October
2022

Cadent
Your Gas Network

Developing networks for the future

Long-Term Development Plan 2022

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We are Cadent

Your gas network

About Cadent

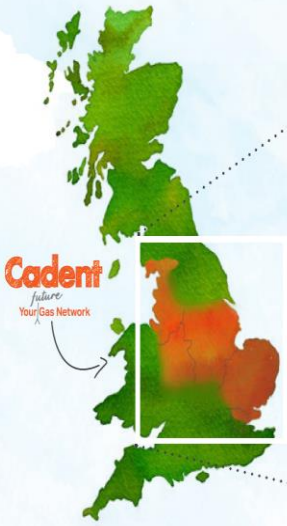
Our responsibilities and geographical reach

Cadent is the largest gas distribution company in the UK. We deliver fossil gas to 11 million homes and businesses throughout the North West, West Midlands, East Midlands, South Yorkshire, East of England and North London – helping keep consumers on our network safe and warm.

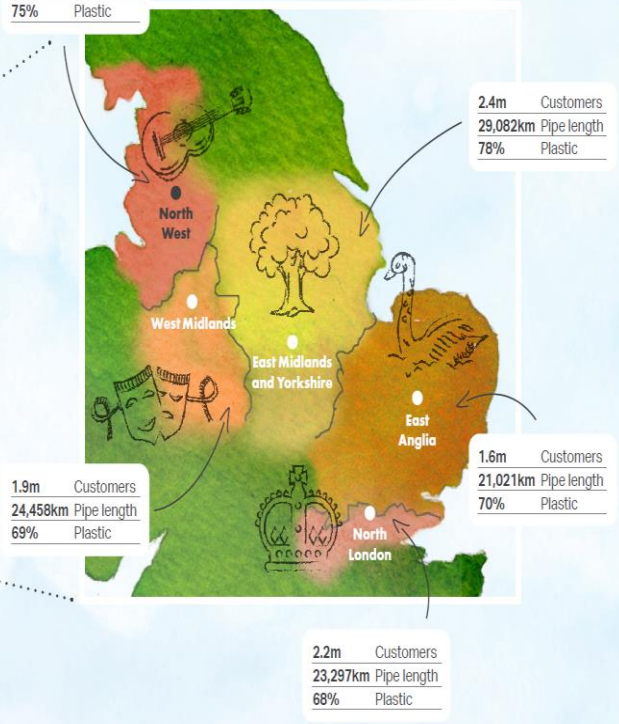
In doing this we are responsible for maintaining our network, ensuring that it operates safety and reliably for those who rely on it. We also help homes, businesses and renewable gas suppliers connect to our network.

Cadent supports the commitment to net zero emissions by 2050. We know that the fossil gas we deliver through our network today is part of the problem and not part of the solution. Low carbon heating technologies need to be deployed across our network – and beyond.

Even as a gas network we are clear that there is a significant role for both heat pumps and low carbon heat networks in the future mix. We also believe that green gases such as hydrogen will be needed if we are to be successful. This requires us to consider where there might be a role for our gas distribution network and where there might not be.



Regions
in which we operate



Cadent
future
Your Gas Network

11m homes and businesses connected to our network

6,155 employees helping consumers on our network keep safe and warm

132,396km of pipe across our region

"We provide the energy our customers need to stay safe, warm and connected. Our responsibility is to look after the gas pipes so they can continue to deliver safe, reliable and low carbon energy for years to come. We are continually finding smarter and more sustainable ways to develop our networks and work closely with local communities to deliver a high quality service that our 11 million customers expect. We are proud to keep the energy flowing."

Welcome to the Long-Term Development plan (LTDP) 2022

It's been another exciting 12 months for Cadent with hydrogen again taking centre stage, with it being recognised by many as a necessary contributor in the move to net zero. HyNet, an ambitious project that will tackle industrial decarbonisation and unlock a low carbon economy for the Northwest is progressing as a lead project for UK Government investment.

Our plan to create the first 'hydrogen village' in Ellesmere Port has taken a step closer, where we are looking to convert around 2,000 homes in the Whitby area from natural gas to hydrogen. To support this Cadent has opened the Hydrogen Experience Centre in Whitby, welcoming the local residents of Ellesmere Port to find out more about the Hydrogen Village trial and try 100% hydrogen gas appliances for themselves.

We believe our gas network has a crucial part to play in the move to net zero, it's a valuable asset that is getting renewed annually through our pipe replacement programme. Cadent has a pivotal role in stimulating debate, developing, and investing in technology, and working collaboratively with a wide range of stakeholders to shape the net zero future of the UK economy.

This annual document shares our thoughts on the future and the evolution of the network, and which investments we plan to make in order to keep our customers' supply safe and secure, while maintaining the high reliability the network can deliver.

Our business plan commits us to continuing investment in our network to allow new demand to be connected, and increased volumes of low-carbon biogas to be transported. It also includes the continuation of our asset investment programme, notably the iron mains replacement programme which is improving the safety of our network, reducing our greenhouse gas emissions and getting our network one step closer to being hydrogen-ready.

We have 42 biogas connections to our network and are investing to allow greater volumes in the future, there are also 150 gas fired power generation units supplying electric at peak periods to customers.

Working with our industry, our hydrogen development work is accelerating. In addition to our work looking at blending hydrogen, HyNet will decarbonise heavy industry in the Cheshire, Liverpool and Manchester regions and potentially provide hydrogen to decarbonise domestic heat as part of a trial. The Hydrogen Village programme will show how hydrogen can be used as an alternative solution to natural gas in reducing carbon emissions through heating homes.

It's becoming clear regional plans and whole energy system solutions could be the way forward to ensure costs for net zero do not greatly impact our customers. We will need to work collaboratively with the wider energy industry to ensure we understand customer demand and can respond to the changing needs and patterns of energy use.

We're now planning to prepare our networks for the future. I hope you find this report both interesting and informative. We welcome any views you have on the plan, including ideas for improvement. Please share your feedback with us at **cadentgas.com/ltdp.**

Dave Moon, Director of Asset Investment

Our customers

Stakeholder engagement

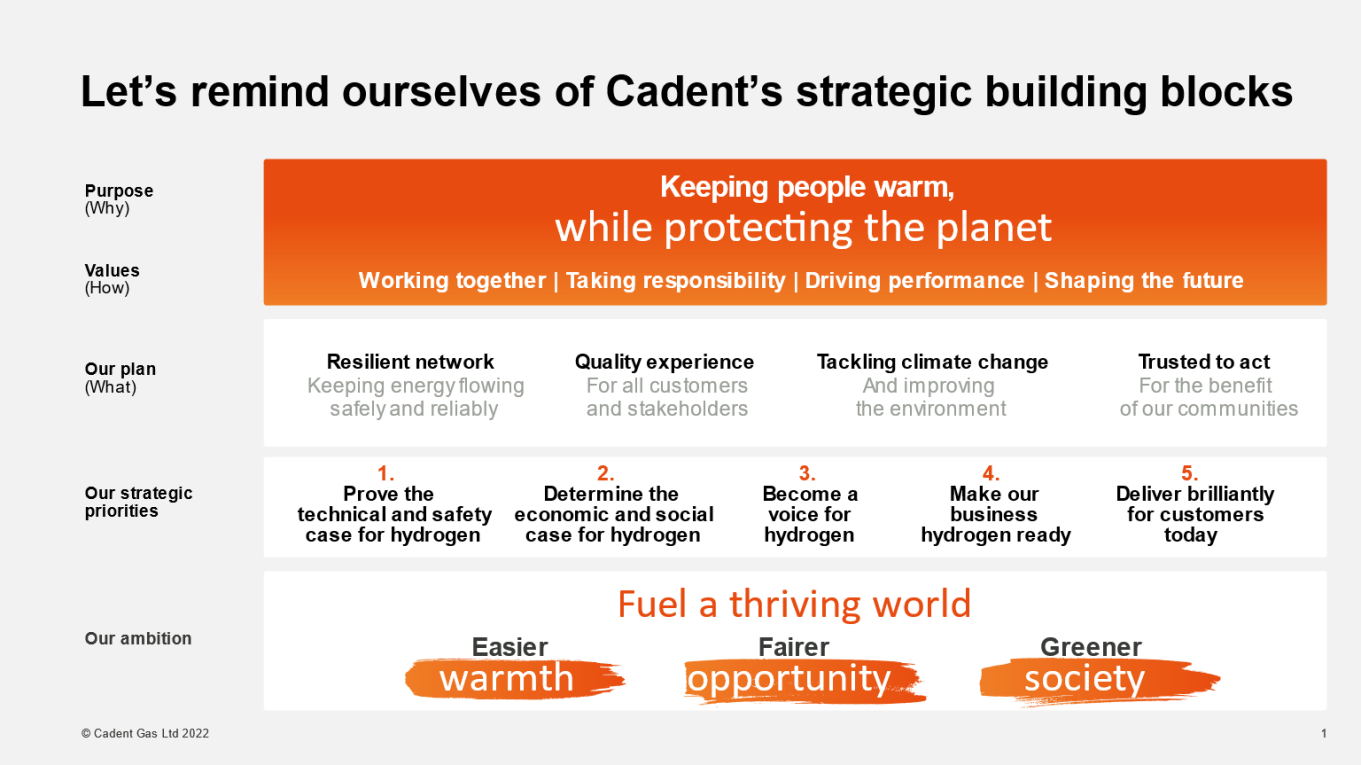
We have continued to engage with a wide range of stakeholders and customers to ensure that our brand remains relevant to society's changing needs.

