

October 2018

# Long Term Development Plan 2018

[cadentgas.com/LTDP](http://cadentgas.com/LTDP)



**Cadent**

Your Gas Network

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# Introduction

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**Cadent own and operate four of the UK's gas networks, covering the East of England (EofE), North London (NL), North West (NW) and the West Midlands (WM). We transport gas safely and reliably to 11 million homes, schools and businesses through a 131,000 kilometre pipe network.**

This document provides you with a view of our plans and investments for the years to come. It describes our assessment of future gas use and the demand on our network under a range of different scenarios.

Your views on our plan and strategic thinking are always welcome, including ideas for improvement, and will be used to shape our activities going forward. Please provide feedback via the form on the Cadent website [cadentgas.com/LTDP](https://cadentgas.com/LTDP).

# Foreword



**Welcome to our 2018 Long Term Development Plan (LTDP), which we produce each October to provide information to help anyone whose activities may require coordination or collaboration with our gas network; anyone that may be considering connecting to our system or working with us to transport gas.**

We are committed to putting our customers and stakeholders at the heart of our business. This means that our long term plans are shaped by our customers and stakeholders. This annual publication is one important opportunity to share our latest long term plan and our strategic thinking, and seek feedback so we can continue to adapt and update our activities going forward. This two-way process is essential to delivering effective and efficient coordination and collaboration across all parties that interact with the gas network.

Over the last 12 months we have significantly stepped up our customer and stakeholder engagement, both with regional events and workshops, and also by building relationships with key organisations across our networks, including Central and Regional government, Local Authorities, Local Enterprise Partnerships, trade organisations, businesses and industry, and academia. We have listened to the concerns, issues and ideas, and are using them to actively shape our business plans to present solutions and services that meet these needs. We will of course be sharing these ideas going forward to ensure they do meet the necessary requirements, and some of these ideas have been included in this report:

- The role of the gas network in decarbonising off gas grid communities currently using high carbon heating sources such as oil or coal
- An approach to ensure gas network upgrades and reinforcements do not become an obstacle to regional economic growth
- Supporting district heating network extensions to multiple occupancy buildings e.g. blocks of flats.
- Supporting the growth in gas fired small scale generation and combined heat and power schemes needed to support electricity network balancing or capacity constraints.

Both Government and public interest in the future direction of the energy industry continues to rise. Energy supply in the future, including both gas and electricity, will need to be:

- **secure** – continuing to operate safely and reliably 365 days a year
- **sustainable** – facilitating decarbonisation of the energy industry
- **affordable** – reducing the number of families living in fuel poverty.

Delivering the future energy needs of our customers efficiently in a low carbon economy is a complex task. We welcome the growing consensus that the gas network must play a central role, alongside the electricity network, in enabling a low emission future. We will continue to work closely with industry and government to clearly show the full capability and flexibility of the gas network, as the energy policies critical to meeting our Nation's emissions targets are being shaped.

We will also maintain our focus on reducing emissions in the shorter term as well, with new sources and uses of renewable gas for heat and transport, and examining how the capability and versatility of the gas network can be used to meet customer demands. We are planning now to meet the needs of the future.

While developing the gas network of the future, we are also continuing to invest to increase the reliability, safety and efficiency of today's network. Our plans to invest approximately £4.5bn in our assets during the RIIO-GD1 price control review period, 2013 to 2021 have not changed. As well as our extensive gas mains replacement programme, this includes investment in network reinforcements and new connections for industrial, commercial and domestic customers.

Efficient and innovative investment will be critical to enable the substantial activity we expect to see in new sources of distributed gas connecting to our network; particularly biomethane. It will be equally necessary to support the increasing levels of connection to our network of new gas fuelled electricity production that is vital to secure the electricity grid; backing up intermittent renewables and alleviating local level grid congestion.

I hope you find our LTDP both interesting and informative. We welcome any views you have on the plan, including ideas for improvement via the feedback form on the Cadent website [cadentgas.com/LTDP](https://cadentgas.com/LTDP).

**Simon Fairman**  
**Director**  
**Safety & Network Strategy**  
**Cadent Gas Limited**

# How we engage with our Customers and Stakeholders

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**Our customer and stakeholders' views, feedback and recommendations are vital to continuously improve the services we provide, and shape the way we develop our network.**

**During 2017/18 year we increased our engagement activities engaging with over 250,000 customers and stakeholders.**

We have benchmarked ourselves against other organisations and we have enhanced our stakeholder strategy and ambition based on the feedback from our stakeholders.

## **Our ambition**

"We will understand and act upon the needs of our stakeholders and customers through a continually improving, tailored approach that gets the best outcome from our engagement.

"Our passion is to work hand-in-hand with our customers and stakeholders to make sure our business plans are fit for present, and future generations."

We use a broad range of engagement methods with our core engagement this year being through regional stakeholder workshops, our annual 'Have your say' consultation and our stakeholder advisory panel.

## **What our regional workshops told us**

We have been out into our regions to hear firsthand what our stakeholders want from us. We discussed our performance, the safeguarding services we provide, the future role of our networks and the next price control.

The insights from these workshops are vital to enable us to deliver change now and to help shape our business plans for the future. There were 23 outputs identified around six key themes:

- Promote who we are and the services we provide
- Deliver safeguarding services for customers in vulnerable situations
- The role our gas networks play in the whole energy system
- Customer outcomes and value for money in the next price control
- Making it easy for customers to connect to our network
- Minimise disruption in our networks



## What our consultation, 'Have your say', told us this year

We received 505 qualitative and 2,832 quantitative insights. There were five clear themes which emerged from the consultation, which we will address:

- deliver a valued service to customers;
- continue to safeguard our customers;
- minimise disruption to customers;
- provide a network for future generations;
- collaborating across the industry.

## Our panel feedback and contribution continues to shape the way we run our business

Our stakeholder advisory panel provides us with expert experience, insight and challenge. We have 22 members on the panel representing seven stakeholder groups, eleven stakeholder sub-groups and contributing expert knowledge in seven key areas: safety, reliability, customer service, innovation, social obligations, environment and regulatory.

Our panel has been involved in workshops, contributing to our enhanced customer and stakeholder engagement strategy and have helped us to develop our engagement plan and approach for the next price control.

## Our future engagement

We are being ambitious and this year we will be conducting our biggest engagement year to date using a broad range of methods. We will be hosting regional customer and stakeholder workshops, targeted customer forums, online surveys and using social media to ensure we have a targeted and tailored approach which is iterative and self improving. We want to find out what customers and stakeholders know about what we do, what is important to them and how we can shape our future business in line with their needs ensuring we are checking out what the impact will be on bills.

Continual feedback from our customers and stakeholders is really helping us to shape our business and make improvements both now and for future generations.

Please do get in touch with us as your views really can make a difference to the communities we serve. Contact [gemma.norton@cadentgas.com](mailto:gemma.norton@cadentgas.com)



# Background

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## **This document outlines our assessment of future demand across Cadent's four gas distribution networks.**

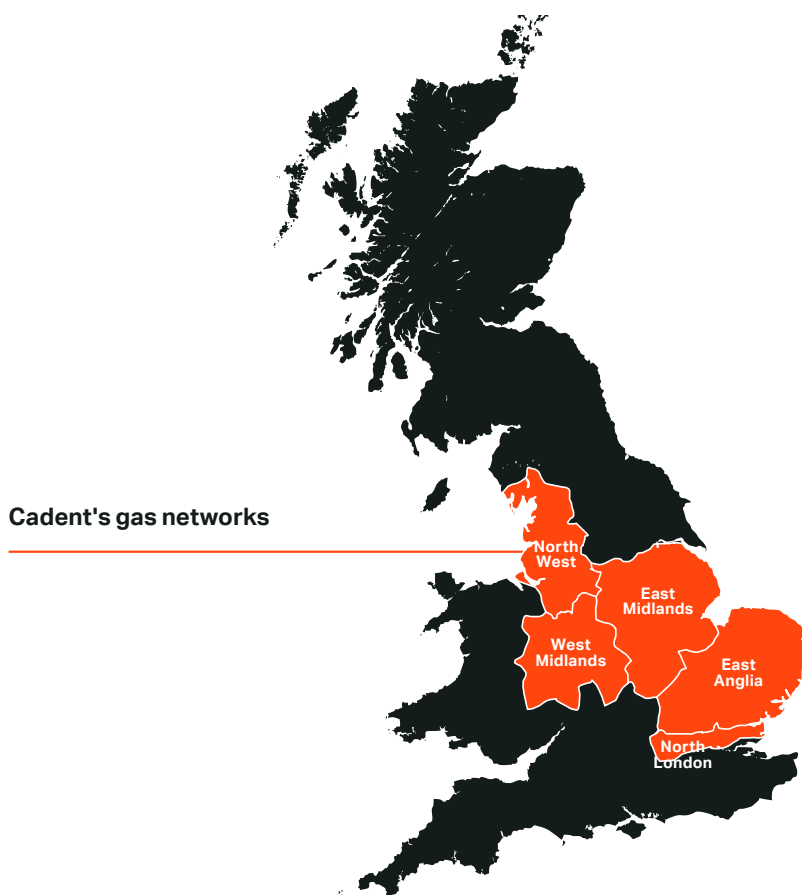
Cadent manage the development, operation and maintenance of the gas distribution networks which in addition to the lower pressure systems, includes extensive high pressure infrastructure operating above 7 barg. The four regional networks are located in the North West of England, the West Midlands, the East of England, and North London. They are comprised of five local distribution zones, one for each regional network, except in the East of England network, which contains two zones: East Midlands and East Anglia.

These networks extend from the offtakes from the National Grid owned National Transmission System (NTS), to the outlet of the customers' control valve, normally before the gas meter.

Most of our supply is from the NTS and as the gas industry develops we expect to see new sources of distributed gas facilitating more greener and sustainable energy supplies into the future.

When deciding how to invest in our networks, we look at supply and demand needs, what's important to our stakeholders and how our customers want to use our system.

This document contains information on our planning processes, including our demand forecasting, our system reinforcement projects and their associated investment as well as actual demands for the previous year (provided in the Appendix A1).





## Demand overview

Our latest peak gas demand forecast shows minimal change over the next ten years. All forecasts are based on annual demands, which are then converted into peak demands. These are established through the analysis of historical behaviour.

With a world that is constantly changing we are continually challenging and reviewing the way we forecast to ensure it remains appropriately robust and accurate.

## Investment implications

Our investment will be approximately £513m per annum, of which £457m is related to the mains replacement programme and £56m is related to other network capital investments, which is the focus of this document. These average annual spends are in 2009/10 prices, and reflect the output commitments made to customers and agreed with our Regulator Ofgem in February 2013.

Even though overall consumption is going down, we must still invest to add exit capacity because of possible local constraints within the networks, to help meet Local Authority strategic development proposals. Other factors may include the dynamic nature of existing loads, as well as industries and customers migrating and changing within our networks.

Our network is designed and operated to meet peak capacity requirements, and whilst action to reduce overall consumption are being seen, such as more efficient boilers, smart controllers, and building insulation; their impact on peak demand is not so clear, and may not be as appreciable.

We may also need to invest to help connect new sources of gas, including renewable gas.

## Your feedback

Our current planning cycle culminates in the publication of the Long Term Development Plan. It has been developed using UK demand scenarios produced by National Grid, supported by feedback from their industrywide consultation process: National Grid's Future Energy Scenarios (FES).

We want this plan to deliver what's important to you so please let us know your views. Our intention is to contact those stakeholders who access this document, but you can also contact us via the website at [cadentgas.com/LTDP](http://cadentgas.com/LTDP).

Our wider stakeholder consultation also provides an opportunity to provide feedback on our activities.

### Feedback

We welcome any views you have on the plan, including areas for improvement via the feedback form on the Cadent website [cadentgas.com/LTDP](http://cadentgas.com/LTDP)

# Gas in our Future Energy System

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## **Before we look at our ten-year forecast for supply and demand, we want to highlight some of our key focus areas and long term network development plans.**

The gas network in the UK is one of the best developed in the world, providing safe, secure, affordable energy to homes and businesses across the UK. It is continuing to grow: every year around 60,000 new customers connect directly to the Gas Distribution Networks including Cadent's, and many more connecting through Independent Gas Transporters. In 2017-18 almost 12,000 of these connections were provided to households at risk of fuel poverty to reduce their energy costs and improve the quality of life. Living in a cold home can have a much wider impacts than just financial, affecting areas such as the physical and mental health of families, educational attainment of children.

The gas networks are at the centre of our energy system. As well as providing 85% of UK households with their primary source of heating, it generates 40% of our power. Gas is inherently storable: it meets sharp increases in heat demand (such as on 1 March 2018), and provides the flexible generation which balances intermittent renewables on the electricity system.

