

Natural Gas Delivering a low carbon future



Introduction

Since the introduction of natural gas into Northern Ireland (NI) over 20 years ago the industry has been recognised as one of the most successful greenfield infrastructure projects of its generation introducing fuel choice as well as consumer competition, adding value to the environmental, social and economic prosperity of NI.

During this time the industry has demonstrated its ability to deliver to a consistently high quality and level of output to include the development of an effective and competitive wider industry and supply chain providing for gas consumer's needs. Furthermore the industry has a proven track record when it comes to delivery on regulated and governmental targets by creating a strong consumer brand and responding to marketplace demands.

The gas industry has been a key enabler for the reduction in carbon emissions in NI over the last 20 years, however the worldwide challenges associated with climate change will demand further action to move to a low carbon economy in the future.

Critically, NI must have a focused plan and direction supported by relevant policies, incentive support and a regulated framework that allows the industry, investors and marketplace to collaboratively deliver on challenging targets.

The natural gas industry is ready and equipped to be front and centre of this energy transition.

This paper, divided into three sections, covers the significant contribution the NI Natural Gas Industry has made to a carbon reduction to date and how increased utilisation of natural gas can support a lower carbon future.

Executive Summary

In this paper we will provide an insight into the significant contribution the natural gas industry has and will continue to make in providing solutions for a low carbon future in NI.

Outlined below are some of the most pertinent points from the paper which are further detailed within:

- NI benefits from one of the most modern and efficient gas networks in the world and by the end of 2022 will be distributing gas to around 320,000 homes and businesses
 - The gas infrastructure is equipped and uniquely sized to be able to support the long-term low carbon needs of NI
 - No other utility infrastructure can provide affordable, practical solutions to a low carbon economy without the need for significant investment in network upgrade, disruption to existing homes and businesses and considerable behavioural changes to energy users heating needs
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- In the absence of government policy or legislation, NI energy users have embraced natural gas due to its wider environmental, economic and lifestyle benefits
 - The gas industry recognises that consumers must be at the heart of the energy transition and that cost effective and less disruptive technologies will be favoured by energy consumers
 - The gas industry recognises the importance of energy efficiency in delivering a low carbon economy and the importance of continuing to educate consumers on the role both technological innovation and behavioural changes can have on reducing energy usage
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- To date 12 million tonnes of CO₂ have been removed from the atmosphere as a result of NI energy user's conversion to natural gas (1996 – 2018)
 - In 2018 NI natural gas users saved 1.1m tonnes of CO₂ – the equivalent of 747,294 cars being removed from NI roads
 - By 2022 (based on forecast growth in gas connections) NI gas users will save 1.3m tonnes of CO₂ annually
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- The natural gas infrastructure will play a key role in the delivery of a low carbon future through further connections to the gas network and future gas utilisation opportunities
 - Future utilisation opportunities will include the injection of biomethane into the existing gas network, Compressed Natural Gas to help reduce NI transport greenhouse gases and the introduction of hydrogen into the gas network
 - Local Energy Policy and regulatory frameworks must act as enablers for the required investment that facilitates the acceleration of low carbon solutions

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Greenhouse Gases

A worldwide challenge

What are greenhouse gases?

The earth is surrounded by a layer of gases that act like the walls of a greenhouse – they allow sunlight to pass through but stop much of its heat from leaving. These greenhouse gases are a good thing, without them the planet would be very cold, but as a consequence of how we are living our lives there are too many greenhouse gases in the atmosphere. As a result, we are seeing changes in our climate which if continued could cause significant harm to our environment and our future.

The main greenhouse gases are water vapour, carbon dioxide, methane, ozone, nitrous oxide and chlorofluorocarbons. Carbon dioxide is the most significant greenhouse gas affected by human activity which is why there is a focus on how to reduce the amount of it being released into the atmosphere.

Current Trends

Figure 1.1 illustrates the 1990–2017 trends in total greenhouse gas emissions of the five largest emitting countries and the European Union, who collectively have a 63% share in global emissions. Most of these five countries and the EU showed a real increase in greenhouse gas emissions in 2017, except in the United States, where emissions remained constant.

Within the European Union, the United Kingdom, Germany and the Netherlands showed decreasing emissions whereas the largest increases in 2017 were seen in Spain and France. Together the five largest emitting countries and the European Union account for 51% of the world population, 65% of global gross domestic product (GDP), accounted for 68% of total global CO₂ emissions and about 63% of total global greenhouse gas emissions.

Global greenhouse gas emissions, per country and region

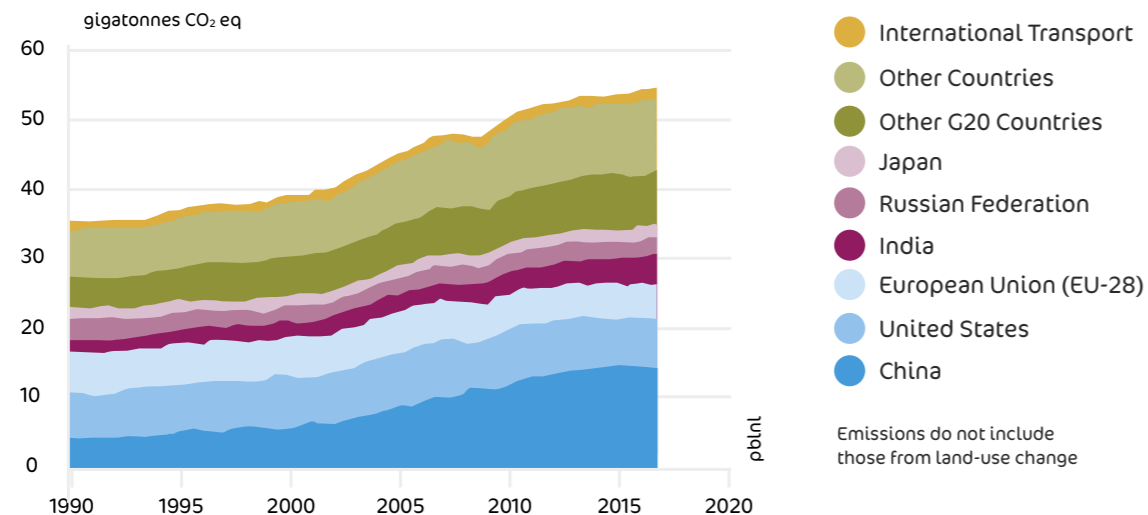


Figure 1.1 Source: EDGAR v5.0 (CO₂: IEA and others), v4.3.2 (CH₄, N₂O) FT2017 (EC-JRC/PBL, 2018).