Although our plans have remained consistent with our stakeholders telling us to take a leading role in helping Britain 'build back better' and the 'levelling up' agenda, the cost-of-living crisis has been an area of significant impact.

We continue to the rise to the challenge, transforming our business operations, values and purpose, investing significantly in people, processes and systems to drive both a customer centric immediate need particularly for fuel poverty while balancing a future focused culture. Our new Force for Good strategy, which is built on the premise of making life easier, fairer and greener for our communities will create a lasting and positive social impact, demonstrating our commitment to delivering excellence today and seeking better solutions for the future.

Our Purpose: **Keeping people warm, while protecting the planet.**

Our Values: **We work together, we take responsibility, we drive performance, we shape the future.**



Our stakeholder engagement Strategy

Our engagement strategy is centrally defined and regionally delivered. It is fully embedded in our business and ensures the strategic alignment of engagement activities across the whole company. It allows us to engage in a way that is tailored to our customers and stakeholders and has the following aims:

- To inform and support the delivery of our Business Plan

- To assess how we are performing against our company's purpose, values, the strategic objectives that underpin them and whether we need to do more
- To be a key element in building trust with our customers, stakeholders and employees
- To establish and maintain a fully engaged workforce with a clear and consistent focus
- To ensure our stakeholders are kept informed in a timely way
- To educate customers and stakeholders on the options for low carbon heating solutions and establish ourselves as thought leaders around hydrogen and the energy transition
- To be a key enabler in helping us to anticipate changing customer/societal needs and expectations; when we consider the current uncertainty that exists around future energy policy and aligning thinking across the industry and beyond
- To gather critical insights on how we can make things fairer, easier and greener to ensure that no one is left behind in the UK's energy transition.

Our commitment to ongoing engagement

Customer and stakeholder insight and engagement is a core part of Cadent's operating model. We have a dedicated Customer Insights team and stakeholder specialists located across the UK to work with regions in both receiving information and imparting it, creating long term strategic relationships across the organisation. It also feeds directly into Cadent's governance process, with Board papers capturing the results of research and engagement programmes to inform the decision-making process. We operate a Critical Friends Panel, which is made up of independent experts in areas such as sustainability, customer research and energy policy and we are looking to evolve this process over the course of the next 6-months, establishing closer ties with Cadent's wider governance arrangements to maximise the benefits it provides.

Customer engagement

Our Customer Forum continues to be an engagement channel that allows us to test our strategies and plans with a diverse group of people living across all our networks. This includes hard-to-reach audiences such as customers in fuel poverty, people with compounded vulnerabilities, future generations and those whose first language isn't English. The forum has grown to 150 informed and uninformed customers to ensure that we have a range of views from different perspectives. In addition to the Forum, we engage with thousands of customers each year through targeted research programmes, using a variety of qualitative and quantitative methods. This year, much of our focus has been on customer attitudes and behaviours in terms of their energy use and preferred low carbon alternative to natural gas. We've also focussed on how we can better support customers through the cost of living challenges.

We also completed regular 'temperature checks' where we engage with both Forum members and other customers to assess if the priorities that we established with them in our business plan remain the same, or where focus could be shifted.

Strategic relationships

Enhancing our relationships with partners remains a priority as our services have expanded in response to stakeholder feedback and evolving customer requirements. We regularly review outcomes and performance using our partnership evaluation tool to ensure that the partnership is delivering against its aims and re-categorise depending on the outputs and conclusions.

Maximising digital technologies

During the COVID pandemic we were forced to find new ways to engage with stakeholders. With less opportunity to meet face-to-face up to 85% of our engagement was moved to digital methods such as online focus groups, roundtables and events conducted on Teams and Zoom as well as one-to-one video calls and webinars. We have continued to use these approaches where it make sense to do so, considering the marginal benefits of face to face interaction vs. the marginal costs of time, money and environmental factors.

If you would like to find out more about our engagement journey, please visit **cadentgas.com/engagement.**

Gas billing in a low-carbon world

As the UK prepares for a future where a range of sources provides us with low carbon energy, it is crucial that the way customers are billed keeps pace with this.

How it can be managed

With 84% of UK homes currently heated by gas, we want to help customers move to low-carbon energy, through hydrogen and other green gases, in a way that's affordable and convenient. Future Billing Methodology (FBM) was a proof-of-concept project that has explored options for a fair and equitable billing methodology for the gas industry which will be fit-for-purpose in a lower-carbon future. It aimed to integrate diverse gas sources without needing to standardise energy content by means of enrichment or ballasting and is informing the industry on potential billing options to support decarbonising the Great Britain gas networks and open the pathway towards a net-zero carbon heat future.

The project developed 5 potential options for tackling billing and through technical evaluation and cost benefit analysis (CBA), recommended 2 of these are taken forward for further consideration. This was put to a wide spectrum of industry stakeholders via a 'call-for-input' style consultation co-ordinated with Xoserve, which included several roundtable events. The results of the technical analysis, CBA and industry responses have been distilled into a final recommendation and submitted to Ofgem on 31st March 2022.

How we consulted

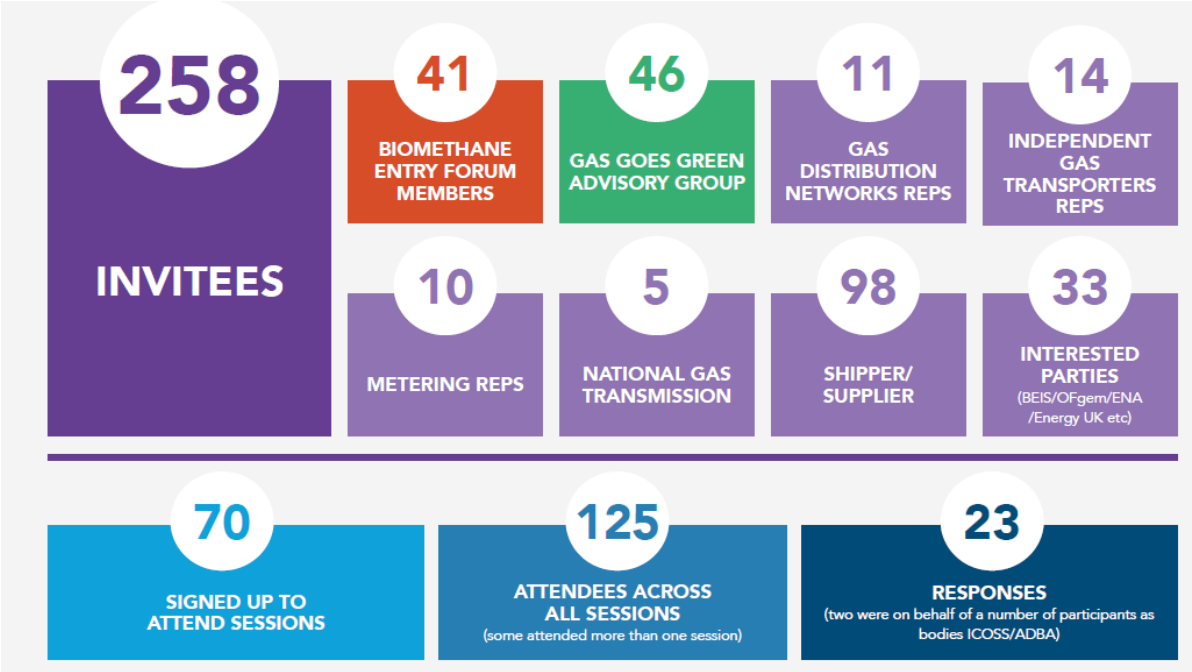


Figure 1 : FBM consultation summary

Recommendations

Following the consultation, the final project recommendations are:

a) Blending of green gases can be achieved within the existing frameworks, if delivered in a controlled way, and should be pursued in the first instance

b) In parallel, the FBM results have demonstrated that network modelling could be used for predicting calorific value (CV) and that further work into using a modelled CV from billing should be pursued in the form of a detailed feasibility study.