As our energy system evolves to meet the challenge of decarbonisation, the gas networks are responding and developing their vision for the low-carbon future. In the short term, biomethane connections are increasing the volume of 'green gas' in the network. This increase in connections to lower pressure tiers is starting to change the way distribution networks are operated, and may require further changes in future to move gas around the system and allow biomethane producers to inject their gas even during times of low demand. In the summer months when there is negligible heating demand, flows are much lower and the capacity for gas to enter our network is also lower.

The decarbonisation of electricity generation has also had significant impacts, with increasing demand for 'peaking' plants connected to the distribution network; demand for electric vehicle recharging may exacerbate this impact further. New demands such as CHP engines for energy users such as hospitals and district heating schemes are also providing new peak requirements and – in some cases – additional overall demand.

The longer term government policy direction for decarbonisation remains unclear, particularly in areas such as heat and heavy industry. However, for the reasons set out above the medium term demands for gas will remain significant given the role it plays across the energy system, and the continued drive for 'low regrets' steps towards decarbonisation such as ongoing Renewable Heat Incentive funding for new biomethane production plants.

The evidence for the longer term role that gas can play in a decarbonised system is becoming clearer, partly through some of the network innovation projects referenced later in this document. Compared to alternative ways of reducing greenhouse gas emissions, such as the wide scale electrification of heat and transport, evolving our gas supply chain towards a low carbon future is more affordable and secure, and will help deliver our emission goals with less disruption. Investing in the continued development of our gas network also makes a wide economic contribution to the country while its innovations and capacity play a crucial role in the UK's integrated energy system.

Between now and 2032, the Gas Distribution Networks are continuing to invest in the Iron Mains Risk Reduction Programme. This work is mandated by HSE to improve safety, while reducing direct emissions of methane, a potent greenhouse gas. By the end of the programme, the distribution networks will be substantially constituted of polyethylene

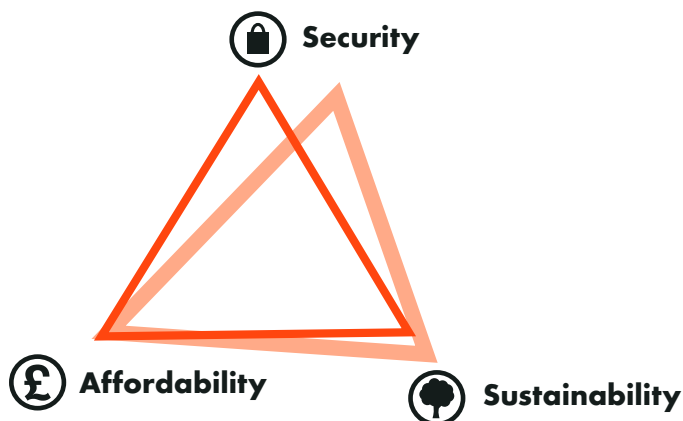
(PE) pipes, which are capable of carrying a wider range of gasses including low-carbon hydrogen. As these pipes also require significantly lower maintenance than existing materials, they will deliver a low cost, low carbon network which can continue to play a central role in our energy system.

## Energy trilemma

The future of energy in the UK and what the whole energy system will look like over the coming decades has continued to gain considerable momentum throughout the industry over the last 12 months. In particular, there is now a much wider appreciation of the challenges of decarbonising the heat and transport sectors at scale.

In order to transition to a low carbon economy and meet the UK's carbon emissions targets, we need to consider the short and long-term role of gas as we meet the challenges posed by the energy trilemma; to deliver affordable, sustainable and secure energy supplies.

- **Security** – continuing to meet demand every day of the year with safeguards in place for exceptional winters or disruptions to supply
- **Sustainability** – facilitating the transition to a low carbon energy
- **Affordability** – managing costs, offering reasonable pricing to customers, protecting households in fuel poverty and the efficient use of energy



Gas was first introduced in the UK over 200 years ago and over this time there has been significant investment in the gas network, providing flexibility to meet customer demands. It is seen by domestic customers as a preferred energy option, being reliable and easily controllable.

Looking forward, we believe gas distribution networks will play a major part in the future of energy, delivering a reduction in emissions at a lower cost to alternative options, with less disruption, while maintaining a secure supply and continuing to meet customer demands. Energy efficiency must continue as a top priority for the energy industry, and it is essential that in the move towards a decarbonised energy system, fuel poverty is properly addressed. An increase in the number of households living in fuel poverty would be unacceptable.

As Government policy to enable the UK to meet its emission reduction targets is being developed, we are playing a key role alongside the other energy networks in supporting the Government by:

- Identifying and filling evidence gaps necessary to enable government to make key policy decisions.

Examples of projects Cadent are working on, alongside the other energy networks include developing Bio-Substitute Natural Gas technology, an initiative looking at the implications of repurposing the gas network to carry pure hydrogen, and another looking at blending hydrogen into the existing public gas system.

- Presenting visions for the future to national and regional stakeholders to show the role of the gas network in a low emission energy system for 2050 and beyond.

The flagship HyNet North West project presents a vision of a hydrogen hub to support the decarbonisation of large industry, the demonstration of carbon capture, as well as providing hydrogen for transport and to reduce the carbon intensity of domestic heating.

- Ensuring a whole energy system approach is considered and the full implications of any policy, both direct and consequential, are properly considered e.g. impact of disruption.

An example of the whole system approach is the Wales and West Utilities Project Freedom which looks at the benefits, the consumer response and other practicalities by installing Hybrid heating systems across 75 homes. This approach enables switching between gas and electric e.g. gas at peak, and electric off peak, to allow optimisation across the two energy networks, and minimise infrastructure upgrade requirements.

## Shorter Term Emissions Reduction

In the shorter term, the gas network can also play a leading role in reducing emissions. There are a number of areas where we are supporting immediate low regrets actions to deliver emissions reductions, such as the growth of green biomethane or BioSNG plants, and the use of gas in the transport sector. We will support and facilitate their connections to our networks, and work with the industry to remove barriers to the continued growth.

Introducing new sources of gas into the existing gas network would represent a lower cost decarbonisation option, and improve the reliability of the UK's energy infrastructure. It is not credible to rely on renewables such as solar and wind to support the decarbonisation of the massive winter demand for heat. Energy network security is a further consideration; it is enhanced by utilising both the electricity and gas networks, and not relying on a single electricity infrastructure to provide all our energy needs.

Demand, supply of renewable gas, domestic heat and transport are all being considered in an effort to decarbonise the UK to meet the emissions reduction target and energy efficiency ambitions. We expect some of these developments to start appearing in our demand and supply forecasts over the next few years. These factors will also influence our investment plans in the next regulatory review period.

We have highlighted the possibilities in this area through the publication of a series of papers under the theme 'Future of Gas'. The series is aimed to promote discussions with our stakeholders and to inform debate in industry. The papers address the critical role that gas has to play in the future energy mix.

[cadentgas.com/About-us/The-future-role-of-gas](https://cadentgas.com/About-us/The-future-role-of-gas)

## Low Carbon Gas Supply

Renewable gas (such as biomethane and bio-substitute natural gas) can play an important part in the decarbonisation of domestic heat, transport and power generation. It does not require significant investment in new network infrastructure: it can be injected straight into the existing gas distribution network; and customers won't need to make any significant changes to their appliances for heating or cooking.

Whilst renewable gas is the same methane molecules it contributes a significant reduction in greenhouse gas emissions when compared with fossil gas, when the sustainable production is taken into account, and the avoided methane that would otherwise have occurred from the waste feedstock.

Cadent sponsored a report that showed that the potential for renewable gas from waste and biomass feedstocks could be as high as 174TWh by 2050, with a central estimate of 108TWh. This is enough renewable gas to meet over 50% of domestic gas demand or to supply all the homes in the south of England. This could be supported further by energy efficiency, imported waste and biomass, and Government policy to encourage growth in the appropriate feedstocks.

This is achievable with continued support and longer-term certainty for Government incentives such as the Renewable Heat Incentive (RHI). The Government will also have to communicate clearly the message that gas will play an important role in the energy mix, so that investors and the supply chain can have confidence for the long term.

Looking further ahead, there is increasing interest in how we could transform the energy market to establish a hydrogen economy, using the existing gas distribution network to transport hydrogen for domestic heat and transport. The gas industry, working with Government, has started to assess the impact this would have, including exploring the use of hydrogen blending, and understanding the implications of transporting a different gas in the pipeline system.

## Biomethane connections

The number of renewable gas to grid connections has increased impressively supported by the Renewable Heat Incentive. However the review of Government policy has resulted in a stop/start delivery for many projects.

Within the last year we have connected an additional 2 biomethane sites, one in the East Midlands and one in East Anglia; both using food waste feedstock. We have now successfully connected 31 sites to our network since 2013, which have the potential to heat up to 200,000 homes.

The Government's review of the RHI and the delay to implementing the revised mechanism has resulted in many projects being put on hold, creating a queue. With the new policy confirmed earlier this year, the queue has been released with a consequential rush to connect in time to qualify for the funding support. We are working with our customers and the supply chain to manage this process as efficiently as possible.

Whilst this behaviour of developers is understandable with millions of pounds at stake on their projects, this activity clearly illustrates the value of long term certainty to support a fast pace of investment.

Further growth in green gas will be limited due to the current lack of certainty over the RHI funding beyond 2021.

Since our first connection in 2013, we have sought and responded to customer feedback to help drive down costs, and improve our processes and commercial frameworks.

Making the connection process as straightforward as possible and providing customer choice will help us increase the numbers of renewable gas connections, and will reduce our reliance on the transmission system for gas supply to our customers.

## Renewable gas through gasification (BioSNG)

We will need large-scale production of renewable gas if it is to make a significant contribution to reducing the greenhouse gas emissions associated with domestic heating. The production of low carbon methane from thermal sources Bio-Substitute Natural Gas (BioSNG) has the potential to do this. Conventional biomethane from Anaerobic Digestion is derived from wet feedstock, but BioSNG can utilise a much wider range of drier feedstocks.

In 2013/14, National Grid and its partners: Advanced Plasma Power (APP); Progressive Energy (PEL) and Carbotech initiated a project to create BioSNG from municipal black bag waste, securing funding from Ofgem's Network Innovation Competition (NIC) and the European BESTF-ERANET programme.

Following the success of the pilot project in Swindon to demonstrate the production of BioSNG by the gasification of residual domestic and commercial waste, in 2015/16, we secured further innovation funding, with partners APP, PEL, Compressed Natural Gas (CNG) Services and Wales & West Utilities for a much larger BioSNG plant to demonstrate the scaled-up technology under commercial conditions.

The project started at the beginning of 2016 and it is due for completion in the next 12 months. The plant can use a range of feedstocks including black bag waste supplied under contract from the local council. The renewable gas will be sold to a local road haulier, who will use the renewable gas to fuel heavy goods vehicles (HGVs). Gas will also be injected into the local Wales & West Utilities network to supply remote CNG fuelling stations. The new plant has also been awarded funding by the Department for Transport's Advanced Biofuels Competition, and it will produce 1 million kg of renewable gas for transport from 2018 (22 GWh/a).

We intend the successful continuous operation of the commercial BioSNG plant to provide the necessary confidence for Government and industry to promote commercial investment in the technology, leading to the roll out of large numbers of BioSNG plants across the UK.

Earlier this year we published a report we commissioned from Ernst and Young to look into the possible approaches that could be employed to support the roll out at scale of BioSNG:

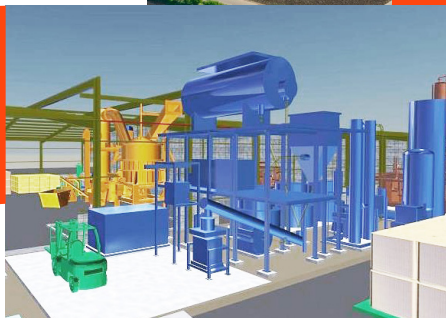
<https://cadentgas.com/about-us/the-future-role-of-gas/investment-in-biosng>



Options for  
stimulating  
investment in  
BioSNG

A report for Cadent Gas Limited

May 2018





In addition we are nearing the end of a study which considers how BioSNG would be integrated into both the energy, waste and transport sectors to support the decarbonisation of a whole city, using examples from the Midlands and Scotland.

We see the potential for BioSNG to play a significant role in helping to achieve the UK's renewable energy targets, whilst maximising the use of existing gas infrastructure, and minimising the need for large scale new energy infrastructure.

The confirmation of the treatment of BioSNG as a development fuel under the Renewable Transport Fuel Obligation is extremely valuable to support this significant new technology.