UK Greenhouse Gas Statistics

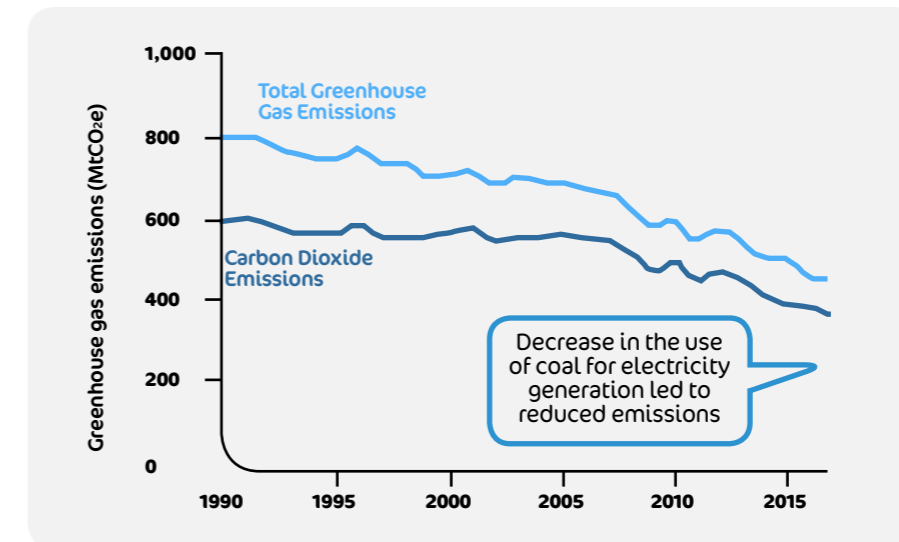


Figure 1.2 Source: Department for Business, Energy & Industrial Strategy

Latest figures estimate UK emissions reduced by 43.5% between the base year (1990) and 2018, a further 2.5% reduction from 2017 figures.

UK Emissions Activity

2018 UK Greenhouse Gas Emissions are provisionally estimated to be lower than 2017.

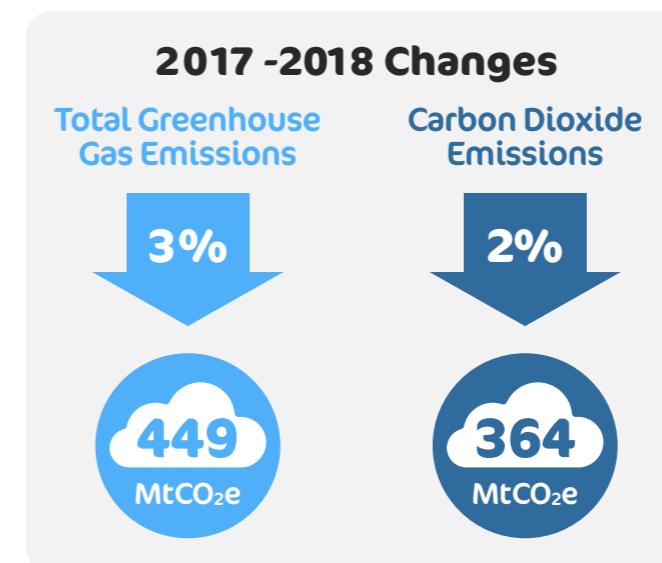
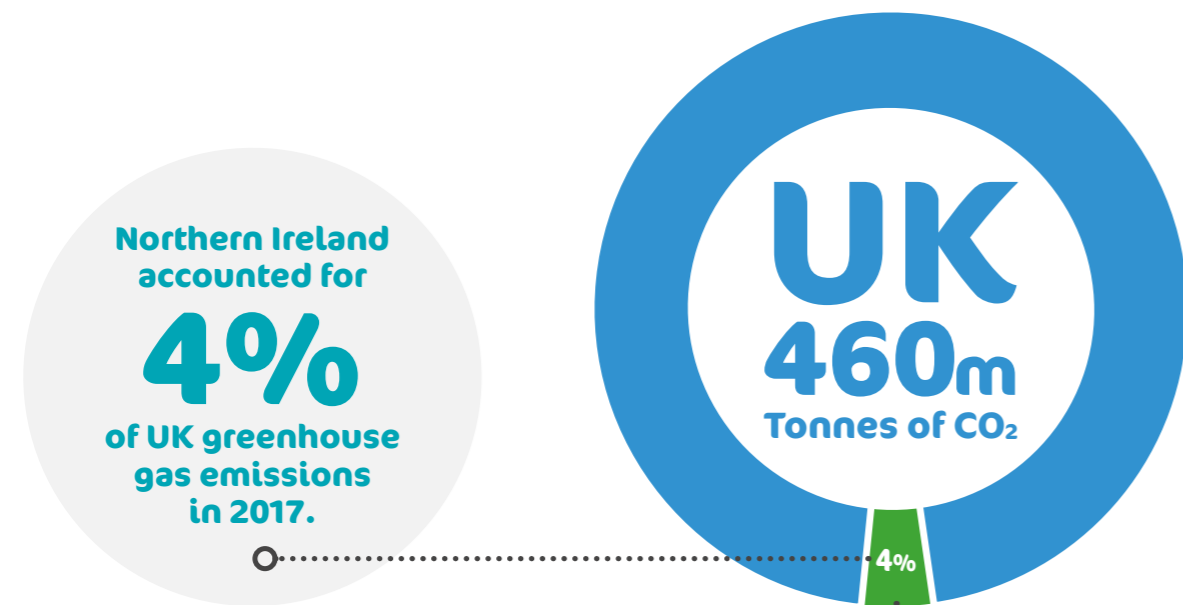


Figure 1.3 Source: Department for Business, Energy & Industrial Strategy

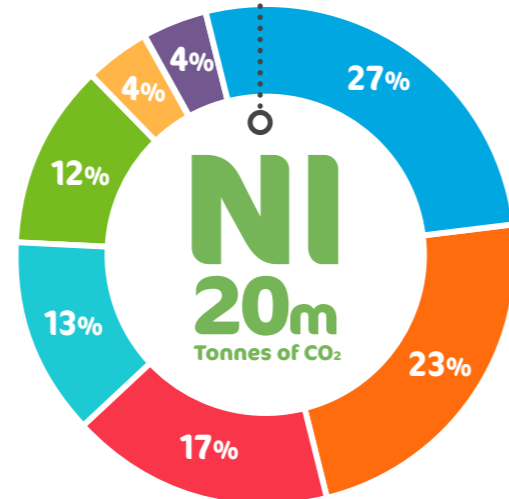
NI Greenhouse Gas Emissions

Based on the latest data available (2017), NI's greenhouse gas emissions were estimated to be 20 million tonnes of carbon dioxide equivalent. This was a decrease of 3% compared to 2016.



Greenhouse Gas Emissions by Sector NI 2017

- **Agriculture** - Includes emissions from livestock, agricultural soils, stationary combustion and off-road machinery.
- **Transport** - Road transport is the most significant source. Also includes domestic & shipping aviation.
- **Energy Supply** - Predominantly from power stations but also oil refineries and other fuel production.
- **Residential** - Includes fuel combustion for heating and cooking.
- **Business** - Includes stationary combustion in the industrial and commercial sectors, refrigeration and air conditioning.
- **Waste Management** - Includes waste disposal at landfills, waste water treatment and waste incineration.
- **Other**



The largest decreases, in terms of tonnes of carbon dioxide equivalent, were in the energy supply, waste management and residential sectors.

These were driven by improvements in energy efficiency, fuel switching to natural gas and the introduction of methane capture and oxidation systems in landfill management.

NI Energy Policy Position

The challenge

The trends and challenges in terms of greenhouse gas reductions are complex and vary across different parts of the world and indeed different parts of the UK.