Recommended approach

- **Implement Option A**

  Options for billing reform require further work and there is an urgent need to make policy decisions on heat, such as hydrogen blending in 2023. It is therefore recommended that gas distribution networks should immediately proceed with developing the minimal changes required to deliver Option A. This will facilitate the development and growth of hydrogen supply from clusters to develop and gain the benefits of the blending connections strategy for biomethane connections, with least investment at risk.

- **Commence feasibility study for Option C**

  Option A has limitations of scale, with current regulatory constraints capping blending rates to within ca. 5%$_{vol}$ until hydrogen can deliver blend volumes as the majority of gas energy in the LDZ. Billing reform is needed to accelerate the benefits of biomethane and hydrogen blending for heat and Option C could deliver one consistent methodology to achieve this. It is therefore recommended that the feasibility of Option C is explored immediately in parallel to Option A.

- **Consider Option B within development of Option C**

  With regard to Option B, it is recommended that the development of this option should be explored as part of the feasibility study for Option C, to determine whether it could be delivered in a way which avoids conflicting systems changes, redundancy, and associated cost stranding.

Figure 2: FBM reform options

Facilitating connections to our networks

We are continually assessing the service we provide to customers who want to connect to the gas grid to receive a safe and reliable gas supply.

Connections

In 2021-22, we facilitated 17,328 new connections for our customers. We envisage the figure to remain static and to start to reduce as we head towards 2025. It is difficult to forecast past this date with the uncertainty around the use of fossil gas boilers in new homes and net zero ambitions.
We offer a variety of services to our connection's customers, including:

- Household connections and alterations
- Business-to-business connections and alterations, including more complex projects.

Our service extends beyond connecting paying customers; we recognise the importance of supporting fuel poor customers. Living in a cold home can have much wider impacts than just financial ones, affecting areas such as the physical and mental health of families, and educational attainment of children. We offer free and discounted connections under the Fuel Poor Network Extension Scheme (subject to eligibility criteria) and connected over 3,200 households at risk of fuel poverty in 2021-22. By offering this service, we reduce fuel poor customers' energy costs and improve their quality of life.

Gas-fired power generation

Over the last year the numbers of enquiries and quotation applications we have received for power generation sites across our networks has levelled however the market segment is still strong and operators are continuing to invest in new sites within hotspot areas within Cadent's network. We currently have 150 power generation sites connected to our network, generating 1866MW of electricity, and a further 60 sites in the feasibility and design stage. Cadent have continued to work with the Power Generation community and Utility Infrastructure Providers (UIP) over the last 12 months, providing support throughout the lifecycle of the projects with increased focus on design and commissioning phases of these projects.

Connection Type	East Anglia	East Midlands	North West	West Midlands	North London	Total
Power Generation Sites	23	45	56	9	15	150

Table 1: Total Power Generation connections to our networks by area

Competitive connections

We also process competitive connections within the industry, such as:

- **Connections to IGT networks:** These independent networks are connected to ours, but the IGT owns and operates the network
- **UIP connections:** A UIP is responsible for designing and constructing the network, which will then be owned and operated by Cadent or an IGT.

Our connections team is continuously improving our service to customers. We recognise that understanding our customers' needs will allow us to evolve our proposition to meet and exceed expectations.

Detailed information on all our connections services, including contact details, incentives for fuel poor areas, charges, and terms and conditions, can be found at **cadentgas.com/get-connected.**

Off gas grid decarbonisation

The government is considering how to reduce carbon emissions from high-carbon domestic heating systems such as oil and coal. We believe that in some circumstances, where the gas network is nearby, extending the gas grid to a community represents the lowest cost pathway for the residents. Gas is an attractive option which minimises disruption compared to the alternatives. We commissioned a report to assess the wider socio-economic benefits of switching from oil or coal to gas, and this showed a minimum net present value of over £6,000, with a much higher amount when switching from more polluting fuels.

There is therefore strong evidence that switching from oil or coal to natural gas achieves significant benefits, including carbon emissions reductions, and these would be further improved by renewable gases. Indeed, the new heating systems could be futureproofed to accommodate a future switch to hydrogen.

With this clear benefit, our future plans include stepping up the support we can provide for off gas grid communities seeking to connect to our network. We are also trialling gas network extension, to demonstrate the added value and provide the evidence needed to influence regulatory changes and ensure such extensions become business as usual.

We would welcome feedback on such an approach, particularly from any off-gas grid areas where extending the main gas network may be supported. You can share your feedback with us at **cadentgas.com/ltdp**.

Renewable Energy and the Environment

Our environmental performance

Cadent shrinkage

Shrinkage is gas that leaves our network without passing through a meter. It is estimated using an Ofgem approved methodology. Shrinkage includes gas that leaks or is vented from our system (leakage), gas that is used for our operational purposes, for example preheating prior to pressure reduction (own use gas) and gas that is stolen upstream of the meter (theft of gas).
The largest contributing factor to a gas transportation network's greenhouse gas emission is leakage, therefore the leakage of natural gas contributes to global warming. Shrinkage gas also contributes to customers' bills and therefore any reduction in emissions will decrease our environmental impact and deliver customer savings.

Calculating shrinkage

To estimate leakage from our gas distribution system, we assess the emissions from our pipes and above ground assets, in addition to an estimate of leakage associated with specific pipe interference damage incidents.

RIIO-1 performance

We are proud of the progress made in reducing emissions since the start of the RIIO1 regulatory period as we focused on three key areas:

- Delivery of the pipe replacement programme by inserting plastic into our metal pipes
- Optimisation of system pressures in the local networks
- Injection of mono-ethylene glycol (MEG) into our networks, which helps reduce leakage by swelling pipe joints.

Based on an assumed typical annual consumption of 12,500kWh for a domestic customer, the reduction in emissions since the start of RIIO-1 is equivalent to the typical gas usage of over 185,000 domestic properties.

	Opening	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
East of Eng (tCO2e)	667,714	624,133	602,472	581,418	580,663	566,945	542,885	527,822	503,170	485,432
London (tCO2e)	351,099	334,911	324,160	316,670	308,933	293,229	276,328	264,695	255,892	248,960
North West (tCO2e)	512,493	480,094	463,835	443,553	430,192	416,704	396,603	380,565	354,664	343,492
West Mids (tCO2e)	430,920	413,224	399,318	381,785	377,816	367,828	355,861	338,573	327,652	319,627
Cadent (tCO2e)	1,962,227	1,852,361	1,789,786	1,723,426	1,697,604	1,644,706	1,571,678	1,511,655	1,441,378	1,397,511
Cumulative % Reduction		-6%	-9%	-12%	-13%	-16%	-20%	-23%	-27%	-29%

Table 2: Carbon reduction performance for RIIO-1 (Global Warming Potential 28)

Mains replacement

The biggest reduction in our year-on-year emissions is from the delivery of the mains replacement programme which replaces ageing metallic pipes with polyethylene. The benefit from this is enduring – once the metallic pipe has been replaced, the environmental benefit is continual.

Average system pressures

We have introduced bespoke operating strategies for our largest networks; these strategies include specific settings to ensure pressure compliance whilst running the networks in the most efficient manner to reduce leakage.

Monoethylene glycol injection

In some of our networks we still have a large percentage of iron mains that have lead yarn joints. These joints, which can dry out and cause leaks, are treated using mono-ethylene glycol, which reduces the rate at which gas leaks from them by swelling the joint.

Future emissions

Our emissions will mostly be influenced in the future by the progression of the mains replacement programme. Over the coming ten years we anticipate a 24% reduction in emissions as the number of metallic mains in the network decreases.

Based on an assumed typical annual consumption of 12,500kWh for a domestic customer, the reduction in enduring emissions for the next ten-year period is expected to be equivalent to the typical gas usage of approximately 140,000 domestic properties.