## Transport – potential growth in CNG vehicles

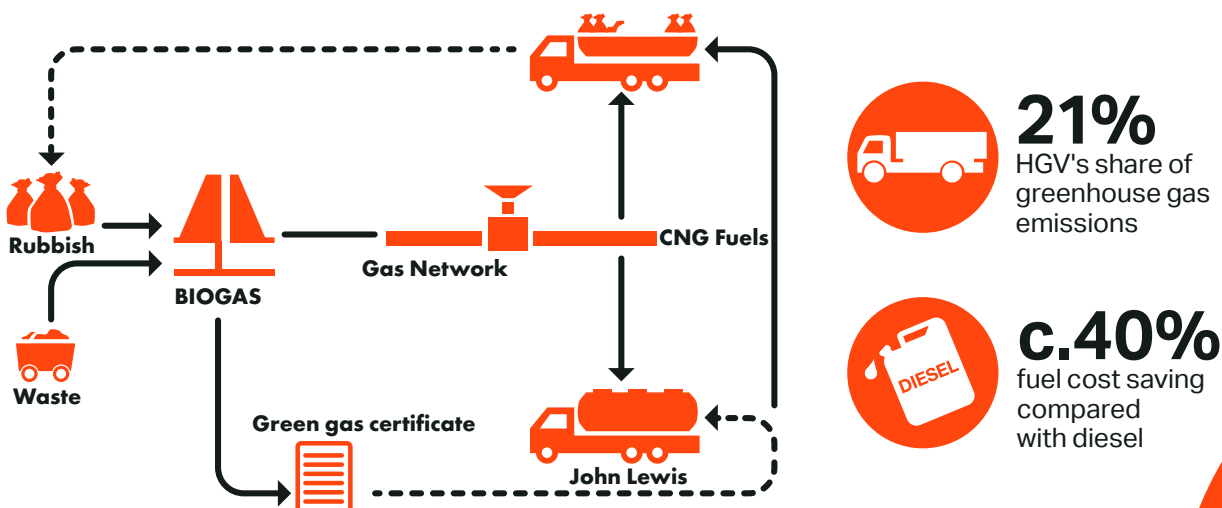
Transport accounts for 25% of the UK's total greenhouse gas emissions and there is no way to completely decarbonise it.

HGVs and buses, which make up only 1.5% of road transport account for 21% of transport emissions. Other emissions affecting air quality are also emerging to drive the search for alternative transport energy solutions, particularly in urban areas. Noise pollution is a further consideration.

There is potential for natural gas to play a major role in lowering emissions from transport; HGVs, refuse vehicles and buses can be fuelled using CNG. The existing gas network provides an opportunity to create a national filling station infrastructure that offers a clean, quiet and cheap alternative to diesel for vehicles and provides connections for customers who want to use CNG vehicles. Unlike other vehicle options such as plug in electric or electricity derived hydrogen, whose roll out will be heavily constrained by the limitations of the local electricity grid, the gas network is a valuable existing asset with massive spare capacity through the year, capable of providing the backbone of a large scale national infrastructure. This market is starting to grow, and we are confident that this activity will accelerate over the next few years.

We are currently anticipating, subject to appropriate Government support, 25-50 CNG filling stations connected to our network by 2035.

Working in partnership with CNG Fuels, Cadent connected the first commercial CNG refuelling station to our high-pressure system in Leyland, Lancashire. The station is being used by the John Lewis Partnership to fuel their fleet of dedicated CNG HGVs with certified renewable biomethane. The success of this initial station has encouraged John Lewis to commit to CNG by expanding their fleet further. The Leyland connection increases the use of the gas network, but no extra investment was required to reinforce the gas infrastructure.





For UK gas customers, the growth of this transport fuel sector will mean greater network use. This will eventually reduce the transportation cost per customer as well as helping to reduce the environmental impact.

## **Off Gas Grid Decarbonisation**

The Government are considering how to reduce the carbon emissions from high carbon domestic heating systems such as oil and coal. We believe that where such communities exist off the gas grid, then a whole community solution should be designed that delivers the optimal preferred solution for the area as a whole. This would be able to take account of the characteristics and needs of the community, recognising different types of homes, different levels of insulation and households in fuel poverty.

Furthermore, we believe that in some circumstances, extending the gas grid to a community may represent the least cost preferred pathway for the residents, when compared with the next best alternative. We expect that many homeowners would see the provision of mains gas as an attractive option compared with alternative, more disruptive options.

A whole community approach would be able to consider current and future energy requirements including any longer term demand for electric vehicles.

Switching from oil or coal to natural gas would achieve significant carbon emission reductions, and these would be further improved with the provision of biomethane or BioSNG, or hydrogen. Indeed, the new heating systems could be future proofed to accommodate a future switch to hydrogen.

Extension of the gas grid to enable decarbonisation of communities not connected to mains gas would require a change to the regulatory treatment of such extensions, and we have started this discussion with Ofgem and Government. If policy does evolve to support this approach then future business plans would include the necessary costs, both to properly engage and consult with communities, as well as to carry out any works to install new pipework.

We would welcome feedback on such an approach, and in particular from any off gas grid areas where the extension of the main gas network may be supported.

## Demand

**This section looks at the demand forecast across our four distribution networks for the next ten years.**

### Scenario appraisal

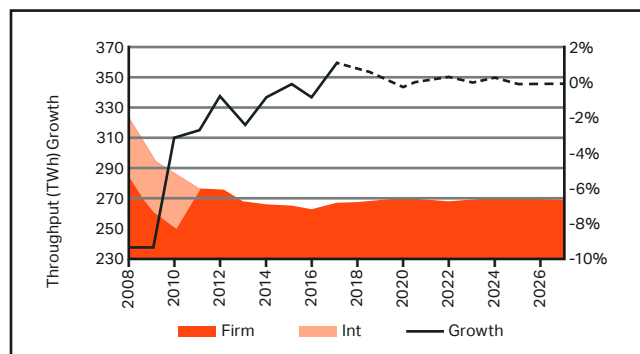
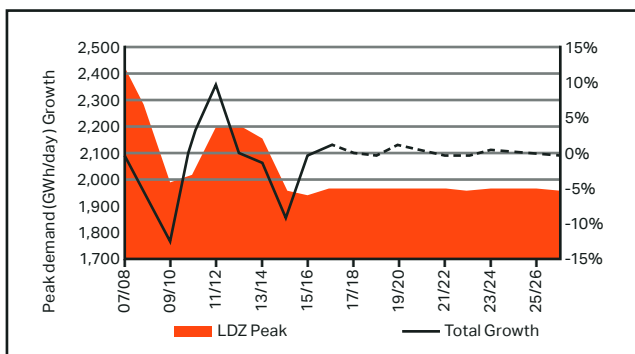
Our demand scenarios are based on planning assumptions derived from market observations and stakeholder engagement. The scenarios take into account the need to reduce our carbon emissions, which is critical if we are to meet Government targets by 2050. They also include the view of specialist consultancies and data collected from National Grid's Future Energy Scenarios (FES) consultation process.

The FES consultation involves market participants, including suppliers, consumers and consumer groups. It provides important feedback on the impact of market developments and data about the consumption of new and existing loads. This year an important part of the production of the anticipated demand is the experience from the "Beast from the East" over the first few days of March. This has reinforced the view that reductions in annual demand seen to date do not lead to the same reduction in peak demands.

### Forecast demand

The projection of our future demand this year reflects the direction of travel from the FES 2018 Slow Progression, but contains our adjustment based on the experiences on our network during 1st and 2nd of March. This has seen an increase in peak demand still with an overall reduction over the 10 year forecast. The increase is partly due to additional peaking electricity generation plants connecting to our network requiring capacity at peak gas demand times.

There are four Future Energy Scenarios in total for 2018, and these are summarised below. We have used Slow Progression as our basis as we believe it currently represents the most realistic view of the likely shorter term evolution of the energy system. Slow Progression is an extrapolation from the current position, and is influenced less by modelling assumptions regarding the large scale policy driven changes required to our energy system to hit the 2050 carbon emission targets.



**Future Energy Scenario's  
July 2018, courtesy of  
National Grid**



✘ 2050 carbon reduction target is not met    ✔ 2050 carbon reduction target is met

Level of decentralisation	Consumer Evolution		Community Renewables	
	Electricity demand	Moderate-high demand: high for electric vehicles (EVs) and moderate efficiency gains	Electricity demand	Highest demand: high for EVs, high for heating and good efficiency gains
Transport	Most cars are EVs by 2040; some gas used in commercial vehicles	Transport	Most cars are EVs by 2033; greatest use of gas in commercial vehicles but superseded from mid 2040s by hydrogen (from electrolysis)	
Heat	Gas boilers dominate; moderate levels of thermal efficiency	Heat	Heat pumps dominate; high levels of thermal efficiency	
Electricity supply	Small scale renewables and gas; small modular reactors from 2030s	Electricity supply	Highest solar and onshore wind supply	
Gas supply	Highest shale gas, developing strongly from 2020s	Gas supply	Highest green gas development from 2030s	
Level of decentralisation	Steady Progression		Two Degrees	
	Electricity demand	Moderate-high demand: high for EVs and moderate efficiency gains	Electricity demand	Lowest demand: high for EVs, low for heating and good efficiency gains
Transport	Most cars are EVs by 2040; some gas used in commercial vehicles	Transport	Most cars are EVs by 2033; high level of gas used for commercial vehicles but superseded from mid 2040s by hydrogen	
Heat	Gas boilers dominate; moderate levels of thermal efficiency	Heat	Hydrogen from steam methane reforming from 2030s, and some district heat; high levels of thermal efficiency	
Electricity supply	Offshore wind, nuclear and gas; carbon capture utilisation and storage (CCUS) gas generation from late 2030s	Electricity supply	Offshore wind, nuclear, large scale storage and interconnectors; CCUS gas generation from 2030	
Gas supply	UK Continental Shelf still producing in 2050; some shale gas	Gas supply	Some green gas, incl. biomethane and BioSNG; highest import dependency	

## Forecast comparison and accuracy

Appendix A1 contains demand forecast information at a LDZ network level through to 2026/27. Tables in Appendix A2 include:

- A comparison of the actual demands during 2017 with the forecasts published in our 2017 LTDP;
- Maximum and minimum demand days and forecasts for winter and summer 2018.

## Future demand factors

In order to meet our carbon emission reduction targets and ensure the future of UK energy is sustainable, affordable and secure, the way in which energy is produced and used will need to change. Heat needs to be decarbonised if we are going to meet our targets. In the UK, almost half of the energy consumed is used to provide heat in buildings and industry (for heating, hot water and cooking) of which two thirds come from natural gas. We have seen demand fall because of the energy efficiency measures employed within the home and in industry. The Future Energy Scenarios published by National Grid show that a significant efficiency saving would be possible if customers choose solid wall insulation, A-rated boilers and smart thermostats. Gas heat pumps could further reduce energy demand, offering efficiencies up to 150% compared against a traditional boiler. We know there will be some electric heating in the future and gas demand will decrease. However, in all scenarios we've modelled, gas will still be needed for heat, particularly on peak demand days, and with increasingly significant contributions from small decentralised gas fired power generation.

Our forecast demand includes alternative technologies, such as, air source heat pumps that will reduce the customer's use of gas. We also include gas efficient appliance technologies like gas sourced heat pumps and micro-combined heat and power (micro-CHP), which reduce carbon intensity. These new and emerging technologies could help us to be flexible as we meet our domestic peak heat demand.

These new technologies will be used across electricity networks as well, helping to reduce the growing pressure on the electricity grid. New hybrid appliances powered from renewable electricity would be able to transfer to gas at peak times or at other times when there is not enough renewable electricity.

Other developments include smart technologies that can switch from electricity to gas depending on changes in the price of electricity, and smart appliances that can choose the cheapest or lowest carbon fuel. Combining all these technologies is the best way to make the most of renewables across both energy supplies. It will also maximise the use of the network and associated assets that customers have already paid for. Looking further ahead, we are starting to research how fuel cells might help us move towards a hydrogen economy.

New technology and the way gas is used across the year and at peak times is changing and this will continue as new technologies become the norm. This is leading to a clear distinction between our view on annual demands versus peak demand. Gas used across the seasons is likely to continue to decline, but the original relationships that the gas industry has built from experience are beginning to be less relevant. There are a number of innovation projects run by the gas networks looking to understand the evolving relationships between peak and annual demands, and to consider whether we take a whole new approach to how we forecast future demand.

# Connections

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## Entry Connections

Historically, gas has only entered the gas distribution networks from the high pressure National Transmission System. This is changing significantly, with new sources of gas entering directly into the distribution network. To date this has been solely biomethane: produced by the fermentation of organic matter, with feedstocks ranging from farm and animal waste, food and sewage waste, crops and silage.

Since the Renewable Heat Incentive (RHI) was introduced for gas to grid production in 2011 we have witnessed an impressive acceleration in the biomethane connections market.

Our biomethane connected customers are able to export their energy securely and recognise the revenues from both the gas sales to the grid and the Renewable Heat Incentives revenue. There may also be potential to support a biomethane's finances from the low emission transport sector via the Renewable Transport Fuel Obligation. Biomethane also affords a green and sustainable solution to waste management for the industrial, commercial and domestic sectors.

Alternative low carbon gases, such as biomethane can make an increasingly positive impact on the UK energy mix and help to address the "Energy Trilemma":

- Contribute to the UK in meeting its decarbonisation targets;
- Economies of scales realised through increased utilisation of a reliable network for the continuation of energy supply of heat, power and light;
- Cost effective in comparison with other renewable sources.