Importantly, NI has devolved control of the power and energy sector, where effective policy is crucial to deliver long term carbon reductions. The challenges with greenhouse gases extend across a number of key sectors in NI that impact upon business, community and social policies.

Therefore, the Energy Policy that the Department for the Economy are currently drafting, which is due for consultation in 2020 must grasp the opportunity to tailor an energy policy that supports the role natural gas can play in the delivery of a low carbon future.

The energy policy needs to challenge the traditional role of economic regulators and be an enabler for the delivery of a sustainable, affordable, low carbon future, shaped for the specific needs of NI.

To effectively influence continued decreases in greenhouse gases, a multi-stranded, cross government departmental range of solutions, technological advances, behavioural changes and policy changes will need to be implemented and adopted across the largest polluting sectors.



Development of the Natural Gas Industry

It is important in the first instance to understand the scale of the NI natural gas industry and the significant savings it has already delivered in the reduction of carbon emissions as well as the opportunities that remain for energy users to switch to natural gas in the short to medium term.

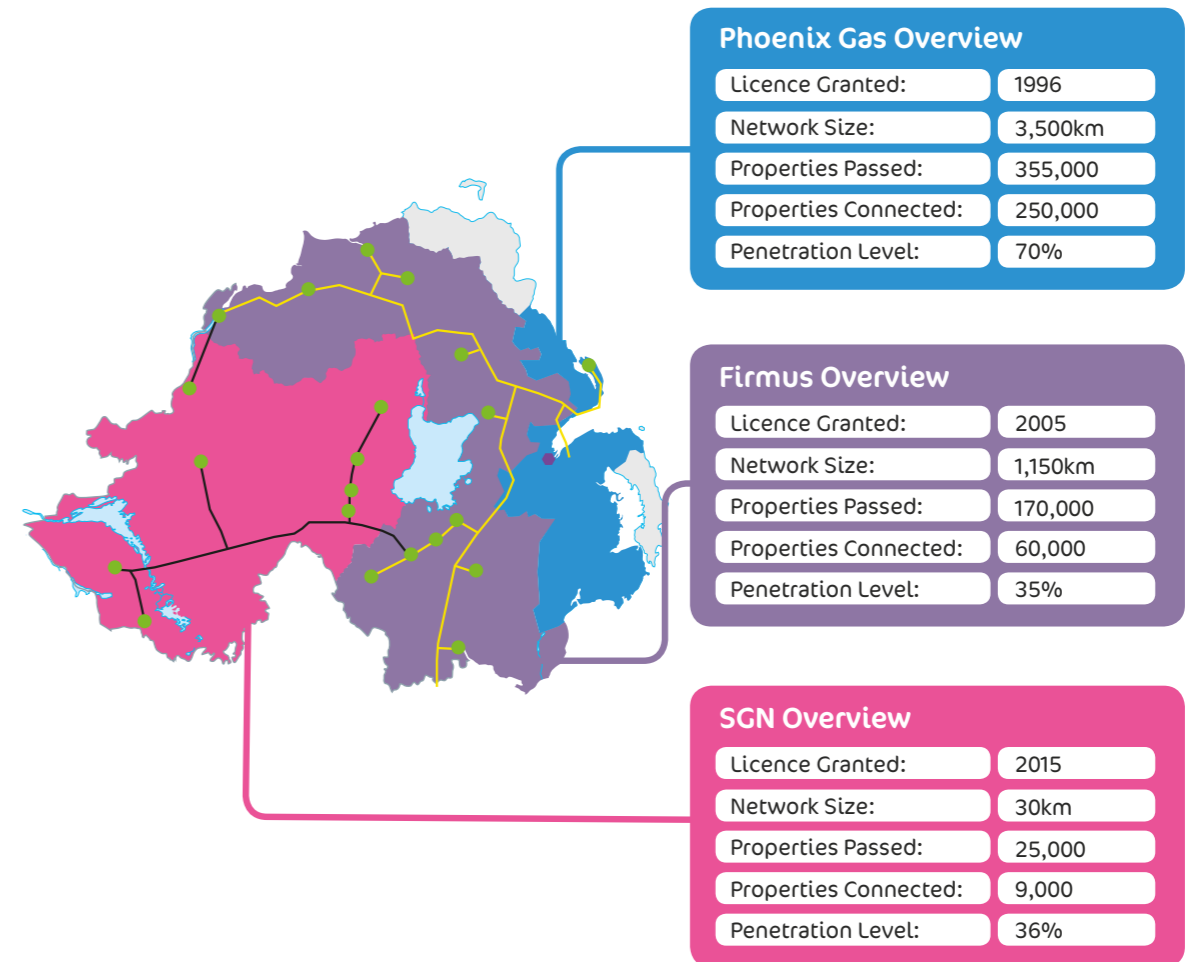
Natural gas was first introduced locally via the Scotland to Northern Ireland gas pipeline in 1996. It was introduced first by Phoenix to the greater Belfast area with further licences granted to Firmus (2005) and SGN (2015).

The industry was built on private sector investment, without a programme of financial support from Government. With the network being rolled out progressively over a 20 year period some areas are only getting access to the network for the first time during the current price control (2017 - 2022).

The investment in natural gas infrastructure to new areas and towns continues across the three distribution network operators.



Overview of NI Natural Gas availability (by end of 2022)*



By the end of 2022 there will be

***231,000**

properties remaining in NI where gas is available but not yet connected.



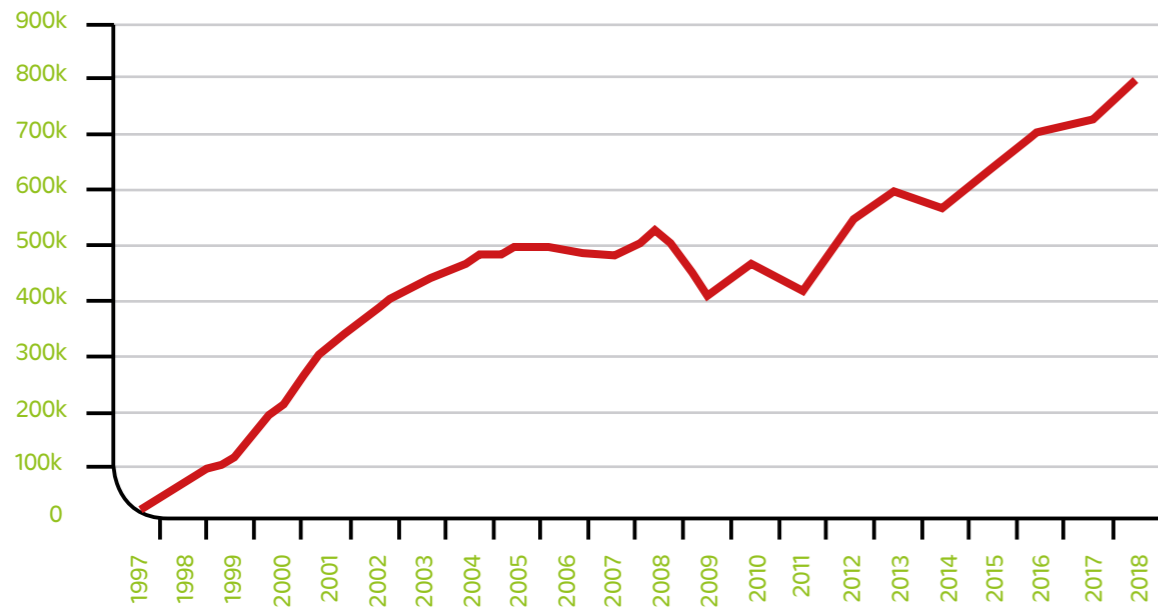
*Source: In line with target connections figures and forecast gas availability for gas distribution network operators within NIAUR 'Price Control for NI Gas Distribution Networks GD17 September 2016 Final Determination. (2017-2022 price control)

