5	3.5	3.5
Sub total	**269.8**	**295.2**	**324.1**	**369.1**	**352.4**	**353.0**	**378.3**	**386.8**	**406.4**	**426.1**
IOM	6.9	6.9	6.9	6.9	6.7	6.7	5.6	5.5	2.0	2.0
NI	105.1	128.9	119.2	150.2	151.4	155.2	157.2	160.0	156.9	157.8
Total	**381.8**	**430.9**	**450.2**	**526.2**	**510.5**	**515.0**	**541.2**	**552.3**	**565.3**	**585.9**

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

GWh/d	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
Power	133.5	141.9	133.4	153.9	149.3	116.4	108.1	102.7	104.5	108.3
IC	55.3	55.8	69.6	72.2	68.3	71.2	74.1	73.0	68.5	67.9
Residential	43.8	41.9	45.0	42.3	37.3	40.4	40.2	38.2	34.1	30.0
Transport	0.1	0.1	0.2	0.3	0.6	0.7	0.8	0.9	0.9	1.0
Own Use	2.0	2.1	2.3	2.3	2.1	2.2	2.3	2.2	2.0	1.9
Sub total	**234.7**	**241.7**	**250.4**	**271.0**	**257.5**	**230.9**	**225.5**	**217.0**	**210.0**	**209.1**
IOM	7.0	7.0	6.4	5.7	5.7	5.6	4.1	4.1	1.2	1.2
NI	80.0	113.2	101.0	138.3	130.9	144.1	145.9	148.7	142.0	137.2
Total	**321.7**	**361.9**	**357.8**	**415.1**	**394.0**	**380.6**	**375.6**	**369.8**	**353.2**	**347.5**

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

GWh/d	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
Power	134.5	135.6	153.7	181.1	173.7	148.9	139.5	146.0	152.4	152.2
IC	55.3	61.0	72.1	75.9	76.7	81.5	88.2	85.5	91.4	93.2
Residential	43.9	46.3	45.1	42.6	42.0	40.1	41.6	38.4	35.8	39.2
Transport	0.1	0.1	0.2	0.3	0.6	0.7	0.8	0.9	0.9	1.0
Own Use	2.0	2.3	2.3	2.3	2.3	2.2	2.4	2.3	2.2	2.3
Sub total	**235.7**	**245.3**	**273.4**	**302.3**	**295.3**	**273.5**	**272.5**	**273.1**	**282.7**	**287.8**
IOM	7.0	7.0	6.4	5.7	5.7	5.6	4.1	4.1	1.2	1.2
NI	80.0	113.2	101.0	138.3	130.9	144.1	145.9	148.7	142.0	137.2
Total	**322.7**	**365.5**	**380.8**	**446.3**	**431.9**	**423.2**	**422.6**	**425.9**	**425.9**	**426.2**

Appendices
(continued)

Table A2-9: Average year peak day demand – high demand scenario

GWh/d	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
Power	135.1	154.0	173.5	196.2	201.7	181.4	178.0	177.9	194.3	212.6
IC	54.7	53.2	70.2	76.2	77.9	94.1	102.4	109.5	116.2	116.5
Residential	43.1	39.0	39.5	42.3	42.3	42.4	42.1	41.7	40.0	40.2
Transport	0.1	0.2	0.2	0.6	1.2	1.7	2.1	2.4	2.8	3.1
Own Use	2.0	2.0	2.2	2.4	2.5	2.6	2.6	2.7	2.7	2.8
Sub total	**235**	**248**	**286**	**318**	**326**	**322**	**327**	**334**	**356**	**375**
IOM	7.0	7.0	6.4	5.7	5.7	5.6	4.1	4.1	1.2	1.2
NI	80.0	113.2	101.0	138.3	130.9	144.1	145.9	148.7	142.0	137.2
Total	**322.0**	**368.6**	**393.0**	**461.8**	**462.1**	**472.0**	**477.3**	**487.1**	**499.1**	**513.6**

Table A2-10: Annual demand – low demand scenario

TWh/yr	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
Power	34.5	34.2	31.7	31.2	25.9	23.7	23.8	18.4	15.0	15.1
IC	16.3	16.5	17.0	17.6	17.8	17.8	17.7	17.6	17.5	17.2
Residential	7.6	7.6	7.5	7.4	7.3	7.0	6.6	6.3	6.0	5.7
Transport	0.0	0.0	0.1	0.1	0.2	0.3	0.3	0.3	0.3	0.4
Own Use	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.4
Sub total	**58.8**	**58.7**	**56.8**	**56.9**	**51.7**	**49.3**	**49.0**	**43.1**	**39.3**	**38.8**
IOM	1.5	1.5	1.4	1.2	1.2	1.2	0.9	0.9	0.3	0.2
NI	16.6	20.1	20.0	26.4	25.0	26.9	25.6	23.2	21.5	20.9
Total	**76.8**	**80.3**	**78.1**	**84.5**	**77.8**	**77.4**	**75.5**	**67.2**	**61.1**	**59.9**