We recognise that as well as accommodating Entry gas where there is existing network capacity, we must also pursue new approaches to supporting gas injections, both at peak, and off peak times. This may involve moving gas across our pressure tiers, and potentially even exporting on to the National Transmission System. This would require investments such as network reconfiguration, compression, and new operational tools and systems. In-grid compression is one initiative we are currently working on, which will require developing a new set of capabilities and a supporting regulatory framework, as this is a new type of asset which is not currently used in the gas distribution networks to provide capacity.

Whilst we the gas coming directly onto our networks is currently biomethane, in the future we expect to see new gases connecting:

- BioSNG or Syngas

Substitute natural gas which is formed from the gasification of material from the waste or biomass industry typically but not exclusive black bag waste

#### ■ Shale and coalbed methane

Accessing shale and coal bed methane is through techniques such as hydraulic fracturing, horizontal drilling and dewatering. Shale is a significant uncertainty over the next 10 years, with individual sites potentially injecting 10,000scm/h. If initial test sites prove successful and with appropriate local and central government support, we could see 20-30 projects connecting to our network over the next 10 years. If tests are unsuccessful and without government support, there may be no shale projects connecting.

#### ■ Hydrogen

Subject to confirming that hydrogen can be transported and used safely, it is a medium and longer term low carbon option, and a huge potential clean energy source for the 2030's and beyond.

Hydrogen could either be blended with methane or used in converted dedicated hydrogen networks. Hydrogen blending could see large injections into the existing gas network in the first half of the next decade, greening the gas supply without having to alter any customer equipment.

## A changing network

These new injections into the distribution gas grid are changing the role and nature of our gas network. Whilst across the network there is huge scope for gas injections utilising existing spare capacity, this can be exhausted in some limited geographical areas, with high levels of entry gas activity.

In anticipation of the revised Renewable Heat Incentive (RHI) arrangements being confirmed this year and to help support the growth in green energy, Cadent has been leading, and working with the other Gas Distribution Networks (GDN's) to standardise a number of elements of the design and commissioning process for biomethane projects. We've set up a working group through the Energy Networks Association, to develop a set of GDN specifications. These will bring significant benefits to our customers and the supply chain, and will reduce the risk of projects failing to meet the current 31 January 2020 RHI deadline for commissioning these projects.

We are currently waiting to find out how many of our customers were successful in securing a RHI tariff guarantee; however Cadent potentially have 23 biomethane projects to deliver before the 31 January 2020. We are working with our customers to provide information quickly to help speed up the assessment of their tariff guarantee applications, and we will continue to support our customers throughout the delivery process.

We are actively consulting both internal and external stakeholders to formulate a blending strategy. The aim is to create a strategy that will enable entry facility operators (such as biomethane producers) to inject lower CV gas into our network without the need for enrichment with propane, or with a significant reduction in required propane injection volumes. The lower CV gas will be fully compliant to GS(M)R and all other NEA requirements prior to blending. Blending of low CV gas presents the opportunity for significant cost reductions for entry facility.

In response to customer feedback, within the last year we have developed some 'heat maps' of our medium pressure, intermediate pressure and higher pressure pipes to highlight areas where we have capacity available in our network to inject gas.

If you would like to view a copy of our heat maps please email [Box.NonStandardConne@cadentgas.com](mailto:Box.NonStandardConne@cadentgas.com)



In addition to biomethane, we will continue to facilitate the connection of new sources of compliant gas to our network. We will work closely with any stakeholders involved to ensure our processes are flexible and evolve quickly to recognise any new challenges.

If you wish to find further information on our entry gas connection services for biomethane, or other forms of distributed gas, please click on the following link: [cadentgas.com/Business-with-us/Biomethane](https://cadentgas.com/Business-with-us/Biomethane)

This contains information to connect to our gas network, simply and efficiently. The "Biomethane Gas to Grid Customer Connection Guide" helps our customers understand the connection process, from the initial customer enquiry, through project construction, to gas flowing on the first day of operations.

## Exit Connections (new demand for gas)

From October 2017 through to March 2018 we saw what is statistically classed as an average winter. But within this average winter we saw some of our highest peak demands in the last 20 years. This experience is a reminder that although annual demand is decreasing, peak demand from a cold snap can still occur in relatively mild winters.

Annual gas demand is decreasing year on year primarily due to the continued increase in energy efficiency within the domestic sector. There is however still a large number of new connection enquiries and requests made to us to supply gas to customers. In 2017/2018, there were over 23,000 of these, produced from our business compared to 16,000 within 2016/2017, and we still envisage this figure to rise due to the number of new domestic sites and commercial/industrial incentives within the UK.

Cadent offer a variety of services to our customers for Exit Connections; such as:

- Domestic Connections and Alterations
- Non Standard Connections and Alterations (which depend on gas load required and the complexity involved)
- Incentives for fuel poverty areas which involve a free or discounted connection to our network (this depends on criteria)

Cadent have seen an increase in the number of enquiries and quotation applications for Power Generation Plants across our network. We have now started to identify who the developers are, and we are engaging with them to understand their future plans. As part of this process, we are actively seeing to identify where the best places on the network are to connect these types of gas usage plants.

Within the last year, we have introduced a Detailed Analysis Study (DAS) for large exit connections. We are liaising with many customers who are looking to take significant loads of gas off our network such as Power Generation Plants and CNG Fuelling Stations. The current cost of a DAS is £950 + VAT. A DAS is carried out to understand the capability of Cadent's network in relation to the customer's request to connect and use Gas. This document summarises the different connection points within Cadent's network to supply the gas for customers.

As we see the connection of small scale gas generation increasing steadily going forward, we have started a discussion with all the gas networks and Ofgem, to consider the appropriate regulatory framework to support these connections. To illustrate the potential long term scale, recent studies by Imperial College has suggested that in a high renewable electricity scenario for 2050, almost 100GW of small gas fired generation would be required secure our power supplies. This could be even higher if electric vehicle take up is high, but consumers do not chose to adopt restrictions on when they can charge.



In addition to reinforcement costs, large amounts of gas fired generation connected to the gas distribution networks may also need other supporting investments, such as gas storage, so that gas supplies can be maintained even if high levels of gas generation are fired up simultaneously across the grid.

The gas networks are working together to properly understand the implications and requirements for our networks, and we expect to include proposals in our regulatory business plans. These will be submitted to Ofgem for approval in 2019.

We would welcome feedback from developers interested in exploring gas generation projects connecting to our networks.

Cadent also process competitive exit connections within the industry; such as:

- Enquiries and Requests from Independent Gas Transporters (iGTs). A connection is made to our distribution network, allowing the flow of gas to the iGT's owned system. These connections are known as Connected System Exit Points (CSEPs). These independent networks are connected to the Cadent system, but the individual iGT owns and operates their networks;
- Enquiries and Requests from Utility Infrastructure Providers (UIPs). A UIP is responsible for designing and constructing the infrastructure, with the intention of an iGT or Cadent adopting, owning and operating the pipeline. In order for this to be completed, the UIP needs to ensure that their pipeline has been designed and constructed to gas industry standards.

Detailed information on all our connections services, including contact details, incentives for fuel poverty areas, charges and terms and conditions can be found at: [cadentgas.com/get-connected](http://cadentgas.com/get-connected)

## Facilitating Timely Network Reinforcement

A common theme we have heard from regional stakeholders is the need to support timely network reinforcements so that energy infrastructure does not become a barrier to economic growth.

The current regulatory regime is low risk, to protect consumers from funding speculative investments that become stranded. This results in reinforcement works being undertaken when there is absolute certainty over the longer term demand. This can be much later than desirable.

The pricing methodologies can also be an issue, as reinforcements are paid for by the triggering party, which incentivises developers leaving their applications for new connections as late as possible, hoping the others will be move earlier and und the reinforcements.

In response to this issue, Cadent have developed a proposal, where in return for a local body underwriting the works, we would accept the obligation to complete the reinforcements within the requested timescales. We understand that new demand may not connect quite as quickly as forecast, and therefore we would seek agreement from Ofgem, our Regulator, that a sensible window was allowed such as 5 years, before the security provided to underwrite the works could be called upon.

We think this approach could enable much more timely reinforcement, and is an approach that could be used for new housing developments, business parks, transport refuelling stations, or for gas fired district heating schemes.

We'd welcome views from local bodies and developers on whether such an approach would be beneficial, and if it could remove a significant barrier to economic growth.

If this new approach is adopted, our future plans would include such obligated reinforcement schemes.

## **District Heating Scheme Extensions for Multiple Occupancy Buildings**

Cadent operates in North London and our network therefore includes the connection of many multiple occupancy low, medium and high rise buildings. We have undertaken a study to look at existing and proposed district heating scheme in London, and we've observed that in many cases, these efficient heating schemes are not being connected to multiple occupancy residential buildings.

The gas distribution networks have an obligation to maintain existing gas supplies, and therefore we are responsible for ensuring the gas pipework connecting each home in the building remains safe. This of course incurs a cost, which can sometimes be significant where pipework is difficult to access. In such circumstances there may be an overall cost benefit analysis from converting the heating from direct gas central heating, to a communal district heating scheme. Where a district heating scheme is already in place nearby, then the economics may be even more favourable.

We want to do more to help communities in multiple occupancy buildings explore the best use of energy and we are planning further specific stakeholder and consumer engagement. If this is positive, then we would look to include proposals in our next regulatory business plans, which will be submitted to our Regulator for approval next year.

We would welcome feedback on this proposal, and would be especially interested in anyone involved in regional district heating schemes.

# Commercial operation of the network

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Industry arrangements, covered by the Uniform Network Code (UNC), set the rules that govern the processes of gas transportation. You can read them on the Ofgem website. The UNC is a contract between shippers, suppliers and gas transporters. It manages the commercial arrangements between the parties and underpins the GB Gas Industry. Any party to the UNC can propose a modification to the contract and all parties then discuss, develop and vote on any recommended changes, which are agreed by Ofgem.

## National Transmission System

A change to the exit capacity regime (providing shippers with an entitlement to take gas off the NTS), introduced in October 2012, means we can now use products of varying capacity to manage the balance between gas supply and demand in our networks safely and efficiently. These include:

- Long-term, medium-term, firm and off-peak daily products
- Using agreed industry processes to manage our use of capacity and transfer capacity between offtakes if necessary
- Long-term, medium-term and daily release of NTS offtake (flexibility) capacity, which is an integral part of our operating strategy.

In addition to this, Cadent will use the natural flexibility of each Network's stock and storage to help balance our customers demand.

## Future developments

Over recent years we have seen an increase in alternative supplies into our networks, this has been through the connection of biomethane plants. There are now 31 connected with the growth forecast to continue. In addition to this we are expecting further alternative sources to connect; these include shale gas, BioSNG and hydrogen. We have also seen an increase in electricity power generation demand and the development of Compressed Natural Gas refuelling stations.

All of these developments provide challenges in how we plan and operate our network that we haven't experienced previously. With the constantly evolving changes in supply and demand it will require the network to be configured and operated differently in the future, with an even greater emphasis on cross Network co-operation, and is likely to require an ever increasing level of flexibility and gas storage within the Gas Distribution Networks.

This will require innovative ways to operate our networks to ensure we continue to deliver gas to our customers safely, efficiently and securely.

Continual feedback from our stakeholders really helps us plan and improve. So please get in touch with us, your views can make a difference to the communities we serve.

# Future investments

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Cadent invests heavily in our networks. These investments fall into 2 categories; Maintaining the Integrity of our existing Networks to ensure they remain in great condition, and Growing the Capacity of our networks to meet the expanding and evolving needs of our customers.

## **Maintaining the Integrity of the Network**

We maintain the integrity of our networks by monitoring performance and targeting those assets whose age, current condition, performance and future expected deterioration or obsolescence pose the greatest risk to the safe and effective operation of our networks.

We ensure that we balance inspection, maintenance and capital expenditure to maximise the efficient operating life of our assets with a focus on enabling a sustainable and future ready gas infrastructure.

### **Monetised Risk**

We have been working with Ofgem and the other gas network operators to develop and implement a consistent methodology for measuring risk on our networks. By better understanding the condition of our assets and the impact of their failure, we can make best value investment decisions, targeting the greatest amount of risk removed for money spent.

### **Asset Data**

Our ability to make good investment decisions is predicated on the availability of accurate and complete asset data. We believe passionately in the continual improvement of our asset data and core systems. In 2018, we initiated a project to review our asset data systems and identify opportunities for leveraging advances in machine learning and data analytics.

## Growing Capacity of the Network

We model predicted demand growth and reinforce or extend the capacity in our networks accordingly. In the period until 2021 a number of Pressure Reduction Stations will be replaced or have their capacity increased in preparation for this anticipated growth. Whilst this process is in continual review PRS capacity upgrades have been confirmed for Fulham (due to complete in 2018/19), at Bow Common, Burwell and Crick (all due to complete in 2019/20), and at Dawley (due to complete in 2020/21).