Natural Gas

The Greener Option

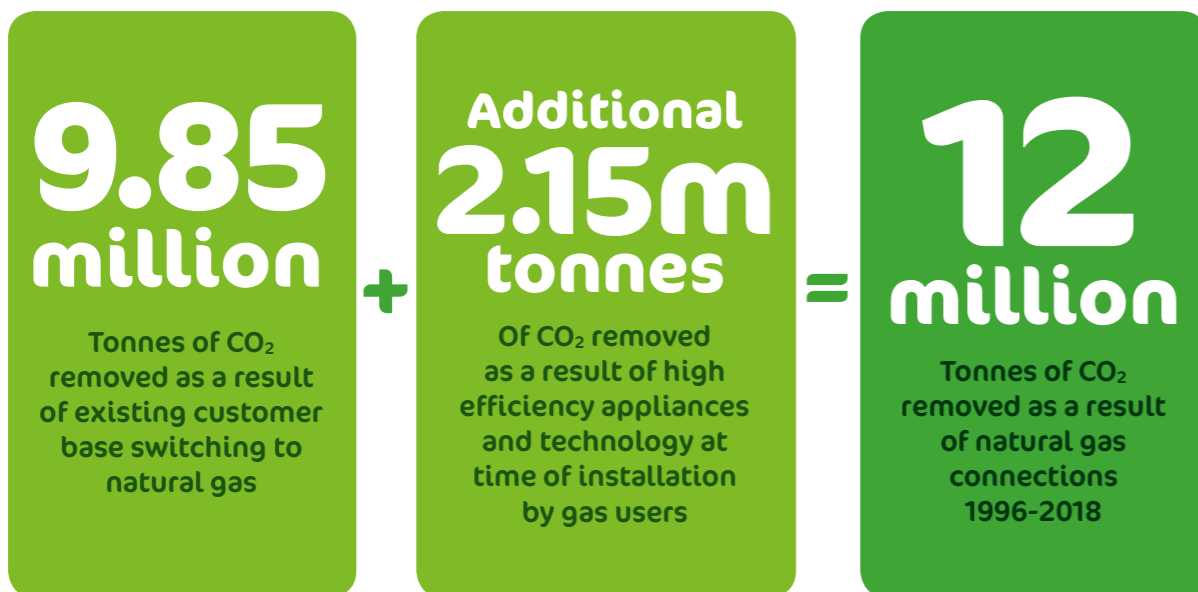
Natural Gas by its nature produces less carbon than any other fossil fuel.

Annual Tonnes of CO₂ removed by Phoenix Natural Gas Customer base*

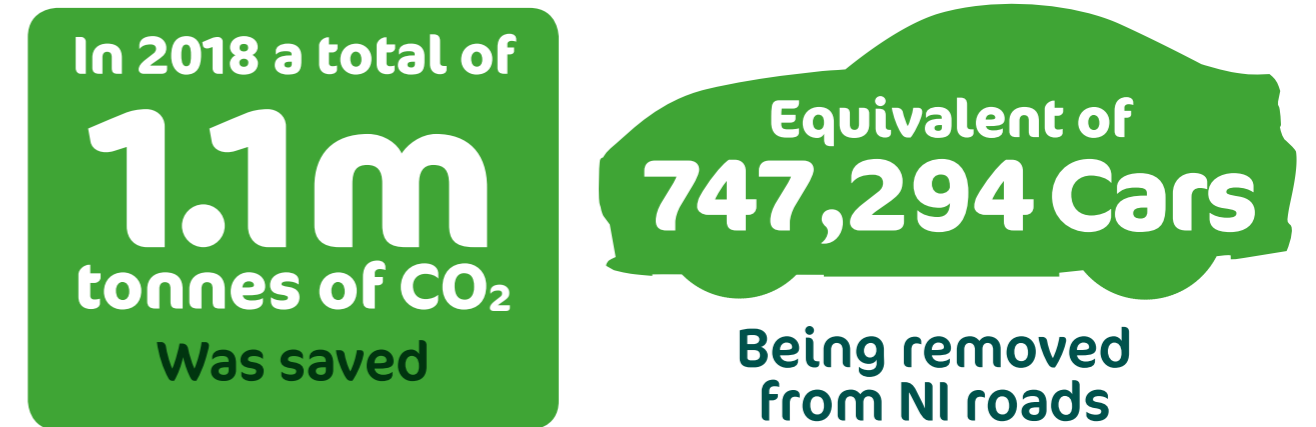


* Source: Phoenix Natural Gas

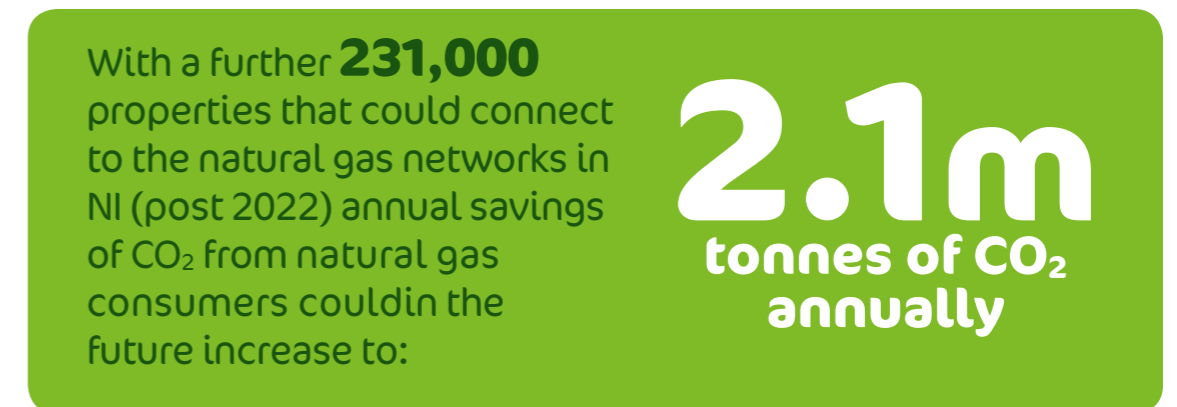
Total CO₂ savings by NI Natural Gas users*



Annual CO₂ savings by NI Natural Gas users*



Looking Ahead*



*All carbon saving figures are based on the carbon savings associated with the installation of natural gas and the displacement of the existing fuel type in line with indicative NI fuel mix each year to include new build gas properties compared to likely alternative.

Efficiency gains applied are assumed based on the installation of a high efficiency gas boiler and associated highly efficient heating controls. An efficiency factor of 17% has been applied that is consistent with minimum efficiency gains and reduced energy use achieved as a result of replacing a SEDBUK E oil boiler (or lower grade efficiency) with a natural gas high efficiency boiler (minimum performance standard of 92% ErP) with upgraded heating controls.