The role of biomethane in achieving net zero

Contributing towards a green economy

In the immediate future, the gas networks will play a leading role in reducing emissions using renewable energy. There are several areas where we support cost-effective solutions to deliver emissions reductions, such as the growth of green biomethane plants and the use of gas in the transport sector. We support and facilitate green fuels connecting to our networks, and work with the industry to remove barriers to their continued growth.

Introducing new sources of gas into the existing gas network represents a relatively low-cost decarbonisation option, allowing us to improve the reliability of the UK's energy infrastructure.

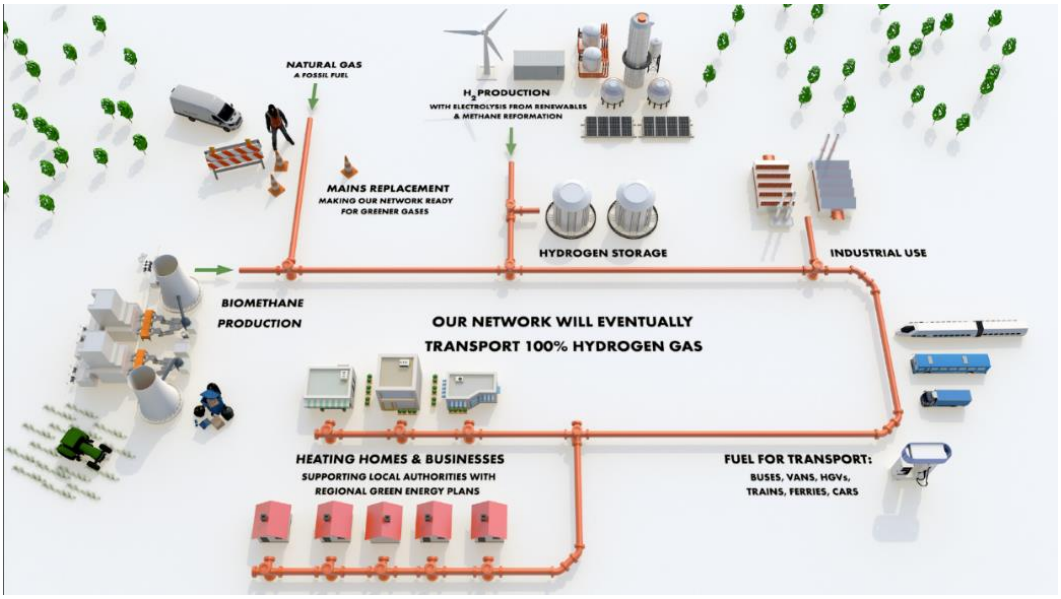


Figure 3: Introducing greener gases into our network for decarbonisation

When considering the supply of renewable gas such as biomethane, we consider domestic heat and transport to decarbonise the UK and meet emissions reduction targets and energy efficiency ambitions.

Biomethane connections

Biomethane is produced by fermenting organic matter, with feedstocks ranging from farm and animal waste to food and sewage waste, crops and silage. In addition to energy decarbonisation benefits, the production and injection of biomethane into the gas grid affords a green and sustainable solution to waste management for industrial, commercial and domestic users as well as providing an additional green, revenue stream.

Figure 4: Biomethane sites on our network

We continue to engage with our customers so we can refine our processes to facilitate continued growth in the biomethane sector resulting in greater volumes of green gas production and injection into our network. Alongside this, developing a collaborative maintenance framework to meet Cadent's legislative obligations whilst the plant is operational and flowing biomethane into the gas grid.

We have now successfully connected 42 biomethane sites to our network, which have the potential to heat up to 268,117 homes annually. We are continuing to work with any new biogas customers since the introduction of the new Green Gas Support Scheme which has provided the market with a sustainable financial and environmental future for biomethane to gas grid and has resulted in a renewed interest in the connection of biomethane sites to Cadent's network.

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. We are continually reviewing and refining our processes through lessons learned following project commissioning. We are encouraged that we have seen an increase in enquiries from our customers for connection of plants, with several plants confirmed for connection during 2023/24. We continue to work with Industry and BEIS to open further potential growth through the conversion of existing anaerobic digestion (AD) plants to Gas to Grid from Combined Heat and Power (CHP) as these assets come to their natural end of life as we are seeing a step change within the market, with the move of existing AD sites from a sole CHP, to combined with a new gas to grid connection

It is clear that biomethane will play a vital part in the transition to a sustainable future, endorsed by the government and fully supported by the AD industry. We will build on the experience that we have gained to date delivering the 42 biomethane plants connected and continue to work collaboratively with the AD community to drive further innovation to maximise the full potential of AD to gas grid.

RIIO Plan	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23
Sites connected	1	10	22	28	29	32	35	36	38	42
TWh Actual	0.07	0.64	1.44	1.78	2.03	2.38	2.52	2.62	2.80	3.08

Table 3: Total Biomethane connections and TWh production

Biomethane supply

> "In the medium term, biomethane can readily be accommodated in the gas distribution pipeline system alongside hydrogen blended at a rate of up to 20%."

Renewable gases like biomethane can be injected straight into the existing gas distribution network, and customers won't need to make any changes to their appliances for heating or cooking. Whilst renewable gases contain the same methane molecules as natural gas, they contribute a significant overall reduction in greenhouse gas emissions due to their sustainable production, along with the avoidance of methane emissions from waste feedstock. In the future, we can offset the minor emissions produced by renewable gas using carbon capture.

We sponsored a **study by Anthesis Consulting Group PLC and E4tech UK Ltd**, looking at the potential scale of bioresources available within the UK to make low carbon gas. The study 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 afforded by government incentives through the Green Gas Support Scheme. We will continue to work closely with government to communicate clearly, the vital role gas plays in the energy mix, so that investors and the supply chain can have confidence for the long term. We will play a full role in supporting the flow on our network by investing to provide capacity where it is required and working with our colleagues across the gas networks to share best practice.

Facilitating distributed entry gas

Entry capacity remains a challenge for the growth of the renewable gas sector in some areas of the gas networks. Cadent have been working on an innovative project partnering with Wales & West Utilities (WWU), tackling this barrier to connect for customers head on through the OptiNet project with a Reverse Compression solution and optimised pressure control. The purpose of this project is to prove the concept of network solutions, unlocking of capacity in the lower pressure tiers of the network through compression to the higher-pressure tiers and a solution that can be replicated in capacity-restricted areas to facilitate the opportunity for more injection of unconventional sources of green gas, supporting the UK's target of net zero greenhouse gas emissions by 2050.

The project has successfully completed the smart pressure control trial and following a pause due covid-19 challenges, the compressor has now been installed with our East Midlands network with final site works planned for completion and operational early 2023.

This solution could also benefit already connected biomethane plants reach the maximum continuous flow rate, 365 days of the year, when currently they are restricted during summer months due to network constraints.

A Changing network

The renewable gas connections to our networks are changing the role and nature of the UK energy system. We continue to work collaboratively with the AD community and the Gas Distribution Networks (GDNs) through the newly formed 'Customer Entry Forum', to drive standardisation and growth of green energy for biomethane connections.

We have implemented change to several key process areas and a number of technical guidance documents collaboratively across the GDNs and with biomethane producers and their service providers, resulting in demonstrable benefits for all parties.

To find further information on our entry gas connection services for biomethane, or other forms of distributed gas, please visit **cadentgas.com/services/gas-producers/biomethane**.

Enabling cleaner transport

On the road to a zero-emission future

We recognise the government and industry focus on replacing UK cars with electric vehicles as a positive step. However, around 19% of transport emissions come from buses, heavy goods vehicles (HGVs) and other vehicles that we rely upon to deliver the goods and materials needed by our economy.
Unlike smaller city-purpose cars, these vehicles are not as suitable for battery-electric solutions due to their higher mileage requirements and much heavier weights. Fortunately, renewable gas provides more practical and feasible green alternatives for such purposes.

Figure 5: Example units from Cadent's zero emission fleet

Decarbonising transport

We have been promoting two primary routes to power these vehicles: biomethane (via compressed/liquefied natural gas – CNG/LNG) and hydrogen (via fuel cell electric vehicles - FCEVs), each at different levels of market readiness. We see an important role for both biomethane and hydrogen in delivering the fastest decarbonisation of transport possible. This was supported by the Government Hydrogen Strategy update in August 2021. Emerging evidence demonstrates the important role for biomethane in delivering emission reductions from HGVs throughout the 2020s and early 2030s, as shown within our Green Gas Transport Pathway report.