### Lower pressure reinforcements

The below 7barg system must operate between levels of pressure defined by statute, regulation and safe working practices. We are developing the below 7barg distribution system, investing in mains, services and associated plant so we can provide capacity to customers who want to connect to our network and to other gas transporters' requests for transportation services.

When we quote any connections to our network, we assess capacity on a first-come, first-served basis. This means that the capacity available today might not be there tomorrow, so, for long-term projects, information about current available capacity may be out of date by the time a development is complete.

There has been a dramatic increase in housing developments on the extremities of our networks in the last 2 years, including sites at Silverstone, Towcester, Lichfield and Bedford, with the fastest growing towns in East Anglia and the East Midlands.

Some of the projects started with a request for a few hundred houses but where we have visibility of the local plans we can factor longer term demand into our reinforcement options. This enables efficient investment and minimises the likelihood of needing to return to an area in future years.

**East of England:** There is a large housing development being built as part of the South of the Wootton network which has required a Medium Pressure solution with a new District Governor being housed. This will protect against future growth in the area. The cost of this project is expected to be in the order of £1m.

The Silverstone and Towcester development on our MP system is our largest project by far which will see us laying up to 20km of pipe by 2021. This will ensure security of supply at the commercial development at Silverstone and the housing growth of Towcester. The cost of this project is likely to be more than £10m.

We have also seen the biggest rise in Energy Centres trying to get connected in the East, with the loads ranging from 2,500scm/h to 13,000scm/h. and even off the medium or intermediate higher pressure systems, this can cause system issues. Due to the MP/IP systems all running at maximum capacity are only solution is to reinforce for these sites with projects ranging from £300k to £2m.

**North London:** Due to the amount of refurbishment happening in historical buildings and new boiler systems being installed, we have quite a few reinforcements required in highly sensitive traffic areas which can sometimes prove difficult to access. Grosvenor Square and Young Street in London being two huge developments, which have required some different thinking in tackling this problem.

**North West:** We have also seen a big rise in Energy Centres seeking connection in the North West. We have the potential to increase some of the MP systems in pressure; however, this is a delicate balancing act with managing our metallic mains and ensuring we do not impact the wider operation of the network. There are 8 complex applications projects all being reviewed for solutions in the North West currently. Solutions for some of these projects could cost up to £2m.

**West Midlands:** Lichfield is seeing a dramatic increase of houses being built over the next few years, and a lower pressure option was selected initially to protect the first 800 households. And, we are monitoring the growth annually to ensure enough capacity is built into the system. We have also been engaged about the development around the Central Hub in Birmingham for the new HS2 station that is planned to be built near the airport and NEC.

New housing developments on the extremities of our systems and Energy centre connection requests are increasing and putting an increasing load on our local and medium pressure systems. We are working with our customers in this space to ensure that we can get them connected without a detrimental impact on the gas infrastructure. Early engagement has been key in making this better and we hope to continue to work on the relationships we have started building over the last 18 months.

Power Generation (Energy Centres) is a significant growth area where we have seen a dramatic increase in requests over the last 2 years, mainly on the extremities of our medium and intermediate pressure systems. As mentioned above these sites can range from 2500-13,000scm/h. This is equivalent to delivering gas to the equivalent of 13,000 homes and combined with the additional factor of very fast ramp rates when they are switched on, we are having to reinforce our network.

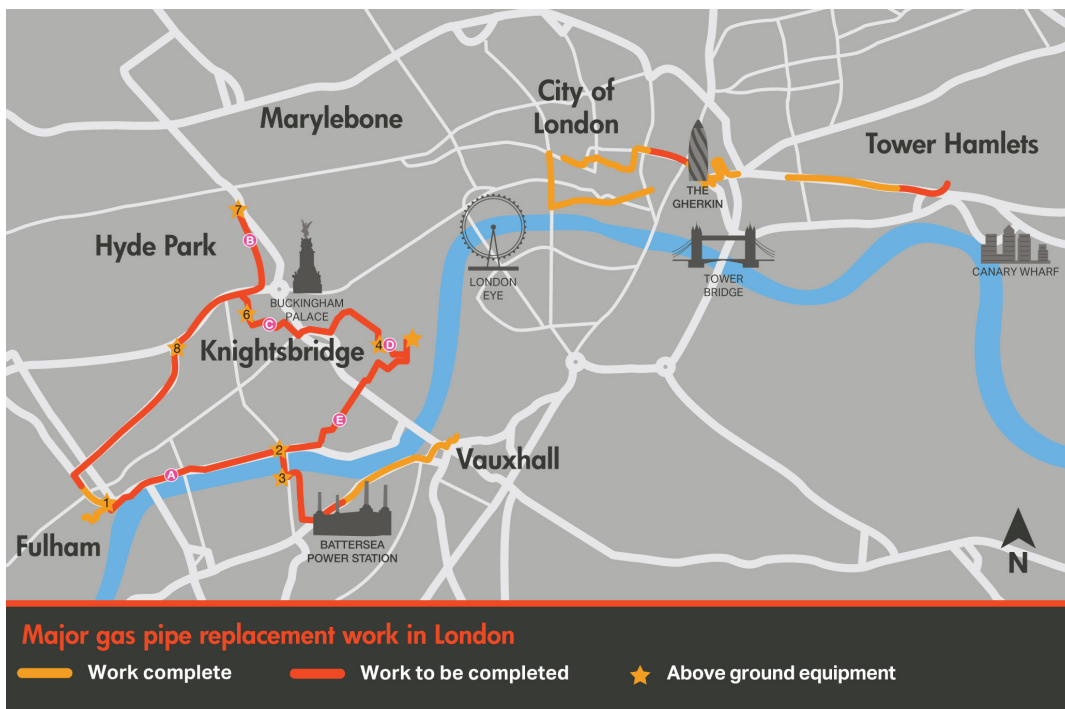
We see this demand for new gas fired power generation sites continuing for the foreseeable future as the need for decentralised secure and reliable electricity generation grows to support renewables and electric vehicles.

## London Supply Strategy

The London Supply Strategy is a long term project to make sections of the city's medium pressure Victorian metallic pipelines safer. Subject to regulatory approval, we'd expect this project to be completed towards the end of our next regulatory period in 2029. Most of these large gas mains are over 120 years old, are in densely populated areas which are close to nationally important landmarks and buildings.

The project aims to create a robust medium pressure network operating at 2 barg. This will be achieved by replacing the metallic mains primarily with more durable polyethylene pipes. Phase 1 of the scheme is valued in the region of £76m. The map shows where the mains are being replaced. The scope includes:

- Abandonment of 28km of metallic mains
- A tunnel under the River Thames for a new gas main
- Replacement of 7 pressure reduction sites (pit governors)
- Remediation of 40 Strategic Valves along the route of the gas mains replacement.



To date, we have successfully replaced over 16km of metallic pipelines in key locations including the Fulham Road, Chelsea and London Wall, City of London. Between Royal Chelsea Hospital and Battersea Park we have also successfully constructed a 30m deep tunnel underneath the River Thames and installed a 7 bar intermediate pressure pipeline which will ultimately serve the Battersea and Nine Elms areas.



We have listened to our stakeholders and we will consult them throughout the project. Our engagement has included:

- Talking to the local community and businesses about the proposed works
- Working with Transport for London and the local London borough councils to agree road closures, diversion routes and traffic management plans
- Working with the Thames Tideway Tunnel project to ensure a coordinated approach for complex diversions at Blackfriars and Victoria Embankment
- Working collaboratively with other utilities to minimise road space and disruption to our customers and the local community
- Working with the Royal Parks to ensure impact to the public and high-profile concerts is minimised whilst we replace gas mains and a pit governor
- Presenting all projects and traffic management plans at Local Authority scrutiny meetings for Local & Ward Councillor's to challenge and review prior to approvals.



We have received praise from Local Authorities for our approach to early engagement. In addition, we have been shortlisted for a number of industry awards including the Institution of Civil Engineers Best Infrastructure Project of 2018 and New Civil Engineers 2018 Tunnelling Project of the year.

After the London Supply Strategy RIIO-GD1 project is complete, we are planning a project to replace another 24km of mains to further reduce risks associated with the Victorian metallic pipelines. This strategic project will provide vital infrastructure to support London's economic growth and help maintain its position as a leading 21st century city.

## **Future of Transport – Revolutionising Fuel for Transport – Transport in transformation**

The UK needs to transition to a low carbon economy to meet its emission targets set out in the Climate Change Act (80% reduction in 2050 compared to 1990 levels). Transport is now the largest emitter of all sectors in the economy. Within the sector, Road transport is the largest emitter of greenhouse gases (GHG) where Heavy Goods Vehicles (HGVs) exhibit disproportionately higher emissions accounting for 17% of road transport CO2 emissions despite making up only 5% of vehicle miles. The importance of tackling HGV emissions was recognised in the recent "Road to Zero" transport strategy which confirmed adoption of a voluntary target to reduce HGV emissions by 15% by 2025.

Switching HGVs from diesel to natural gas has the potential to significantly reduce GHG and air pollutant emissions. Unlike other solutions, natural gas is a proven technology and can lead to immediate results which is important in the context of the new target. Sustainable sources of gas can provide additional emissions benefits to support the transport sector. Whether from biomethane or gasification, the GHG emissions are over 80% less than diesel consumption (ref Leyland experience).

With air quality from vehicle emissions having such a significant impact on health, the need to act fast is even more imperative. We believe that renewable gas taken from the extensive and existing gas network represents the primary at scale cost effective fuel of choice for large vehicles. It is the only practical option available today that reduces carbon emissions and improves air quality.

## Addressing difficult to decarbonise transport sectors today with Sustainable Gas

Cadent is taking an active role in supporting development of a UK Compressed Natural Gas (CNG) infrastructure. There are currently 6 CNG stations connected to our network, with another 2 under construction and a further 10 expressions of interest received from CNG station developers. We are also developing a CNG station at our National Distribution Centre site located in Erdington in Birmingham.

Fifty percent of licensed HGVs and 43% of depots from the UK's largest fleets are based in the Cadent area.

Scaling national CNG demand projections puts the potential demand in the Cadent region at 4 – 8 TWh of CNG /year by 2035, requiring 25 - 50 stations.

Other developments supported by Cadent include:

- Extension of the Renewable Transport Fuel Obligation (RTFO) until the end of 2032;
- Recognition of Bio-Substitute Natural Gas (BioSNG) as a development fuel under the RTFO;
- Ofgem and BEIS now accepting that an Anaerobic Digestion biomethane plant can supply to both Renewable Heat Incentive (RHI) and RTFO customers;
- Lobbying positive outcome from pending HM Treasury Autumn Budget review of fuel duty differential between diesel and natural gas.

## The benefits from leveraging Cadent's gas network to support the transport sector include:

- Supporting UK CO2 reduction and cleaner air in cities;
- More throughput and utilisation of the gas network, supporting lower consumer bills;
- Cadent's gas network is well placed to form the backbone of a national filling station infrastructure.

## Connecting CNG refuelling stations to Cadent's higher pressure network has significant benefits;

- No leakage
- Lower station operating costs, due to less compression (to 250 bar)
- High throughput so lower opex/maintenance costs
- Scalable as utilises huge year-round spare capacity on the gas network.

Filling stations connected to the higher-pressure system can increase the emission benefits of CNG trucks, and could offer an improved business case for stations serving hundreds of vehicles.

In terms of numbers, we are anticipating ~50 filling stations in total connecting over the next 10 years to Cadent's networks, given our assessment of the market, and with a continuation of the current support mechanisms.

The UK benefits from an extensive gas transmission and distribution network, with sufficient residual capacity and flexibility to support development of a comprehensive refuelling structure. The LTS provides the best economic solution to access gas for transport. However, intermediate and/or medium pressure network can also support commercial operations.

## Potential role of the gas network in a hydrogen transport future;



## HyNet North West

Cadent is already taking an active role in preparing for a transition from natural gas to hydrogen with the HyDeploy and HyNet North West projects. HyDeploy is a project aimed at demonstrating that blends of up to ~20% of hydrogen can be added to the existing public gas network without impacting the network or end user equipment and appliances. HyNet is a project designed to provide hydrogen to support the decarbonisation of large industry, power generation and transport in the Liverpool/Manchester area. Dependent on the success of HyDeploy, HyNet would also include the blending of surplus hydrogen into the public gas supply to reduce the carbon intensity of domestic heating. Together these two projects:

- Reduce carbon intensity of existing gas network using low carbon gas (combination of blended hydrogen up to 20%, biomethane, BioSNG);
- Supply up to 100% hydrogen to large emitters;
- Focus on difficult to decarbonise areas, including heat, power and transport applications e.g. HGV's, buses and trains to displace carbon intensive petrol and diesel.