This is further evidenced by the c. 17% lower annual natural gas consumption of NI domestic consumers when compared to GB domestic natural gas users (Source: NIAUR 'Price Control for NI Gas Distribution Network GD17' September 2016 and BEIS 'Sub-National Electricity and Gas Consumption Statistics' December 2018).

Natural Gas

The Fuel of Choice



Since its introduction to NI natural gas is recognised as the fuel of choice in areas of gas availability across domestic, industrial and commercial and new build property types.

Natural Gas users have made this choice based on the broad range of benefits that natural gas offers in terms of meeting modern lifestyle demands and crucially affordability challenges rather than a result of government legislation.

Significant investment has been made by gas network operators to educate consumers and build trust and confidence in natural gas as a product – which is highlighted by the high levels of satisfaction consumers enjoy with natural gas as a product.

Market Drivers for Natural Gas Growth in NI



Efficiency & Controllability

Gas boilers are highly efficient and help reduce energy use and in turn carbon emissions in households.

Systems are installed with highly efficient controls and water treatment which enhances efficiency further and aids controllability thereby creating additional decreases in energy use.



Environmental

The installation of a gas system reduces a households heating carbon footprint by up to 42%*.

A household switching to natural gas on average reduces its carbon use by the equivalent of taking 1 car off NI roads per annum.



Cost Advantages

Gas is competitively priced versus other fuels. In addition consumers are protected by regulation of the supply prices charged by the main suppliers in each of the licensed areas.

The NI domestic gas prices rank amongst the lowest in the EU. The NI gas price is less than UK, ROI and considerably less than the EU median.



Knowledgeable & Skilled Supply Chain

By law all gas engineers must be on the Gas Safe Register and hold current qualifications to install, service or maintain gas appliances.

The NI Natural Gas Industry is supported by investment from leading product manufacturers both through sales and servicing representatives ensuring NI is embracing the latest high efficient technology.



Lifestyle

The convenience and versatility associated with natural gas makes it an aspiration for householders, including:
Never running out of fuel/ creating space inside and outside the home/
Budgeting via Pay as you Go meters and the ability to have instant and constant hot water for busy households.



Customer Experience

98% of our customers would recommend Phoenix Natural Gas to a friend or family member.

97% of our customers said it was easy to purchase and install Phoenix Natural Gas.

Source: Based on comparative Carbon Emission Factors (kg of CO₂ per kWh) – solid fuel to natural gas. Oil to natural gas equivalent delivers 28% reduction.

The Future of Natural Gas in Northern Ireland

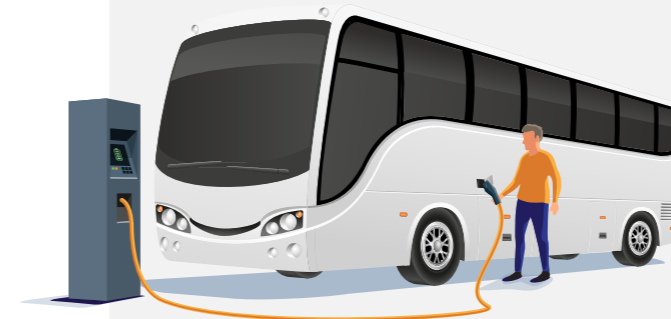
Future Utilisation of Natural Gas

This section of the paper will explore the critical role natural gas can continue to play in both the short to medium term to further support carbon reduction in NI, placing primary focus on:



1

**Residential
Greenhouse Gases**
(2017 figures - 13% of GHG)



2

**Transport
Greenhouse Gases**
(2017 figures - 23% of GHG)

Figure 1.5 Source: Department for Agriculture, Environment and Rural Affairs - NI Greenhouse Gas Emissions 2017

Future Utilisation of Natural Gas Network

The most challenging aspect of future energy policy direction will be the necessity to craft a practical solution to the energy trilemma that supports carbon reduction, security of supply and affordability.

Whilst all three are supportive of wider social, environmental and economic prosperity locally, addressing the needs of each effectively will require an approach to energy that spans across a broad mix of solutions and a collaborative approach from key governmental departments within the NI Executive.

The first section of this document highlighted the fact that NI, unlike other areas of the UK and the Republic of Ireland has significant potential for additional gas connections across the three gas network operators and the associated carbon reductions that conversions to natural gas attract.

The natural gas grid is a secure way of delivering energy to properties. Natural Gas is currently around 70% cheaper than electric equivalent (per kWh) and is convenient to use in meeting needs.

Given the significant gas infrastructure investment across NI it is entirely logical therefore to explore the medium and long-term role that the gas industry can play in a lower carbon society.

Each of the measures below have been given a timescale for delivery



Time Stamp Key

Immediate: 1-2 Years

Short Term: 2-5 Years

Medium Term: 5-10 Years

Long Term: 10+ Years

In this section we will explore:

- 1 Maximising Gas Availability
- 2 Improved Energy Efficiency within Domestic Properties
- 3 Biomethane – ‘Greening’ our gas network
- 4 Decarbonisation of Northern Ireland Transport
- 5 Decarbonisation of Gas Network

Source: Domestic Electricity Prices NI vs Domestic Gas Prices NI (CCNI Price Comparison July 19)

Maximising Gas Availability



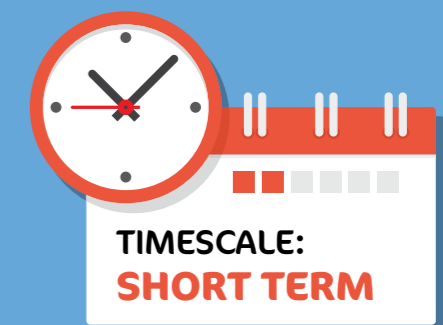
Within the current Utility Regulator price control for NI’s gas distribution networks for 2017 -2022 (GD17), there is significant ongoing investment in the construction of new gas network that will allow natural gas to be available to around 550,000 properties by the end of 2022. Whilst around 319,000 properties will be connected to the gas network, 231,000 will have yet to make the decision to connect.

Extending the natural gas network further and allowing for such extensions in future price control periods would allow new communities to benefit from a more secure, affordable and carbon friendly form of energy.

As well as reducing carbon emissions this would stimulate economic growth, with benefits for employment, inward investment and industry expansion.

It would also support previously off gas grid communities who are in fuel poverty.

The three natural gas network operators are carrying out a study to identify opportunities to extend the respective licenses to c.100,000 new properties and in turn access the viability of this extension activity when measured against the potential carbon savings and compared to alternative carbon saving solutions.



Improved Energy Efficiency within Domestic Homes

Background

Energy efficiency belongs at the heart of any low-carbon economy. By reducing energy use and cutting down on waste, we can reduce energy bills, make our energy system more sustainable, and drive down greenhouse gas emissions.



Technological innovations

The NI natural gas industry has been a key enabler for the introduction of highly efficient technology to gas users. This includes condensing gas boilers, highly efficient controls and pay as you go metering, all of which provide energy users greater efficiency and controllability.

Innovation across this sector continues through increasingly efficient gas heating systems with innovations such as load and weather compensating features which further reduce energy use. Features such as these have led to boiler manufacturers promoting system efficiencies of an impressive 98%.