The benefits from leveraging our gas networks to support the transport sector include:

- Supporting UK CO_2 emissions reduction and cleaner air in cities.
- Maximising the use and benefit of our gas networks with new demand from a new sector.
- The potential for our gas networks to form the backbone of national filling station infrastructure (the Zemo Partnership WTT report found that network-transported 100% hydrogen provides the most efficient, lowest emission distribution pathway).

Hy4Transport

Looking longer-term – hydrogen has significant potential to decarbonise sectors that have proven highly difficult to 'electrify', such as heavy transport. This presents a great opportunity for the existing gas network to add major value to the decarbonisation of transport – if a reliable, accessible, and economical refuelling infrastructure is developed – as was identified in our NIA-funded Hydrogen Grid to Vehicle (HG2V) work.

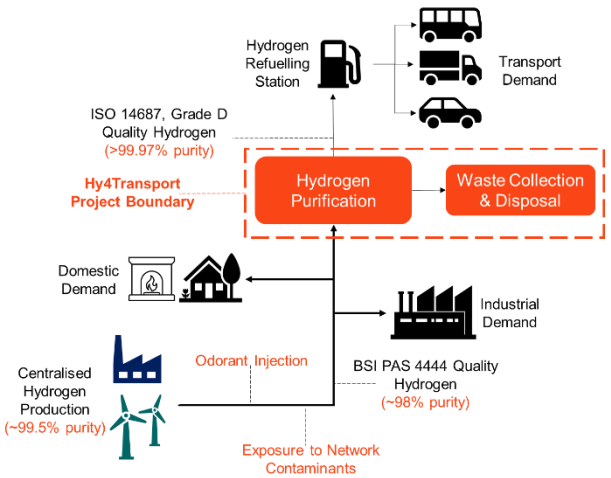


Figure 6: Hy4Transport Concept Diagram & Project Boundary

Our Hy4Transport project has evolved from this and aims to deliver essential evidence and demonstrates the technical and commercial viability of purifying grid-supplied hydrogen, so that it can be used for FCEVs. This could link the decarbonisation of both heat and transport in a way that may prove to be more efficient, and economically favourable, than alternative options further stimulating the growth of hydrogen production and demand. We were awarded 'Phase 1' funding by BEIS to conduct a full 8-month Feasibility Study this year, as part of the Low Carbon Hydrogen Supply 2 Competition.

Phase 1 of the project explored how grid-supplied Hydrogen can be purified for utilisation in FCEVs across the UK transport sector. We intend to demonstrate this concept in practice throughout a future Phase 2 to prove that we can provide a reliable, safe, and cost-competitive supply of fuel cell grade hydrogen to support future low carbon UK transport infrastructure.

Biomethane Vehicles

Each 100% biomethane-powered HGV typically saves up to 84% (typically 130-150 tonnes per year) of CO_2, compared to the same vehicle powered by Euro VI diesel (a standard diesel blend).

We are actively decarbonising our own fleet, converting our HGVs to bio-CNG, which will reduce our greenhouse gas emissions by more than 500 tonnes/year. We are also operating a number of CNG vans in our Northwest and West Midlands networks to understand how these will reduce the emissions associated with roadside working.

The Warrington bio-CNG refuelling station, which is owned and operated by *CNG Fuels* and connected to our network, is one of the largest bio-CNG stations in Europe.

The facility can refuel 12 trucks simultaneously from ten dispensers and is capable of dispensing more than 300GWh of biomethane per year which equates to a reduction in greenhouse gas emissions of 100,000 tonnes per year. In order to meet the increased gas demand, we carried out key reinforcements to the local gas network.

Figure 7: Warrington bio-CNG refuelling station

Network	East Anglia	East Midlands	North London	North West	West Midlands	Total
CNG Fuelling Stations	1	3	2	4	1	11

Table 4: Total CNG connections to the Cadent network by area

The number of natural gas filling stations for HGVs has started to grow, with eleven now fully operational including Hatfield (in partnership with *GasRec*), which is supporting *Ocado*'s growing fleet of gas-powered vehicles. We are pleased to update that *CNG Fuels*' large-scale, publicly accessible refuelling station at our National Distribution Centre in Erdington, Birmingham – capable of refuelling over 500 HGVs per day - has been completed and will reduce emissions from our own vehicles and other fleet operators in the area. We have also connected a new *CNG Fuels* station in Knowsley (500 HGVs per day) and an additional station in Corby is planned.

Electrification of our FCO fleet

Towards the end of 2019 we commenced operational trials of electric vans for our North London First Call Operative (FCO) fleet. Expanding from this, we have now rolled out EVs across all four of our networks - with a RIIO-2 commitment to make every one of our 1,100 FCO vans zero-emission across our networks by 2026, in line with our Environmental Action Plan.

We currently have 80 electric FCO vans in operation and have inducted a further 95 by the end of September 2022. We then plan to have 360 in place by March 2023. We have learned many lessons, during the roll out, which has put us in the best place to deliver on our promises and approach the full roll out in an informed and structured manner, drawing from advising partners such as *Cenex*. In addition to this we are exploring the potential to use electric motorcycles for our first responder riders.

Shaping the Future

Transitioning the energy networks to net zero

Our focus remains on enabling an effective transition of our gas network to green gases

We recognise the biggest impact we can have as a gas distribution company is to encourage and enable the switching away from fossil gas, that we transport through our pipes today, to green gases such as hydrogen. We can say with near certainty that in 30 years' time, we will no longer be doing what we do today. It is likely however that green gases will play a key role. We have therefore continued to focus on developing our overall approach to net zero.

We have organised ourselves to be the most effective in thinking about the near, medium and long-term solutions where the existing infrastructure, that our customers have already paid for, could be repurposed to carry low carbon gases.

We continue to invest significantly in our Future of Gas (hydrogen) programme, which has created a positive momentum both across our research activities, but also in providing a clear pathway for hydrogen as a viable energy source of the future.

Figure 8: Hydrogen fuelled gas hob

This covers both blending hydrogen into the gas network at a concentration of up to 20% and then later, a full transition to 100% hydrogen in the gas network.

Our work, combined with the collective work across the sector, is supporting the government and other key stakeholders in their decision making around the plans needed for the UK to achieve net zero by 2050. We are actively working on projects to aid the government in achieving their 10-point plan (published in 2020), such as our hydrogen village conversion project in the Northwest and soon, initial feasibility studies into the conversion of a number of towns to hydrogen.

In October 2022 we launched a digital campaign (Hello Hydrogen) aimed at domestic customers, which will seek to raise awareness of the role hydrogen can play in helping the UK achieve net zero. This campaign is being undertaken in conjunction with other gas networks, in-home energy service providers, gas boiler and appliance manufacturers, potential hydrogen producers and other stakeholders in the energy industry.

The importance of hydrogen in the delivery of net zero

There continues to be more certainty of the role that hydrogen will play in the future of the UK. The UK's gas pipe network is an asset of enormous value and one which we can operate and should continue to serve the country for many decades to come. Fortunately, this network can be adapted to deliver low carbon green gases, such as hydrogen and biomethane.

Hydrogen's role in helping the UK achieve net zero has been discussed more and more over the past year, because of its ability to support the decarbonisation of areas previously thought difficult to reach. Due to the flexibility of hydrogen as an energy vector, it is expected to play a significant role in the decarbonisation of industry, flexible power

generation, aspects of transport and heat. Hydrogen is recognised as a key component in creating a balanced and resilient energy system, allowing the peak demands of winter energy needs in the UK to be met at lowest cost to the customer.

Hydrogen is a valuable energy store and utilising the gas network for this, plays to the strengths of the sector allowing electricity and gas to work in tandem.

The amount of hydrogen required by 2050 is still an area of much debate, but most net zero pathways centre around a figure close to 300 TWh of hydrogen per year. This is as large as the current annual UK electricity demand.

Kick starting hydrogen production has already begun, with the government providing funding to a number of industrial clusters, including our own HyNet.