The HyNet project would be a critical early component of a pathway to a low carbon gas future. Work by the Committee on Climate Change has indicated an order of 300TWhs/year of low carbon gases could be required by 2050 to meet our carbon reduction targets. The figures on the next page show that the transport sector could utilise 58TWhs of these green gas supply, alongside heat and power generation.

Figure 3.3: Build-up of Hydrogen Supplied to 2050

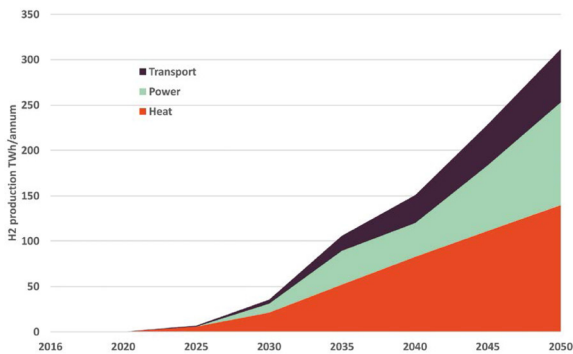
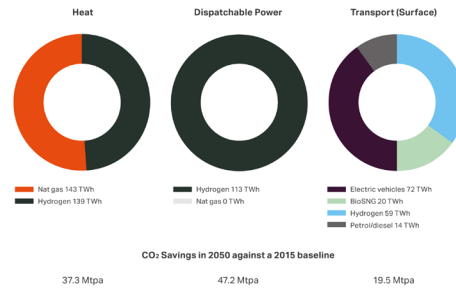


Figure 3.2: Potential Low Carbon Gas use in 2050



Reference; [https://hynet.co.uk/app/uploads/2018/05/14368\\_CADENT\\_PROJECT\\_REPORT\\_AMENDED\\_v22105.pdf](https://hynet.co.uk/app/uploads/2018/05/14368_CADENT_PROJECT_REPORT_AMENDED_v22105.pdf)

Specifically in the transport sector, Cadent has a number of initiatives, utilising our Innovation funding mechanisms, to realise new/future potential:

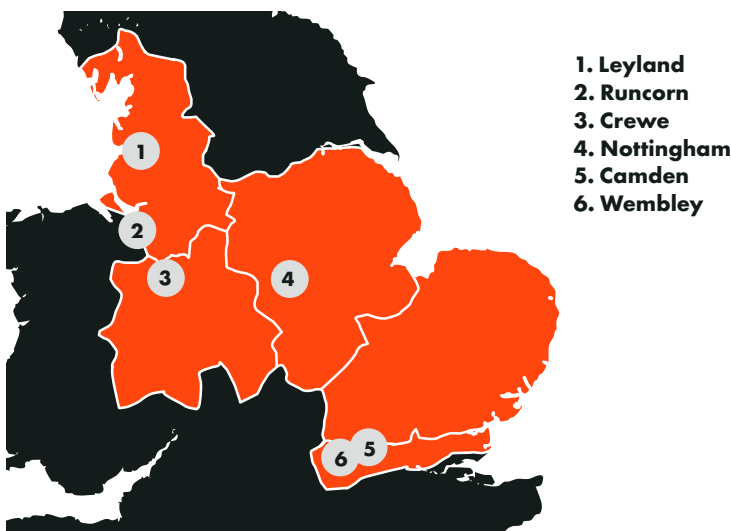
- **HyNet Motion:** Optimising network delivery of hydrogen for vehicle transport for the HyNet project;
- **Hydrogen Grid to Vehicle (HG2V):** Understanding the gas purity implications for network supplied gas for transport;
- The impact of hydrogen blends on engine performance;
- Dual Fuel Transport; the role of future multi-fuel refuelling hubs in optimising network capacity management/grid balancing.

We will continue to engage with the industry to explore options to facilitate the roll out of gas vehicles, and we welcome any further supporting feedback in this area.

As we develop out business plans for the next regulatory period from 2021, there is an opportunity, if necessary, to secure Ofgem approval for expenditure to support this area.

Feedback on how we can further support the role out of gas vehicle refuelling infrastructure would be particularly appreciated.

Contact [david.jones@cadentgas.com](mailto:david.jones@cadentgas.com)





# Innovation

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Innovation is an important part of the energy network's regulatory framework. Incentives and funding mechanisms are in place that are designed to encourage innovation, whilst recognising the value of sharing best practise and working across network boundaries, to maximise the benefits for all customers.

## Working collaboratively

Since the start of the current gas network price controls in 2013, the gas networks, including Cadent, have delivered over 400 innovation projects. Innovation projects allow network operators to better understand how to integrate new technologies into our energy networks, help them identify new opportunities for their use and speed up their wider adoption. They also reflect our commitment to build an efficient, smarter, cleaner energy system fit for Britain's homes and businesses.

In March 2018, The Energy Networks Association (ENA) published the first Gas Networks Innovation Strategy (GNIS).<sup>1</sup> This summarised progress in network innovation to date, and set out our priorities for the future under seven key innovation themes:

- Future of gas
- Distribution mains replacement
- Safety and emergency
- Reliability and maintenance
- Repair
- Environment and low carbon
- Security

In each of these areas, the document sets out strategic aims for the future, explaining how we will use innovation to help us deliver the low cost, low carbon network of the future.

We work closely with colleagues from the Electricity Networks and the wider energy industry to deliver innovation. The GNIS was published alongside an equivalent Electricity Network Innovation Strategy, and we worked closely with the electricity networks to map common priorities. We work hard to disseminate learning from projects across the industry, via the Smarter Networks portal and events such as the Low Carbon Network Innovation (LCNI) conference.

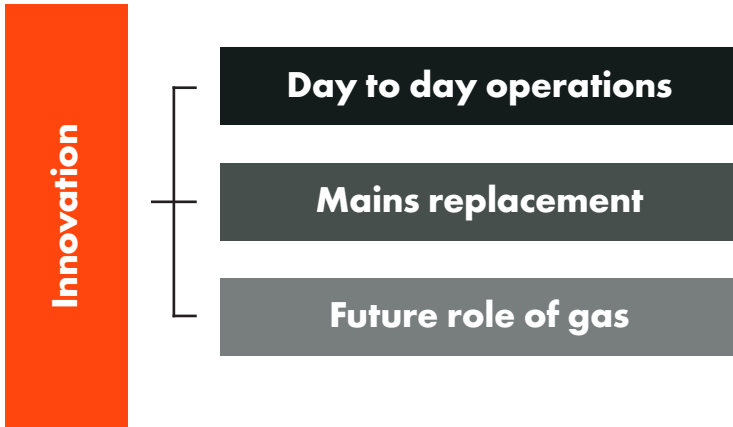
As the Strategies set out, we encourage third parties to participate in our innovation projects and present new ideas to network operators. In 2018 we launched a joint call for ideas for the Network Innovation Competition across all gas and electricity networks, and created a "Dragons' Den" style event at the LCNI to encourage cross-vector ideas with the potential to become new Network Innovation Allowance projects.

<sup>1</sup> <http://www.energynetworks.org/assets/files/Gas%20Network%20Innovation%20Strategy%20Final%202018.pdf>

## Innovation: from discovery to delivery

Innovation is evolving. Exciting new technology must be matched with cost effective and measurable results which fit into a rapidly changing environmental, economic and social picture. This approach will shape the way we approach innovation in the sixth year of the Network Innovation funding under the RIIO regulatory framework, and beyond.

*Cadent's innovation work aligns the 7 key innovation themes into three areas, so we can deliver targeted projects to give the best results for our customers.*



## Smart thinking for every day: Operations

To improve our efficiency when maintaining, responding to emergencies and repairing the network, we sometimes need to innovate new tools and techniques.

Over the last year, we have been developing small scale, wide application technology that can be quickly moved into business as usual. Two new innovation technologies have already been delivered into our networks this year and to facilitate faster repairs on the ground. Several other projects for repairs and maintenance have also progressed from early stage research to development, testing and field trials; offering real promise for the future. Further trials innovation is in progress and to ensure we make a measurable difference for customers impacted by our work. Future projects will also revolutionise the way we manage data; taking us into a new era of artificial intelligence application for the gas networks.





## Exploring the future: Future Role of Gas

Finding ways to lower carbon emissions from energy use is vital work for the UK meet its climate change targets and achieve cleaner air. Finding affordable and practical ways for customers to do this underpins all our futures work which explores the potential of delivering low carbon gases such as hydrogen through the existing gas network. This area has seen significant growth in the last twelve months; and we are leading a number of diverse projects.

Our HyNet North West project is an example of how an integrated, regional approach for heat, industry and transport can deliver strong environmental and economic benefits. As we continue to develop this project, a further Cadent led hydrogen project, HyDeploy is also now well under way. HyDeploy is seeking to demonstrate that natural gas blended with hydrogen can be delivered to customers without disruption, paving the way for larger public trials of blended gas in the future. The findings from both projects will provide valuable evidence about how low carbon gases could be an affordable and practical option for UK domestic, industrial and transport fuel customers.

## A network for today and tomorrow: Gas mains replacement

The upgrading work we do to replace old metallic gas mains with plastic pipes can be disruptive for customers in homes and businesses across our network. This has been a challenging area for innovation but a fresh approach has seen good results.

New technology which significantly reduces the footprint of a mains excavation has performed well across three field trials. Further applications for this technology are under development and it will be moved into business as usual in 2018/19. Digital solutions to speed up data processing are being investigated; and other innovations have overcome technical challenges to move ahead to final field trials. Together these solutions will reduce the disruption, and improve the efficiency of our pipe replacement work over the next two to three years.

*Live innovation field trial for 'Bonded Saddle' - technology to allow faster pipe repairs.*



# Appendices

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## A1 – Supply and demand data

**This section contains the forecast for demand looking ten years ahead by geographic network.**

Each network contains four graphs detailing:

- historical and forecasted annual gas demand
- historical and forecasted 1-in-20 peak gas demand
- comparison in demand between 2017 and 2018
- load breakdown by category.

This information will help our stakeholders to review the changes in our forecasted demand through to 2026/27 so that they can anticipate how the information could influence any potential commercial considerations. All graphs shown in this section, and the data that sits behind them, can be downloaded in an Excel format from the Cadent website.

# Appendices

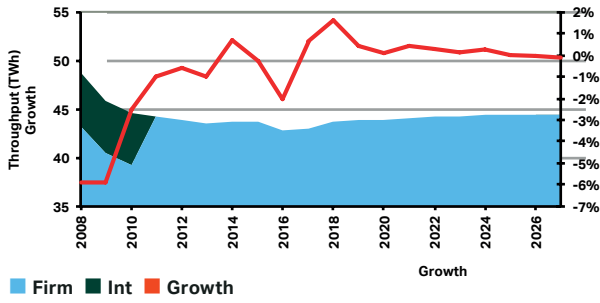


FIGURE 3.2A – East Anglia LDZ Historical & Forecast Annual Gas Demand

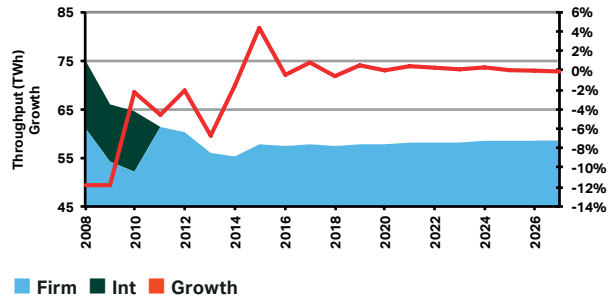


FIGURE 3.2B – East Midlands LDZ Historical & Forecast Annual Gas Demand

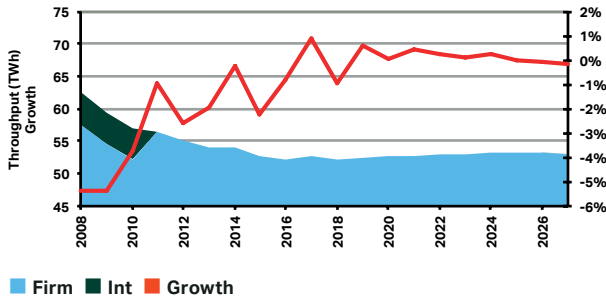


FIGURE 3.2C – North London LDZ Historical & Forecast Annual Gas Demand

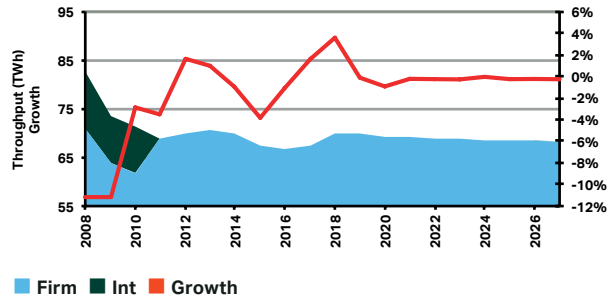


FIGURE 3.2D – North West LDZ Historical & Forecast Annual Gas Demand

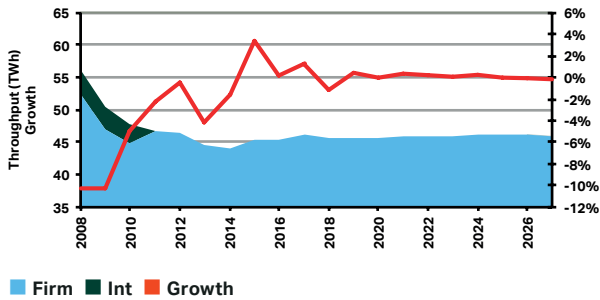


FIGURE 3.2E – West Midlands LDZ Historical & Forecast Annual Gas Demand

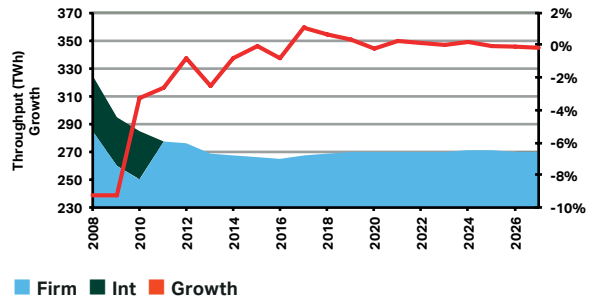


FIGURE 3.2F – Aggregate National Grid Gas LDZ Historical & Forecast Annual Gas Demand