Energy Efficiency

Wider energy efficiency measures do not necessarily require new technological solutions but instead need policy, education and messaging to highlight the benefit of improving the fabric of existing and new build properties and in turn reducing their overall energy needs and carbon footprint.

Consumer Behaviour

Aligning wider energy reduction targets with householders motivations and behaviours is key to maximising potential in this area. Wider economic and environmental impacts of energy efficiency are not always understood by energy users and therefore there must be investment in both awareness and educational programmes that are persuasive, approachable and challenge existing householder habits.

Northern Ireland Context

Typical areas of heat loss in an NI home

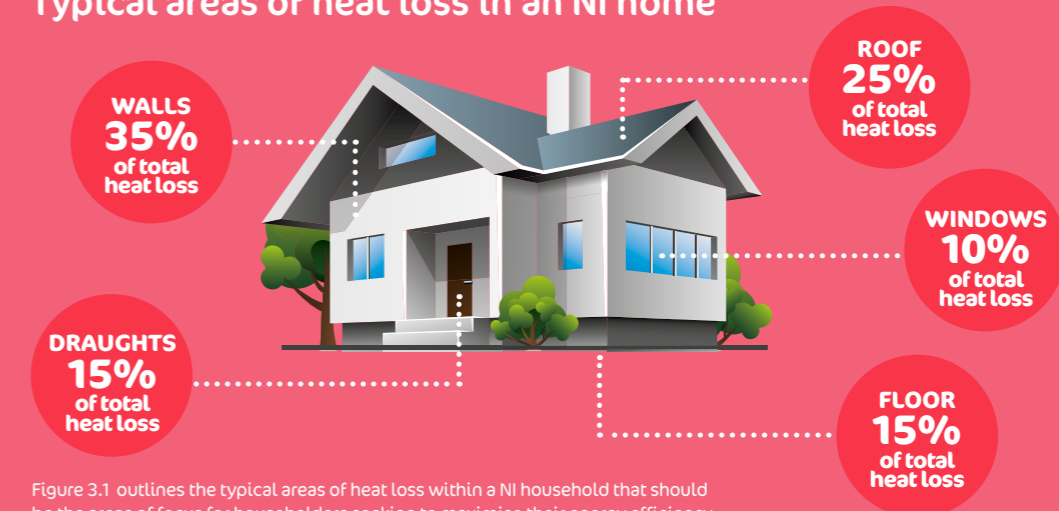


Figure 3.1 outlines the typical areas of heat loss within a NI household that should be the areas of focus for householders seeking to maximise their energy efficiency.

Whilst improvements in the energy efficiency of properties in NI have been made, particularly in homes with highly efficient natural gas heating systems, the opportunity for energy efficiency to play a continued role in reducing carbon emissions is significant. For example:

- The NI Housing Condition Survey reports that there are 50.6% of properties in NI with a Band D (55-68% efficiency) or lower Energy Efficiency Rating.
- *Householders in NI are largely apathetic regarding energy efficiency measures in their homes – 59% confirm that they have not completed an energy efficiency measure in the last 3 years.
- Energy efficiency is recognised by leading fuel poverty representatives as being a key enabler for reduced energy consumption.

*Source: CEPA Impact Utilities - NI Domestic Consumer Insight Tracker 18/19

In Conclusion

Policies to incentivise energy efficiency improvements in homes are largely targeted at low-income households and not proportionate to the high level of need in this area.

NI should consider policy options to deliver an attractive package for able-to-pay householders aligned to trigger points (such as when a home is sold or renovated) to include above the line advice and messaging to encourage a change in consumer behaviours.

Whilst there are a number of schemes to incentivise energy efficiency improvements in low income households, funding is not proportionate to the high level of need and therefore the level of government spend in this area must increase.



Biomethane Greening our Gas Network

What is it?

Biomethane is a green non-fossil source of energy and is produced from biogas derived from organic matter (often from landfill, food waste or agricultural waste) which makes it a renewable source of energy and an important feature of future energy needs.

Biogas can be dried and cleaned to remove impurities and upgraded to pure biomethane. Biomethane has a number of environmental benefits, the main one being that the methane produced by organic matter decomposition would be released into the atmosphere if simply left to decompose naturally (a contributor to the high level of greenhouse gases from the agricultural sector – 27% of NI Greenhouse Gas Emissions 2017).

Advantages of Biomethane injection.

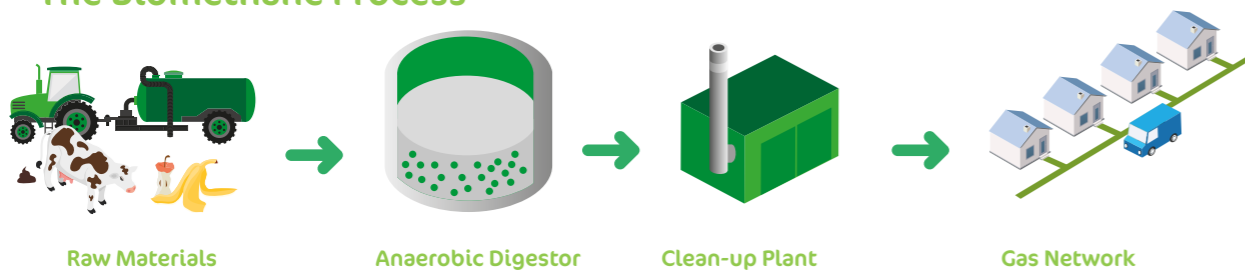
Biomethane is currently being injected into the gas grid infrastructure in GB and the ROI for electricity generation, heat and vehicle fuel. By using biogas as a fuel you are effectively disposing of it in an environmentally neutral manner.

This clean, sustainable fuel can be transported to homes and businesses using the existing gas distribution network, avoiding the costs of widespread infrastructure upgrades.

Biomethane injection does not require consumers to upgrade or change their existing systems. Retaining gas as part of our energy mix, rather than dependence on electricity, will also avoid the need for unsustainable upgrades to electricity distribution networks.

Injecting biomethane into the natural gas grid is more energy efficient than using bio gas to generate electricity. Around 90% of energy is retained through grid injection, but just 65-70% when combusted to generate electricity.

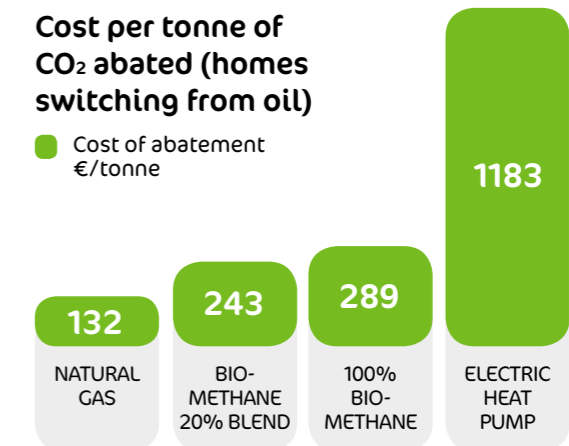
The Biomethane Process



Northern Ireland Context

- Whilst NI has no shortage of biogas producers, none of this product is currently reaching the gas network due to a lack of support mechanisms and the required regulatory framework.
- There are over 80 Anaerobic Digestion (AD) plants in NI generating biogas however, this is inefficient in comparison to Biomethane injection to the natural gas grid.
- Biomethane injection does not require consumers to upgrade or change their existing system and continues to utilise the modern natural gas network

Recent analysis by Ervia* clearly demonstrates that whilst the switch from oil to natural gas is the most efficient way to remove CO₂ from the atmosphere – the introduction of biomethane into the gas network is very competitive when compared to alternative solutions such as electric heat pumps.