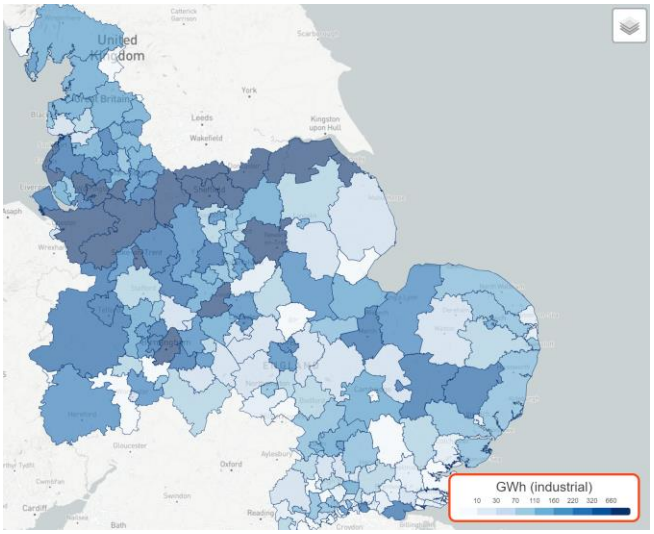


Figure 9: Heavy industrial usage across Cadent networks

Domestic heat

The role of hydrogen in domestic heat is also becoming more certain as the strengths of utilising the gas system are becoming clearer from not only a safety aspect, but also the technical feasibility of both blending hydrogen into the gas grid. In addition, hydrogen-ready appliances have been developed and prototyped. Hydrogen provides a low disruption pathway to heating homes for consumers, without the potential hassle associated with some of the electrification options on offer.

As set out in our annual report, our Future of Gas (hydrogen) programme has been focused on all aspects of innovation required around a future hydrogen economy.

We have reviewed the structure of our programme and now split the activities across 4 core areas;

- **Future Shape:** Where we seek to understand the demand for hydrogen across our networks and which areas of our networks would need to grow or adapt.
- **Advocacy:** Building stakeholder and consumer knowledge for a green gas future through sharing information
- **Technical and Policy:** Gathering the necessary technical evidence to demonstrate that hydrogen is safe and technically feasible across the value chain and seeking to understand the regulatory framework needed for both a blended network and a 100% hydrogen network.
- **Operational Transition:** Designing the future hydrogen network and how our own business transitions to it safely and cost effectively.

Sharing our knowledge about hydrogen

Our advocacy programme is aimed at getting the decarbonisation of the gas grid on the national and regional political and public agenda, by providing information and education about the cost-effective role that it can play and what the gas industry needs from government to enable this to happen.

Our external affairs team together with senior members of the business have continued to attend key events over the past year. This has included speaking at webinars, political engagement, cross sector working, and collaborative workshops, including groups such as the Energy Networks Association, and Hydrogen UK. The teams have used

these platforms to share the research and trial outputs, in support of the case for including hydrogen in the UK's energy plans.

Since the launch of our hydrogen 10-point Plan in 2021, setting out the role we intend to play, subject to the government's support, we have been progressing the work needed to meet our commitments and have recently released a new publication providing an update on our progress to date.

- **Cadent Hydrogen Ten Point Plan** https://documents.cadentgas.com/view/962033428/
- **Cadent Hydrogen Ten Point Plan Update 2022** https://documents.cadentgas.com/view/852427184/

Figure10: Our Hydrogen Ten Point Plan documents

Hydrogen projects

HyDeploy – 20% hydrogen blending for domestic gas

Cadent has continued to take a lead on the development of blending hydrogen, as we recognise that blending into the gas grid not only enables an immediate reduction in the carbon emissions of gas users but provides hydrogen producers with certainty of demand. This is key to kick starting scaled hydrogen production in the UK.

The government have set a target in their 10-point plan to enable blending by 2023. This has been driven by our successful work on the HyDeploy project. HyDeploy has completed its work demonstrating the blending of hydrogen into both a private network at Keele University and then into a public network at Winlaton (part of Northern Gas Network's region). The project is now drawing to a close, with a focus on seeking to close all the evidence gaps in relation to the full system boundary of hydrogen blending within the GDNs. The evidence being created includes workstreams covering Gas Characteristics, Materials, Assets, Procedures, and Industrial and Commercial Users.

Transition planning: HyNet – 100% hydrogen with CCS

Our first flagship industrial cluster project is HyNet, where our role in the consortium is the construction of the UK's first regulated hydrogen pipeline, that will distribute 100% hydrogen to multiple users and to blending points for the cities of Manchester and Liverpool.

The HyNet NW hydrogen pipeline project is progressing well and is now recognised as a nationally significant infrastructure project. The project is being delivered over a number of phases, with design and consent currently underway for phases I and II, which includes connecting major industries and power generation plants.

Figure 11: HyNet NW – one of the UK's first hydrogen industrial clusters

Regional interest is high, due to the potential to both provide significant carbon emissions reduction, but also supporting the boost to much needed jobs and skills in the region.

It is our ambition that HyNet will ultimately provide hydrogen to the first hydrogen village, Whitby (Ellesmere Port) in the Northwest.

Whitby, Ellesmere Port - hydrogen village conversion project

The government's 10-point plan sets out targets for a neighbourhood, village and town to be converted to hydrogen by 2030. These conversion projects are aimed at exploring all aspects of the transition of homes and businesses from natural gas to lower carbon hydrogen (which includes technical, safety, socio-economic and consumer impacts), to provide evidence in support of the government's heat policy decision anticipated in 2026.

Over the past year we have explored the potential options for the UKs first hydrogen village, which resulted in a bid to convert the village of Whitby (Ellesmere Port), which lies within our Northwest network. Following a competitive bidding process, Cadent is now one of two networks who have successfully won funding to progress to Stage 2 of the village conversion project, where we are working up detailed plans. Our project is in partnership with both British Gas and Cheshire West and Chester Authority. We are actively engaging with customers in Whitby, to gain their support for the project, ahead of a bid for the subsequent phases of the project (the construction of assets and conversion of homes), which is due early next year. We are very proud of the local engagement and support that we have received for the project to date and hope to receive a positive outcome next year (2023).

Regional development

Whilst HyNet has gained a lot of ground over the past year, so too have our other industrial cluster opportunities that sit across our footprint. Our East Coast hydrogen cluster, looking at how we deliver hydrogen into East Anglia and the East Midlands, is now at the pre-FEED stage, which involves looking at potential production and demand centres and the pipeline routes to optimise hydrogen distribution. We also launched two further feasibility studies looking at how we get hydrogen into London (Capital Hydrogen) and into the Midlands (Hydrogen Valley). Whilst these projects are a couple of years behind HyNet in terms of maturity, we know they will soon gain more ground from lessons learned to date.

Our priorities for 2022/23

Whilst 2022 has proved to be a turbulent year in government, with a new Prime minister and cabinet office now in place, hydrogen has gained ground in terms of its importance and support. We therefore recognise the need to build on this and continue to prioritise:

- Our focus on addressing any evidence gaps in support of hydrogen's use in the gas grid and homes, which includes our hydrogen village project in Whitby, Ellesmere Port
- Progress our support for the regulatory framework that enables hydrogen blending to happen. This is important as it unlocks a significant demand centre for hydrogen producers
- Progress our plans to demonstrate how a town conversion to hydrogen could happen
- Building on our economic assessments and consumer research, to ensure a fair and just heat decarbonisation.

A culture of innovation

By embracing innovation, we are finding the most up-to-date tools, techniques, and practices to keep gas flowing safely, reliably and with minimal disruption to customers.

Having developed a regional customer-focused structure, we address issues at a local level and share best practice throughout our networks. Each of our five Network areas have their own Innovation Project Management capability to drive local ownership as well as ensuring they are close to their own operational colleagues.

The Gas Network Innovation Strategy has been developed by all the GDNs and is designed to bring together all the most important challenges and opportunities facing the UK gas transmission and distribution networks. In RIIO-2, we are focusing on and securing funding on innovation that addresses opportunities around customers in vulnerable situations and the energy system transition.

We believe we can respond in an agile way to the changing needs of the communities we serve and work collaboratively with the other GDNs on specific projects and share learning and best practice. We recognise that working together ensures the maximum benefit to customers, by enabling all parties to embrace new, value-adding technology and ways of working. We strive to identify and deploy innovations across our footprint; ensuring we support the UK's energy transition, always aiming to improve how we support our customers in vulnerable situations and by utilising a localised operating model, we continue to look for improvements in operational efficiency.

Full details can be found in our Innovation Annual Summary here.

Connecting with our customers

EasyAssist ECV (Emergency Control Valve)

This project places customers with mobility challenges at the forefront of our thinking and we have been working with Continental & Oxford Product Designs to create a device which would allow such customers to easily turn off their gas supply. The mechanical device can be retrofitted over the existing ECV with a single push button. This provides the customer with a solution to isolate their gas supply whilst also making the property a safer environment for our field force colleagues. Alongside these benefits, the initiative will also reduce the understandable stress and confusion that a gas emergency can create.