# Appendices

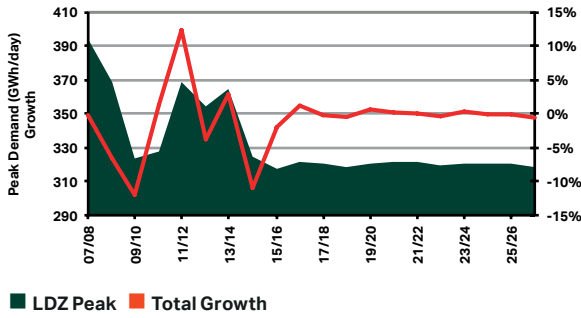


FIGURE 3.2G – East Anglia LDZ Historical & Forecast 1 in 20 Peak Gas Demand

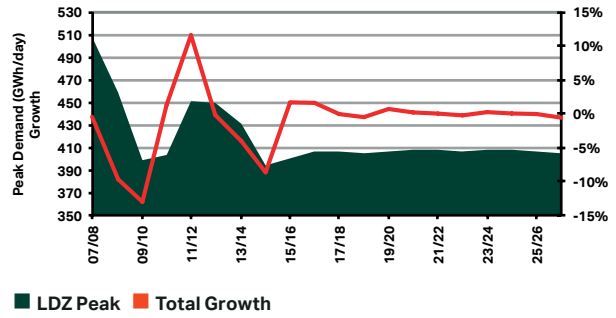


FIGURE 3.2H – East Midlands LDZ Historical & Forecast 1 in 20 Peak Gas Demand

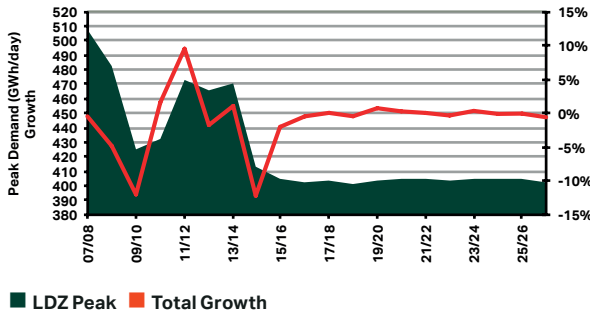


FIGURE 3.2I – North London LDZ Historical & Forecast 1 in 20 Peak Gas Demand

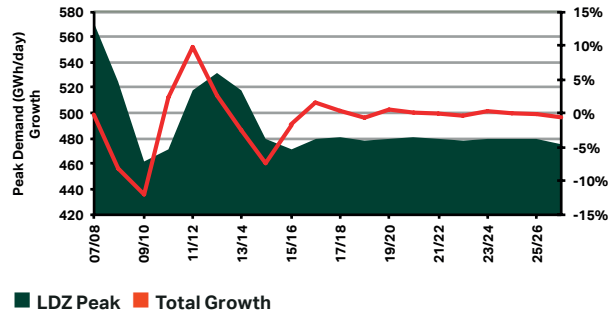


FIGURE 3.2J – North West LDZ Historical & Forecast 1 in 20 Peak Gas Demand

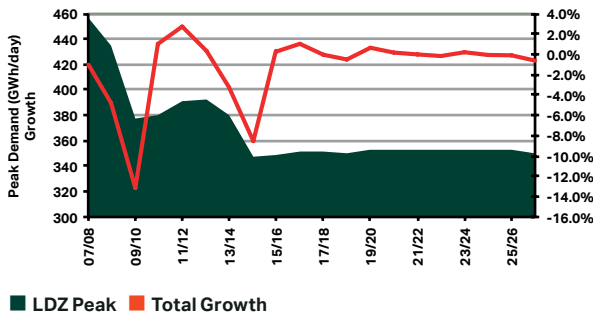


FIGURE 3.2K – West Midlands LDZ Historical & Forecast 1 in 20 Peak Gas Demand

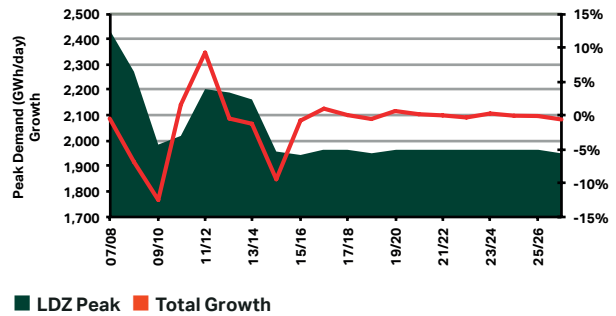


FIGURE 3.2L – Aggregate National Grid Gas LDZ Historical & Forecast 1 in 20 Peak Gas Demand

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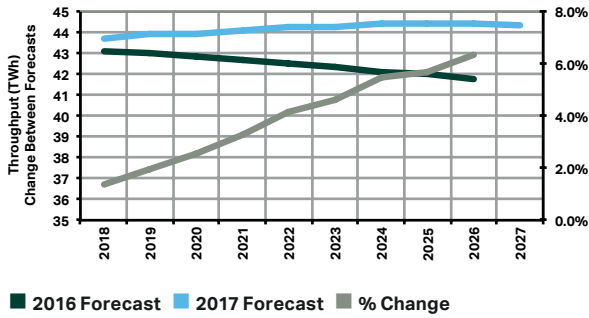


FIGURE 3.3A – Comparison of East Anglia LDZ Annual Demand Forecasts

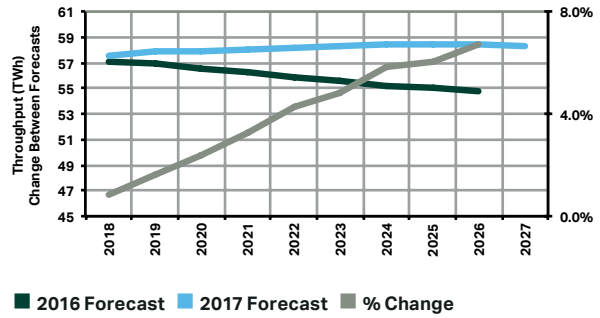


FIGURE 3.3B – Comparison of East Midlands LDZ Annual Demand Forecasts

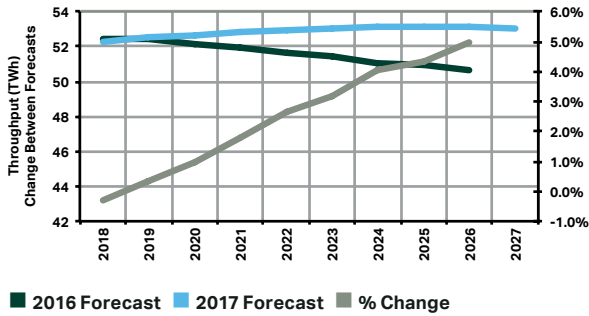


FIGURE 3.3C – Comparison of North London LDZ Annual Demand Forecasts

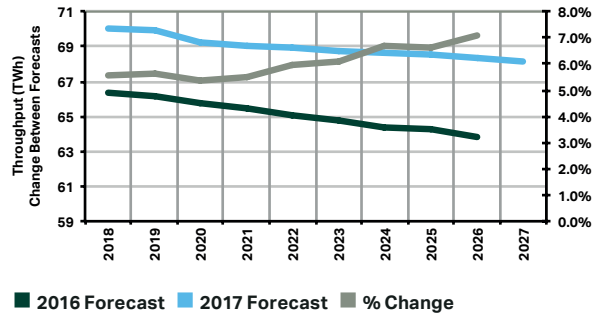


FIGURE 3.3D – Comparison of North West LDZ Annual Demand Forecasts

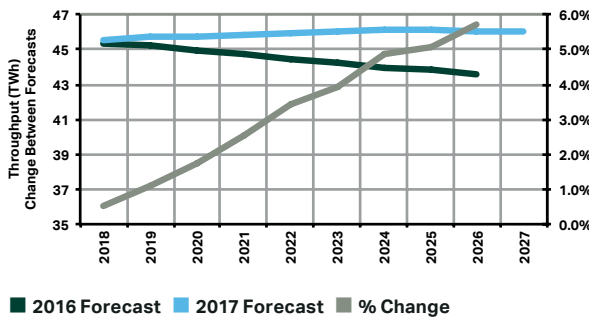


FIGURE 3.3E – Comparison of West Midlands LDZ Annual Demand Forecasts

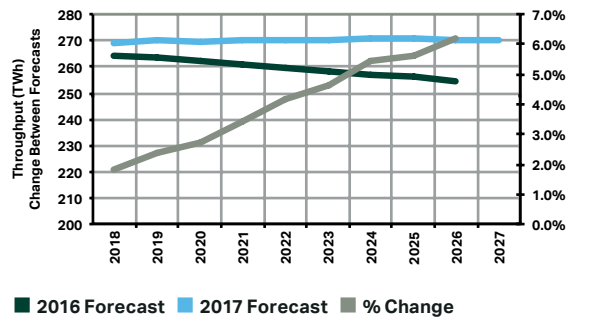


FIGURE 3.3F – Comparison of Aggregate National Grid Gas LDZ Annual Demand Forecasts

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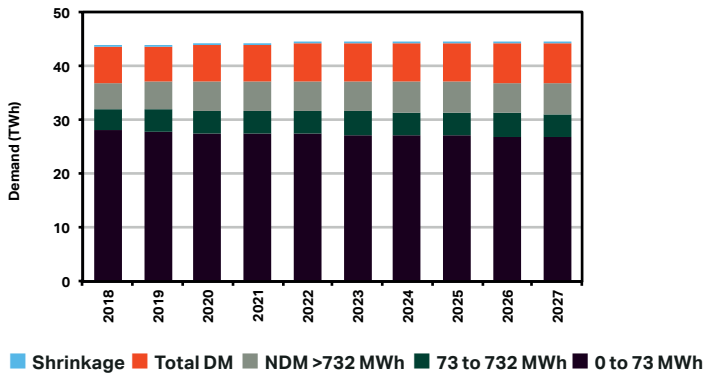


FIGURE A2.1A – East Anglia LDZ Forecast Annual Demand – Split by Load Categories

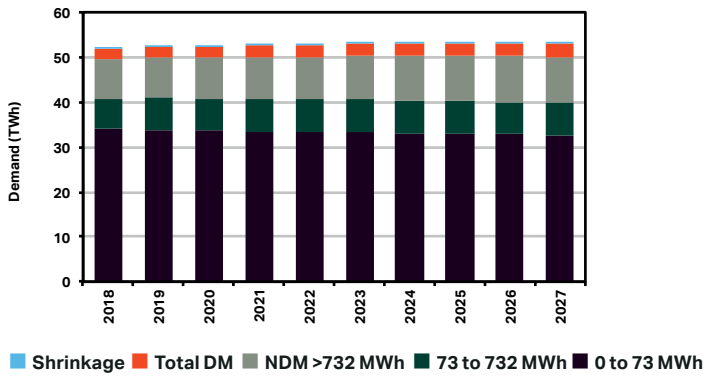


FIGURE A2.1B – East Midlands LDZ Forecast Annual Demand – Split by Load Categories