Table A2-11: Annual demand – best estimate demand scenario

TWh/yr	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
Power	34.9	35.9	34.4	35.9	31.3	28.2	28.0	22.5	19.5	18.5
IC	16.3	16.7	17.5	18.5	19.1	19.7	20.0	20.3	20.7	20.9
Residential	7.6	7.6	7.5	7.5	7.3	7.2	6.9	6.6	6.4	6.2
Transport	0.0	0.0	0.1	0.1	0.2	0.3	0.3	0.3	0.3	0.4
Own Use	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Sub total	**59.2**	**60.6**	**60.1**	**62.5**	**58.5**	**55.8**	**55.7**	**50.3**	**47.5**	**46.5**
IOM	1.5	1.5	1.4	1.2	1.2	1.2	0.9	0.9	0.3	0.2
NI	16.6	20.1	20.0	26.4	25.0	26.9	25.6	23.2	21.5	20.9
Total	**77.3**	**82.2**	**81.4**	**90.1**	**84.7**	**84.0**	**82.2**	**74.4**	**69.3**	**67.6**

Table A2-12: Annual demand – high demand scenario

TWh/yr	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
Power	35.6	37.5	38.3	42.3	38.1	35.1	34.7	28.6	27.6	27.2
IC	16.3	16.7	17.6	18.7	19.6	20.3	20.8	21.3	21.9	22.3
Residential	7.6	7.6	7.6	7.6	7.5	7.5	7.4	7.3	7.3	7.2
Transport	0.0	0.1	0.1	0.2	0.4	0.6	0.8	0.9	1.0	1.1
Own Use	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Sub total	**59.9**	**62.3**	**64.1**	**69.4**	**66.2**	**64.1**	**64.3**	**58.7**	**58.5**	**58.5**
IOM	1.5	1.5	1.4	1.2	1.2	1.2	0.9	0.9	0.3	0.2
NI	16.6	20.1	20.0	26.4	25.0	26.9	25.6	23.2	21.5	20.9
Total	**78.0**	**83.9**	**85.4**	**97.0**	**92.4**	**92.2**	**90.8**	**82.8**	**80.3**	**79.6**

Table A2-13: 1-in-50 Peak Day Demand – Sensitivity 1

GWh/d	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
Power	136.9	152.4	192.6	225.2	220.0	215.4	211.0	211.1	210.4	226.8
IC	73.3	75.1	72.3	78.9	75.4	76.2	80.7	85.0	83.8	89.6
Residential	63.2	63.2	39.3	47.8	35.5	34.4	35.9	38.4	30.9	29.7
Transport	0.1	0.1	0.2	0.3	0.6	0.7	0.8	0.9	0.9	1.0
Own Use	3.1	3.2	2.3	2.6	2.2	2.2	2.3	2.4	2.2	2.2
Sub total	**276.6**	**294.0**	**306.6**	**354.8**	**333.7**	**329.0**	**330.7**	**337.9**	**328.1**	**349.2**
IOM	6.9	6.9	6.9	6.9	6.7	6.7	5.6	5.5	2.0	2.0
NI	105.1	128.9	119.2	150.2	151.4	155.2	157.2	160.0	156.9	157.8
Total	**388.5**	**429.7**	**432.7**	**511.8**	**491.8**	**491.0**	**493.6**	**503.4**	**487.0**	**509.0**

Table A2-14: Maximum Daily Supply Volumes[84]

GWh/d	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
Corrib	40.6	34.0	30.3	26.6	23.3	20.0	18.2	15.9	15.6	12.3
Moffat	386.9	386.9	386.9	386.9	386.9	386.9	386.9	386.9	386.9	386.9

84 Figures shown for Moffat are the current maximum daily supply volumes. Gas Networks Ireland is progressing and proposing a series of short-, medium- and long-term measures to increase the maximum daily supply volumes available from Moffat. These measures will provide incremental increases in capacity at both Compressor stations. Detailed engineering studies are ongoing to determine the potential increase to Moffat supply volumes over the time period presented.

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 GFS.

Network analysis was carried out using hydraulic network modelling software, Pipeline Studio®. A single hydraulic model of the interconnector and ROI transmission systems[85] 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 2031/32;

- 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 – 12m/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[86]	Up to 85.0
Gross Calorific Value (MJ/scm)	39.8[87]	37.7
Max Supply (mscm/day)	35	4.7

As per the existing Pressure Maintenance Agreement (PMA), National Grid is required to provide gas at a minimum pressure of 42.5barg at Moffat for flows up to 26mscm/d. They have also advised a higher Anticipated Normal Off-take Pressure (ANOP) pressure for Moffat of 47barg (i.e. the expected pressure under normal circumstances).

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

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 & Storage
CCUS	Carbon Capture Utilisation& Storage
CEF	Connecting Europe Facility
CGI	Central Gas Injection
CHP	Combined heat and power
CNG	Compressed Natural Gas
CO2	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 & 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
GFS	Gas Forecast Statement
GHG	Greenhouse Gas
GNI	Gas Networks Ireland
GRAZE	Green Renewable Agricultural & 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
GWhe/yr	Gigawatt hours of electric energy per year
HGV	Heavy Goods Vehicle
HUGE	Hydrogen Utilisation Green Energy
I-SEM	Integrated Single Electricity Market Project
I/C	Industrial & Commercial
IC	Interconnector
ICT	Information & 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 & Climate Plan
NEEAP	National Energy Efficiency Action Plan
NGV	Natural Gas Vehicle
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

Gas Networks Ireland

The main contact details for Gas Networks Ireland are:

General enquiries
1800 464 464

Lines open Monday to Friday 8am – 8pm and Saturday 9am – 5.30pm

24 Hour emergency service
1800 20 50 50

networksinfo@gasnetworks.ie

@GasNetIRL
gasnetworks.ie