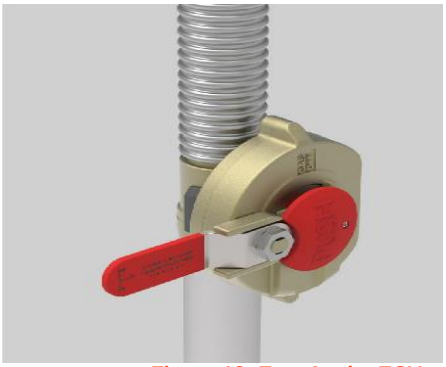


Figure 12: EasyAssist ECV

EasyAssist – Remote Actuation

We're currently looking to deliver a further step forward with EasyAssist – Remote Actuation. This will provide a complementary device specifically and uniquely designed to be installed with the EasyAssist™, to provide our customers on the Priority Services Register (PSR) with mobility limitations, or where the meter is in an inaccessible location, the ability to isolate the supply in the case of an emergency gas situation.

We're also reviewing the feasibility of a research project for Digital Exclusion – A project which will look at how Gas Networks can ensure that customers who do not have access to digital communications, are not excluded from important correspondence that may impact them.

Vyn

If a customer wants a new connection or alteration, or wishes to report an issue with work undertaken, Vyn helps them record a pre-installation video using their smartphone. This saves the surveyor having to make an in-person visit. In the case of issues reported on the quality of work, previously, when receiving a complaint, a supervisor would drive to site to review the issue. This may not happen until the next day, which can frustrate customers. Customers can record a short, guided video of the issue, enabling us to resolve it faster. The platform uses artificial intelligence and machine learning technology to label, tag, and categorise the video content, making it searchable and actionable, enabling faster triage and response.

By reducing the need for physical visits, Vyn helps save time, cuts costs and improves overall productivity. With this technology, surveyors can also share insight, best practice and collaborate across teams.

StreetScore Phase 2

This is a cross network collaboration project, working alongside our Gas Distribution and Electricity Networks partners, to take learnings from the phase 1 StreetScore project and accelerate them. At the end of the Phase 1 Research Project, it was clear that individuals' carers and advocates are unhappy with the current way street works are designed and there is a wish for more accessible works. This project will look to further understand the challenges when travelling through Street Works for customers, to ensure they are not put into vulnerable situations and have a range of designed and tested products and systems to enable minimal disruption to customers in vulnerable situations as well as the wider public.

Improving Operational Efficiency

Our localised teams proactively work to meet the objectives of improving efficiency within their respective networks through the deployment of innovative solutions.

Valve Track

Valve Track is a low powered tracking device that is activated through a secure mobile application allowing field-based operatives to quickly locate underground assets while acquiring asset records specifically for the asset in question.
In relation to customer focus, several direct and indirect benefits will be experienced through successful implementation of this system. By the provision of accurate data supplied through this technology, pin-point accuracy of our underground assets results in minimal disruption to our customers and the public.

The award winning Valve Track was developed in conjunction with Utility Innovation Services (UIS).

Pipeline Spacers

We have been working with leading pipe supplier FT Pipeline to improve the efficiency and safety of work for our field force colleagues. Working inside buried gas pipes could result in ground failure and flooding from adjacent water mains. Pipeline Spacers eliminates the need for entry into a cast iron pipe. The Spacer is an encirclement band with wheeled ramps, for installation onto PE pipe in order for it to be inserted into a cast iron host pipe without the need to remove Weko seals from socket and spigot joints, with the spacers rolling over the seals and brackets holding them in place.

During the first year of RIIO-2, we have successfully delivered two trials of the Pipeline Spacers in our North London network. We will then continue to explore options for spacers for different sized polyethylene pipes.

Further information on all our current and future projects can be found here.

Energy Networks Association: Innovation

At the start of the new regulatory period RIIO-2 in April 2021 Britain's network companies introduced the Energy Network Innovation Process providing full governance details of the end-to-end industry led process for reporting, collaboration, and dissemination of Ofgem funded NIA projects in GB.

This new process will include reporting against an Innovation Measurement Framework (IMF) Energy Networks will report on a range of innovation outcomes, including collaboration and partnerships, the speed at which successful innovation is transitioned into BAU and the benefits innovation has delivered for network customers.

RIIO-2 has also introduced a Strategic Innovation Fund (SIF) to support the transition to net zero. This fund supports large-scale transformational research and development projects and will be available to Gas Distribution (GD), Gas Transmission (GT), Electricity Transmission (ET) and the Electricity System Operator (ESO) in the first instance.

In September 2022, ENA jointly held its first Energy Innovation Summit in Glasgow with BEIS, Ofgem, UKRI and Innovate UK. Sector colleagues used the first major in person event following Covid to reconnect in person and share updates on key innovation projects and discuss new projects that need to be taken forward to help Britain decarbonise.

You can find out more information about individual projects at the Smarter Networks Portal, https://www.smarternetworks.org/

Taking a whole energy system approach

As the energy networks face increasing challenges from decarbonisation and our journey to net zero, coordination between electricity and gas network operators grows increasingly important.

Extracting the most value from the electricity and gas network infrastructures can be achieved by developing and implementing initiatives that optimise their collective utilisation. This approach will deliver the least costly and least disruptive solutions our customers and stakeholders require urgently to meet our carbon emission reduction ambitions.

Through the work we have completed on a joint basis with our electricity colleagues, we have seen the value in presenting a shared solution, championed by both networks. This undoubtedly helps regional bodies establish robust actionable plans with low and no regrets investments at the right time. This is enabling significant progress to decarbonise in the short term, whilst longer term policy driven solutions are developed.

To support this work, we have added additional senior resource to the Cadent team, to manage the complex stakeholder relationships regionally, to support the education of the future of the gas network and provide joined-up and collaborative solutions.

Local authority engagement for whole energy system solutions

We want to continue with this type of local area energy planning, and welcome contacts from regional bodies and current and future major energy users that may be keen to pursue a similar approach to identify credible net zero solutions, including hydrogen, in their geography. We would also be interested in supporting whole system solutions for off gas grid communities, where extending the gas grid to provide access to low and zero carbon gases may be a credible and more attractive option compared to the alternative whole community solutions. Whole energy system planning for such communities can ensure robust, efficient, sustainable solutions with minimal disruption are identified to decarbonise their complete future energy needs, including both heat and transport.

We are actively supporting the ENA's Open Networks project alongside our electricity and gas network colleagues, to explore whole system solutions facilitating local authority growth ambitions.

How this will be taken forward is still under development and has been impacted by other initiatives in this area, but the ambition remains to provide a higher value efficient service to local authorities by providing a one stop shop for whole system optioneering.

We would be very pleased to hear views from any local authority that would like to find out more and help shape the future services provided by the gas and electricity networks in this area.

Another great illustration of the value of whole system cooperation is the connection of gas-fuelled power generation sites to support the electricity system. Whilst renewable power generation will take an increasing proportion of the electricity demand, secure, reliable, dispatchable power generation is required for when intermittent renewables are not available, and to provide other power system support services. Gas-fuelled power generation is playing an increasingly vital role in this sector, which is pushing up peak gas demands in certain areas of our networks. We welcome early conversations from parties seeking to connect onto our network, so we can ensure we can provide the necessary capacity efficiently and within the required timescales.