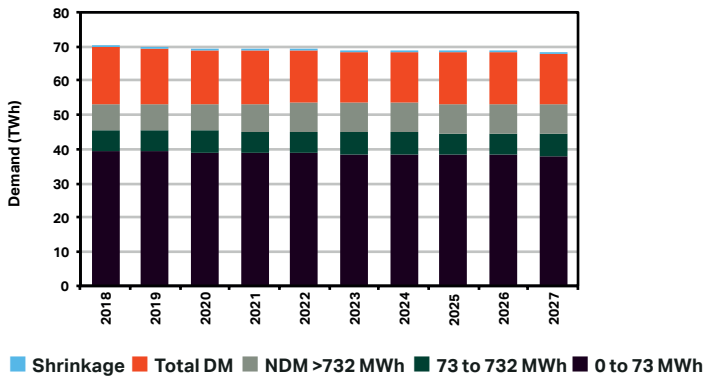


FIGURE A2.1C – North London LDZ Forecast Annual Demand – Split by Load Categories

# Appendices

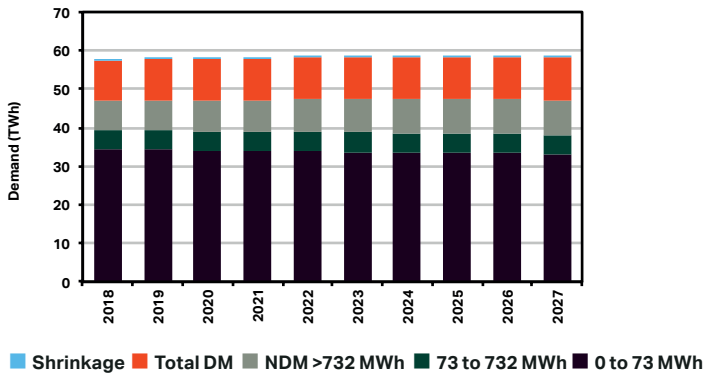


FIGURE A2.1D – North West LDZ Forecast Annual Demand – Split by Load Categories

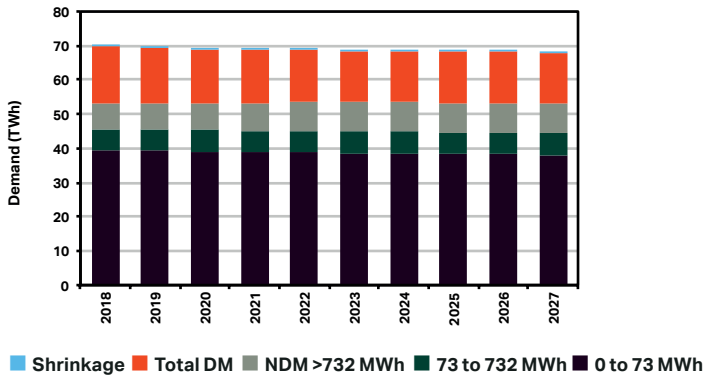


FIGURE A2.1E – West Midlands LDZ Forecast Annual Demand – Split by Load Categories

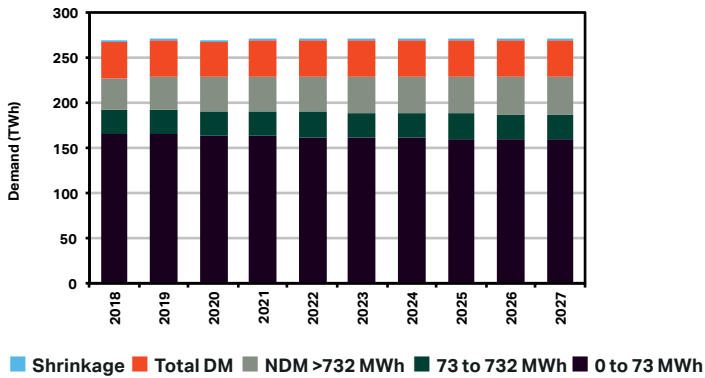


FIGURE A2.1F – Aggregate National Grid Gas LDZ Forecast Annual Demand – Split by Load Categories



# Appendices

## A2 – Actual flows 2017

### Annual flows

Forecasts of annual demand are based on average weather conditions. So when comparing actual demand with forecasts, demand must be adjusted to take account of the difference between actual weather conditions and seasonal normal weather.

The result of this adjustment is the weather corrected demand. Seasonal normal weather conditions are recalculated at appropriate frequencies determined by the cross-industry Demand Estimation Sub Committee (DESC). They were last updated in winter 2014/15 and are based on a historic dataset which has been adjusted for the effect of climate change using the Climate Change Methodology (CCM). This replaces the older EP2 method used between 2010 and 2014. For more information please refer to the document 'DESC Approach to derivation of new Seasonal Normal Basis'.

Tables A2.1A to A2.1E compare actual demands during the 2017 calendar year with the forecasts presented in the 2017 LTDP. Annual demands are presented in the format of LDZ bands/categories, consistent with the basis of system design and operation. All figures have been corrected in line with the CCM approach.

TABLE A2.1A - East Anglia LDZ Annual Demand for 2017 (TWh)

TWh	2017 Actual Demand	Weather Corrected Demand	2017 LTDP Forecast Demand
0-73 MWh	28.1	27.1	27.9
73-732 MWh	3.9	3.8	3.9
>732 MWh Firm	10.7	10.4	11.2
Interruptible	0.0	0.0	0.0
Total Consumption	42.8	41.4	43.1
Shrinkage	0.2	0.2	0.2
Total Throughput	43.0	41.6	43.3

TABLE A2.1B - East Midlands LDZ Annual Demand for 2017 (TWh)

TWh	2017 Actual Demand	Weather Corrected Demand	2017 LTDP Forecast Demand
0-73 MWh	34.8	28.0	34.8
73-732 MWh	4.6	3.9	4.6
>732 MWh Firm	18.3	10.6	17.9
Interruptible	0.0	0.0	0.0
Total Consumption	57.7	42.5	57.3
Shrinkage	0.2	0.2	0.2
Total Throughput	57.9	42.7	57.5

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TABLE A2.1C - North London LDZ Annual Demand for 2017 (TWh)

TWh	2017 Actual Demand	Weather Corrected Demand	2017 LTDP Forecast Demand
0-73 MWh	34.3	33.0	34.6
73-732 MWh	6.7	6.5	6.7
>732 MWh Firm	11.6	11.5	11.1
Interruptible	0.0	0.0	0.0
Total Consumption	52.5	51.0	52.3
Shrinkage	0.2	0.2	0.2
Total Throughput	52.8	51.2	52.6

TABLE A2.1D - North West LDZ Annual Demand for 2017 (TWh)

TWh	2016 Actual Demand	Weather Corrected Demand	2016 LTDP Forecast Demand
0-73 MWh	39.9	38.2	39.7
73-732 MWh	5.8	5.5	5.7
>732 MWh Firm	21.6	21.4	21.2
Interruptible	0.0	0.0	0.0
Total Consumption	67.3	65.0	66.6
Shrinkage	0.3	0.3	0.3
Total Throughput	67.6	65.4	66.9

TABLE A2.1E - West Midlands LDZ Annual Demand for 2017 (TWh)

TWh	2017 Actual Demand	Weather Corrected Demand	2017 LTDP Forecast Demand
0-73 MWh	29.8	28.8	29.6
73-732 MWh	4.4	4.2	4.3
>732 MWh Firm	11.6	11.6	11.4
Interruptible	0.0	0.0	0.0
Total Consumption	45.8	44.6	45.3
Shrinkage	0.3	0.3	0.3
Total Throughput	46.1	44.9	45.5

# Appendices

TABLE A2.1F - Aggregate National Grid Gas LDZ Annual Demand for 2017 (TWh)

TWh	2017 Actual Demand	Weather Corrected Demand	2017 LTDP Forecast Demand
0-73 MWh	166.9	155.0	166.5
73-732 MWh	25.4	23.9	25.2
>732 MWh Firm	73..8	65.6	72.8
Interruptible	0.0	0.0	0.0
Total Consumption	266.1	244.5	264.6
Shrinkage	1.3	1.3	1.3
Total Throughput	267.3	245.8	265.8

TABLE A2.2A - Actual GD UK Input Flows on Maximum Demand Day of Gas Year 2017/18 (Mcmd)

LDZ	Maximum Day	Demand	1 in 20 Forecast Peak for 2017/18
East Anglia	01-Mar-18	29.96	29.36
East Midlands	01-Mar-18	37.97	36.96
North London	01-Mar-18	36.55	37.16
North West	01-Mar-18	43.13	44.09
West Midlands	01-Mar-18	33.33	32.35

TABLE A2.2B - Actual GD UK Input Flows on the Minimum Demand Day of Gas Year 2017/18 (Mcmd)

LDZ	Minimum Day	Demand
East Anglia	27-Jul-18	3.30
East Midlands	07-Jul-18	4.68
North London	27-Jul-18	3.92
North West	07-Jul-18	5.89
West Midlands	28-Jul-18	3.22

## Appendices

### A3 – High pressure distribution system



#### North West



#### West Midlands



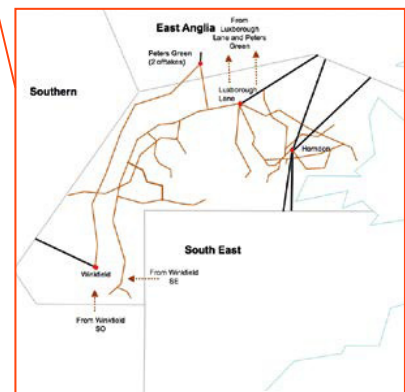
#### East Midlands



#### East Anglia



#### North London



# Key Contacts and Links

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If you would like to find out more our services or the wider gas industry, here is a list of useful website links.

- If you would like to give feedback on any aspect of our 2018 Long Term Development Plan, you can use the feedback form on the Cadent website **[cadentgas.com/LTDP](https://cadentgas.com/LTDP)**
- Cadent Connections: Taking or injecting gas  
**[cadentgas.com/Get-connected](https://cadentgas.com/Get-connected)**  
The Get Connected webpages provide further information for parties interested in connecting to our network.
- Dial before you dig and working safely near Cadent's gas network  
**[cadentgas.com/Digging-safely](https://cadentgas.com/Digging-safely)**
- The future role of the gas network in a low emission energy system  
**[cadentgas.com/About-us/The-future-role-of-gas](https://cadentgas.com/About-us/The-future-role-of-gas)**
- National Grid Future Energy Scenarios  
**[fes.nationalgrid.com](https://fes.nationalgrid.com)**  
Find out more about the future energy scenarios underpinning our supply and demand forecasting
- Ofgem  
**[www.ofgem.gov.uk](https://www.ofgem.gov.uk)**  
The agency responsible for regulating Great Britain's gas and electricity markets.
- BEIS  
**[www.gov.uk/government/organisations/department-for-business-energyand-industrial-strategy](https://www.gov.uk/government/organisations/department-for-business-energyand-industrial-strategy)**  
The Department for Business, Energy & Industrial Strategy is a Government department bringing together responsibilities for business, industrial strategy, science, and innovation with energy and climate change policy.
- Energy Networks Association  
**[www.energynetworks.org](https://www.energynetworks.org)**  
The organisation that represents electricity and gas network operators. They influence decision makers about regulation, cost and safety matters and facilitate best practice and collaboration across energy industries.
- Energy Utilities Alliance  
**[www.eua.org.uk](https://www.eua.org.uk)**  
A not-for-profit trade association that provides a leading industry voice to help shape the future policy direction within the energy sector.
- The Natural Gas Vehicle (NGV) Network  
**[www.eua.org.uk/natural-gas-vehicles-network](https://www.eua.org.uk/natural-gas-vehicles-network)**  
Formed to promote natural gas and biomethane vehicles as a transport solution
- Office for Low Emission Vehicles  
**[www.gov.uk/government/organisations/office-for-low-emission-vehicles](https://www.gov.uk/government/organisations/office-for-low-emission-vehicles)**  
The Office for Low Emission Vehicles works across Government to support the early market development, manufacture and use for ultra-low emission vehicles. Read how their work helps to reduce greenhouse gas emissions and air pollution on our roads.
- Joint Office of Gas Transporters  
**[www.gasgovernance.co.uk](https://www.gasgovernance.co.uk)**  
Read about the Uniform Network Code on the Joint Office website. This site also contains details of live modifications to the UNC document and details of the technical committees.

■ **Smell gas?**  
Contact the National Gas Emergency Service if you have any concerns about gas safety on:  
**0800 111 999**





Your Gas Network

This statement is produced for the purpose of and in accordance with Cadent Gas Ltd obligations in Standard Special Condition D3<sup>1</sup> of its DN Gas Transporters Licence and section O4.1 of the Transportation Principal Document of the Uniform Network Code in reliance on information supplied pursuant to section O of the Transportation Principal Document of the Uniform Network Code. Section O1.3 of the Transportation Principal Document of the Uniform Network Code applies to any estimate, forecast or other information contained in this statement.

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1. Standard Special Condition D3 requires that a statement, published annually, shall provide a ten-year forecast of Distribution Network Transportation Activity concerning likely use of the pipeline network and system developments that can be used by companies, who are contemplating connecting to our system or entering into transport arrangements, to identify and evaluate opportunities.

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