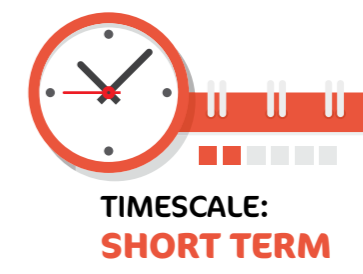


*Analysis carried out by Ervia Feb 2019 — Information from SEAI; Gas Networks Ireland; ESB.

In Conclusion

NI urgently needs a regulatory framework that facilitates the injection of biomethane into the natural gas network. This framework will provide direction and momentum that will enable the existing industry to use their skills and proven track record of delivering an innovative solution that supports lower carbon energy.

Whilst a regulatory framework will allow the practicalities of biomethane injection to take place, energy policy must consider how the opportunity can be maximised to include consideration of a supporting incentivisation scheme for biomethane producers.



Decarbonisation of Northern Ireland Transport

Background

Around 25% of greenhouse gases come from transport with around a quarter of this produced by HGV's and buses, which make up only 1.5% of all road traffic in the UK.

Whilst it is recognised that electrification is considered a practical solution for cars and light vehicles, a solution for HGV's and buses has yet to be established in NI.



What is CNG?

Compressed Natural Gas (CNG) is simply natural gas taken from the gas grid and compressed. The gas is compressed to 300bar and stored in a bank of high pressure vessels, ready to be transferred via fast fill dispensers into vehicles.

CNG is a lower cost, lower emission alternative to petrol and diesel. There are already 12 million CNG vehicles in the world, 1.1 million in the EU.

CNG makes an excellent vehicle fuel for combustion engines due to its high octane rating and low carbon content. These characteristics mean a more complete combustion and results in reduced exhaust emissions. This clean burning characteristic reduces engine stress and extends engine life.

There are a number of other benefits to using CNG as a vehicle fuel, such as:

- Cost effective alternative cutting fuel costs by up to 30%
- 15% reduction in tail-pipe CO₂ emissions for dual-fuel trucks
- Little or no emissions during fueling for dedicated CNG vehicles (this type of emission accounts for 50% of a vehicle's hydrocarbon emissions)
- Significant reductions in NO_x and PM10s compared to petrol / diesel - often exceeding the Euro 5 emissions standard

Source: CNG Service Ltd.

CNG Vehicles in the UK



Today we are seeing specific investment in the natural gas infrastructure in GB & ROI to enable CNG refuelling stations to be constructed and in turn to be used in mobile applications such as buses and heavy goods vehicles.

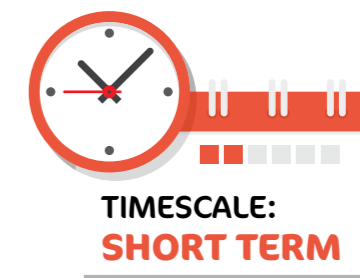
Colourless, odourless and non-corrosive, it can be used in a wide variety of vehicles, including commercial applications, from vans, light, medium and heavy-duty trucks and buses. CNG has the potential to transform the ecological credentials of transport firms across Britain.

The credentials of CNG are recognised across the world and it is increasingly playing a role in reducing carbon emissions in GB. With the cost of running CNG vehicles around 30 per cent cheaper than those powered by other fuels, CNG can be a major component in tackling NI Transport emissions which account for 23% of all NI greenhouse gases.

In Conclusion

The Energy Policy that replaces the Strategic Energy Framework (2010) in NI must recognise the need to tackle transport greenhouse emissions (23% of total greenhouse emissions in NI) and furthermore support the implementation of legislation within the regulatory environment that allows for the development of solutions across both domestic and commercial vehicles.

The CNG solution is based on the use of existing gas infrastructure however will require investment in CNG refuelling stations at strategic points. NI Policy must meet the needs of the transport sector and encourage a regulatory framework that provides the conditions and stimulus for investment in this sector



Decarbonisation of Gas Network

Background

The decarbonisation of natural gas through the long term use of hydrogen is gaining considerable momentum across Europe.

This is largely driven by a new UK Government plan to tackle climate change that has set a target for 'net zero' greenhouse gases by 2050.

Furthermore the challenges both technically and economically of alternative solutions such as the electrification of households has led to a very clear ambition from leaders in this area, to repurpose the existing natural gas infrastructure to accommodate hydrogen.

This is particularly the case in countries which experience large swings in demand for heat, something the gas network has demonstrated a unique ability to meet.



Hydrogen



By 2022 around 70% of homes and businesses in NI will have access to one of the most modern natural gas networks in the world.

A hydrogen solution is considered to be the least disruptive long term option as it does not require significant additional support infrastructure or significant change within energy users systems and behaviours.

How Hydrogen is produced

There are various ways to produce hydrogen – ranging from steam methane reforming combined with carbon capture and storage, to water electrolysis and use of waste streams. Other routes to hydrogen are expected to be commercially developed.

It is expected that no single hydrogen production method will dominate future markets. All production methods could be a part of the future hydrogen energy portfolio; this will provide greater flexibility and resilience to the system than would be the case with any single method.

1. Hydrogen using Electrolysis

In short: Process where water (H₂O) is split into hydrogen and oxygen gas with energy input and heat in the case of high temperature Electrolysis.

In Practice: An electric current splits water into its constituent parts. If renewable energy is used, the gas has a zero-carbon footprint, and is known as green hydrogen.

2. Steam Methane Reforming:

In short: Natural gas contains methane (CH₄) that can be used to produce hydrogen with thermal processes, such as steam-methane reformation and partial oxidation. Steam methane reforming is the most widely used process for the generation of hydrogen. This is largely due to its cost effectiveness in obtaining a high level of purity in its produced hydrogen.

In Practice: Steam Methane Reforming requires carbon capture and storage (CCS) to transport emissions offshore and into depleted oil and gas fields or salt caverns.

Carbon Capture Storage (CCS)



Carbon Capture and Storage (CCS) processes remove carbon dioxide (CO₂) that would otherwise be emitted from the production of Hydrogen using SMR and transport it for permanent underground storage.

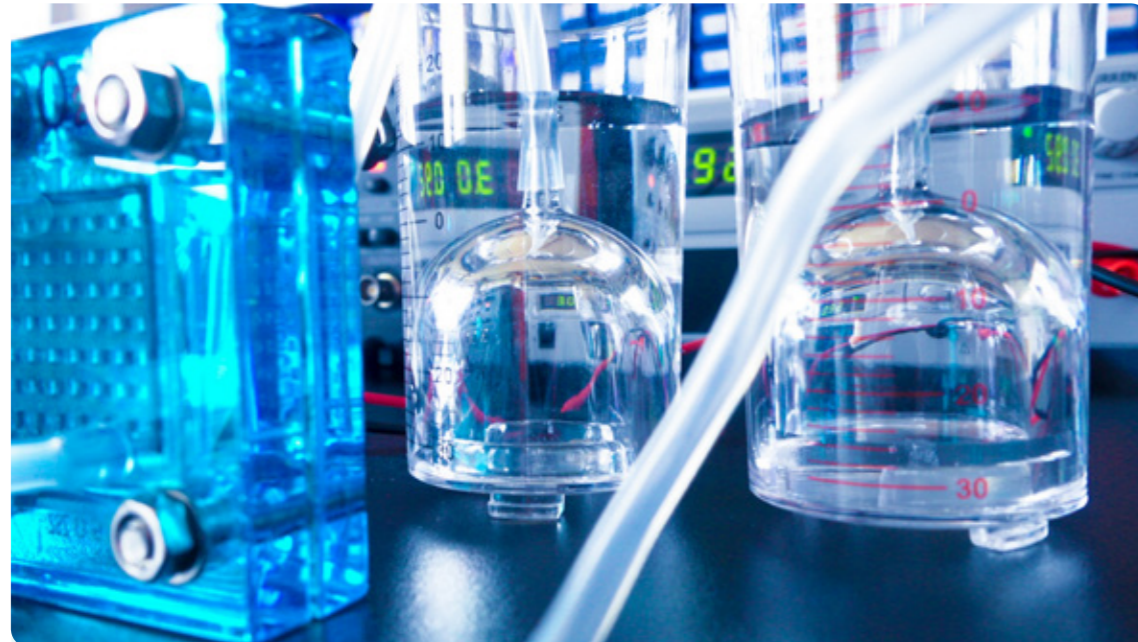
In Great Britain (GB), storage of CO₂ will only take place offshore in saline formations or depleted oil and gas fields.

The CCS process involves three stages:

1. Capture of CO₂ from power stations and other large industrial sources
2. Transporting CO₂ (usually in pipelines) to a storage site
3. Permanent storage of CO₂ in deep geological features

Hydrogen Trial Projects

There are around 20 high profile projects underway in the UK alone to investigate hydrogen being provided to homes and businesses instead of natural gas by repurposing the gas network. The trials cover both hydrogen blending and full hydrogen solutions.



HyDeploy at Keele University

HyDeploy is an energy trial to establish the potential for blending hydrogen, up to 20%, into the normal gas supply to reduce carbon dioxide (CO₂) emissions.

A year-long live trial of blended gas will take place on part of the Keele gas network from Summer 2019. HyDeploy will help to determine the level of hydrogen which could be used by gas consumers safely and with no changes to their behaviour or existing domestic appliances for potential UK wide roll out.



Network Suitability

Using higher blends of hydrogen in the gas network will require plastic pipes. The UK-wide iron ring main replacement programme is now about 70% complete and should be 100% complete by 2032, potentially creating strong alignment for higher hydrogen use in the next decade.

The NI network, a more recent infrastructure project, was laid with the vast majority of network consisting of polyethylene plastic.

The hydrogen trials urged by the Committee on Climate Change are starting to take shape.



One major project which is showcasing the potential of hydrogen is the H21 Leeds City Gate feasibility study. H21 is a Northern Gas Networks (NGN) led project, in partnership with Wales & West Utilities, and part-funded by the Ofgem Network Innovation Allowance.

The basis for the study is to determine whether it is possible to convert our current distribution system in a large city from natural gas to 100% hydrogen.

“We used Leeds as a blueprint for conversion due to its size, energy demand and geographic location, but this blueprint could be adapted for any large UK city,” said Mark Horsley, Chief Executive at NGN.

The advantage of hydrogen over natural gas is that, when it is burned, it produces no carbon dioxide. This means that fewer harmful emissions are released when it is used as a fuel. The final H21 study confirmed that the gas network in Leeds does in fact have the correct capacity for a full conversion to hydrogen, with minimal new energy infrastructure needed compared to alternatives, such as electrification. A 2016 KPMG report, 2050 Energy Scenarios, found that the cost of converting the UK to hydrogen gas could be at least £150 billion cheaper than electrification.

Safety Trials

A significant project within the H21 programme aims to produce quantitative safety-based evidence to confirm, by 2021, that a 100% H2 grid would carry comparable safety risk to current networks supplying natural gas and/or town gas.

The safety research is the focus of the GBP10 million (m) H21 Network Innovation Competition (NIC) initiative involving all UK DSOs and supported by the country’s gas and electricity markets regulator, Ofgem.

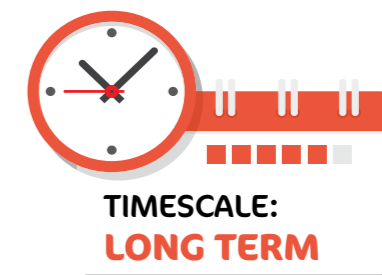


In Conclusion

Wider government policy will be required to trigger the required investment needed to substitute natural gas with hydrogen within our gas network locally and across UK. This decision is likely to be influenced primarily from the extensive trials that are underway across the UK currently.

that will be transporting a low carbon alternative in the long term and offer the most cost effective, least disruptive method for each householder to meet the required targets.

In the short to medium term it is important for existing gas users in NI and those converting to natural gas in the coming years to understand that the infrastructure they are investing in today is likely to be the same infrastructure



**TIMESCALE:
LONG TERM**

Conclusions

The natural gas network in NI has been a key enabler for a lower carbon economy in recent years and as the gas network continues to expand offers continued carbon reduction opportunities by displacing high polluting alternative fuels.

We believe that the gas infrastructure in NI can be carbon neutral by 2050 and in turn has a unique ability to offer a long term affordable decarbonisation solution for NI, providing a platform for the required level of innovation and investment is created.

The £1 billion gas infrastructure in NI is one of the most modern gas networks in the world and can be further utilised to help tackle the challenge of greenhouse gases in sectors such as Transport.

The primary points of conclusion at this important juncture of NI Energy Policy are:

- Natural gas and the natural gas infrastructure will play a key role in the delivery of a low carbon future. The gas network needs to be further expanded across licenced network operators to maximise the opportunity for householders and businesses to connect to the natural gas network.
.....
- NI must continue to focus on reducing energy demand through enhancements in technology, energy efficiency measures and energy users' behaviours in order to further maximise reduction in carbon emissions.
.....
- Injecting biogas into the gas network is a short term practical way to further 'green' the natural gas we use. NI Energy Policy must create the conditions for a regime that encourages gas injection given its efficiency and environmental credentials.
.....
- Compressed Natural Gas (CNG) refuelling stations can be connected to the existing natural gas infrastructure and provide an effective alternative to high polluting petrol and diesel commercial vehicles.
.....
- The hydrogen solution both blended and fully concentrated offers a practical, affordable and secure long terms solution to the decarbonisation of natural gas networks in the UK.



DISCLAIMER
While all due diligence has been taken to prepare this document, we cannot completely guarantee the quality, accuracy and completeness of the information as other external factors may fluctuate any statistics and interpretations may deviate from what has been published. Information in this document was deemed accurate and appropriate to the best of the knowledge of Phoenix Natural Gas as of 18 September 2019

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