Demand forecast

Demand forecast across our four gas distribution networks for the next decade

Appraisal of scenarios

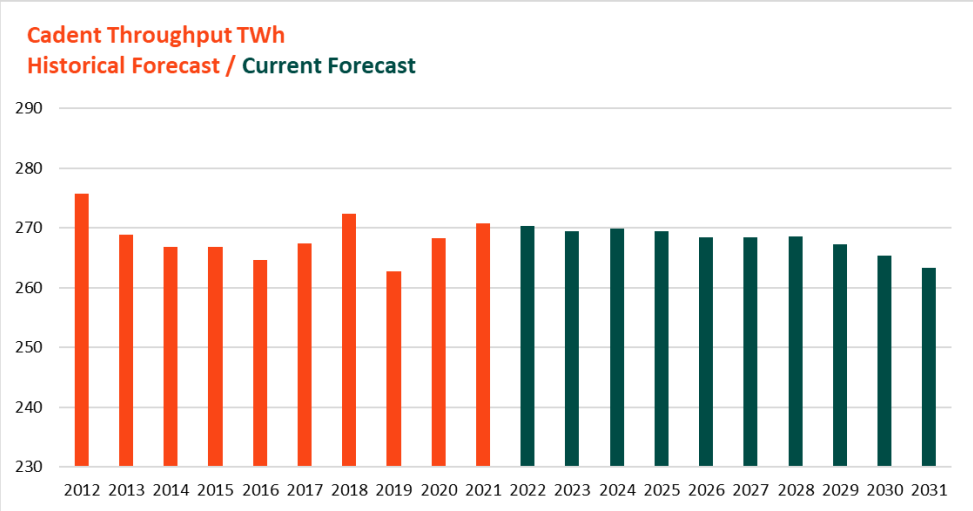
Our demand scenarios are based on planning assumptions we have derived from market observations and stakeholder engagement. The scenarios consider the need to reduce our carbon emissions, which is critical to meeting the UK's decarbonisation targets by 2050. They also include the views of specialist consultancies and data collected from National Grid's Future Energy Scenarios (FES) consultation process.
The FES consultation involves market participants, including suppliers, customers and stakeholder groups. It provides important feedback on the impact of market developments.

Demand overview

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

Forecast demand

This year's projection for future demand is similar to the previous year's forecast. This has seen an increase in peak demand, with a slight decrease in annual demand over the ten-year period.
The increase is partly due to general network growth and in particular additional peaking electricity generation plants connecting to our network, requiring capacity at peak gas demand times. Other factors include the change in how peaks have been calculated, incorporating experience from the Beast from the East in March 2018.



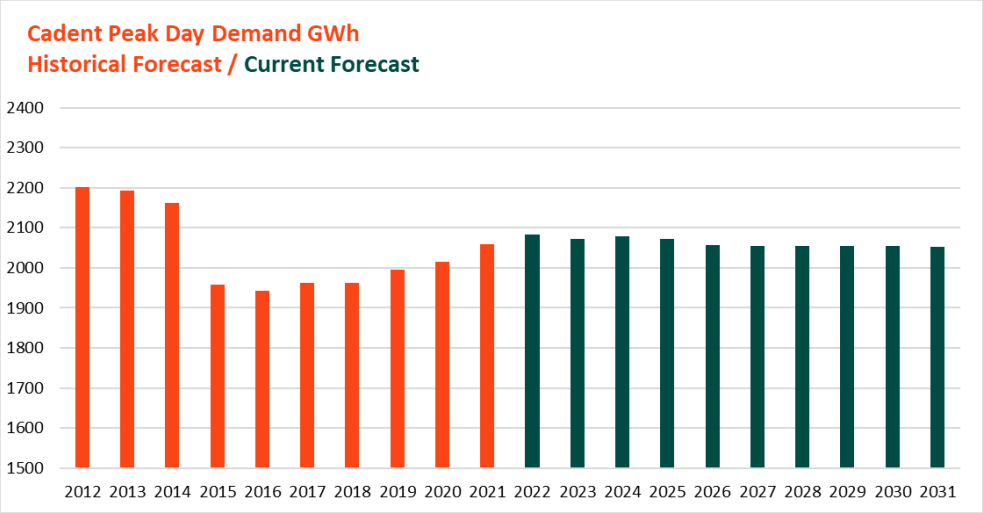
Graph 1: Annual throughput – 10-year historical forecast and 10-year current forecast

In 2018, Ofgem requested that networks across transmission, distribution, gas and electricity agree a common set of factors and assumptions for developing their core view of the future. As part of this review, we debated the key areas that will affect and drive behaviours in gas demand over the next ten years.

The outcome was an unprecedented level of collaboration and knowledge sharing, which has resulted in greater understanding and agreement on the common factors and assumptions affecting each network's demand forecast. This has reinforced the stance we take in all key areas, providing a strong basis on which to review and agree the position for our demand forecast.

The FES 2022 document provides four scenarios in total, with a five-year forecast. The scenarios provide guidance based on the underlying assumptions for each scenario, whereas the forecast indicates the expected demand based on these assumptions.

This year, we have used the five-year Central Forecast provided by National Grid ESO as we both believe that this represents the most realistic view of the shorter-term evolution of the energy system and is influenced less by the modelling assumptions regarding the longer-term decarbonisation choices.



Graph 2: Peak day demand - 10-year historical forecast and 10-year current forecast

For the last 5 years we have used Steady Progression scenario to determine our 10 year forecast.

Forecast comparison and accuracy

The forecast is broken down as follows:

- **Appendix A1** contains demand forecast information at a local level through to 2030/31.
  - A comparison of actual demands during 2021 with the forecasts in our LTDP
  - Maximum and minimum demand days and forecasts for winter and summer 2021/22.

Future demand factors

We have seen annual demand increases in 2022/23 as described above, then there is a gradual decrease over the 10-year period because of energy efficiency measures employed in homes and industry. The assumptions made about the impact of energy efficiency measures on gas demand continue to be reviewed as the easier measures are completed, which leaves the more costly and difficult ones to address. We do not yet know what the longer-term impact of the COVID-19 pandemic and the uncertainty around the economic climate will be on demand, and we are monitoring the situation.

Our forecast demand includes alternative technologies such as air source heat pumps, which will reduce customers' use of gas. We also include gas-efficient appliance technologies like gas-sourced heat pumps and combined heat and power, which reduce carbon intensity.

These new and emerging technologies can help us be flexible as we meet our domestic peak heat demand and reduce pressure on the electricity grid.

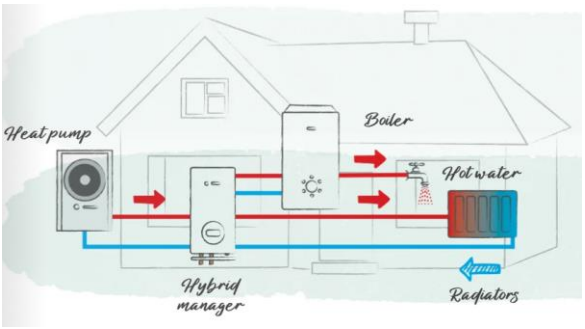


Figure 13: Hybrid heating system

New hybrid appliances powered by renewable electricity could 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 funded.

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 and behaviours evolve. 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. Through numerous innovation projects run by the gas networks, we are 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.

Investing in our networks

We continue to invest heavily in our networks to maintain their integrity and to provide enough capacity for peak demand periods, ensuring we meet our customers' needs.

Investment implications

Our average annual investment across our four regulatory networks over the current regulatory period set by Ofgem is over half a billion pounds. The majority of this investment relates to our gas mains replacement programme, which we have a legislative commitment to deliver with our safety regulator HSE by 2032. This investment programme has considerably reduced the safety risk on our networks since it started in 2002.

We continue to invest in reinforcing and increasing the capacity of our networks where required to respond to local authority strategic development proposals and demand from our customers in biomethane connections.

Our networks are designed and operated to meet peak capacity requirement to satisfy our 1 in 20-year demand license obligation (1st March 2018, Beast from the East as an example) and we are focused on reducing emissions and leakage to reduce our carbon footprint and ultimately costs to our customers. We also drive efficiencies in asset performance through asset investment decisions to introduce smart technology and updating our asset base with more efficient models.

Maintaining the integrity of our networks

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.

Both live and retrospective performance data for all critical network assets is reviewed regularly by our technical engineering and control centre teams.

The purpose of any live data monitoring is to ensure on-day demand and supply within Cadent's networks is enough, and to identify any alarms/faults which require investigation.

Retrospective asset data monitoring seeks to identify variances, patterns, trends or cycles in historic asset performance.

Figure 14: Asset monitoring and maintenance

By monitoring the performance and health of our assets, we can 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

Our Gas Transporter Licence requires GDNs to have a common Network Asset Risk Metric Methodology (NARM). NARMs are an evolution from RIIO-1 Network Output Measures and relate to the risk of asset failure. Through our asset management activities, such as replacement or refurbishment, we ensure that the risk to customers is maintained within reasonable bounds. The purpose of this approach is to track delivery of agreed risk reduction measures through the regulatory period.

Risk values are represented in monetary terms as a ‘common currency’ for comparison between different asset groups and failure modes. This common currency for the statement of asset risk is referred to as monetised risk. The core principle is that ‘risk’ is the product of probability of failure of an asset – the consequence that such a failure could lead to, and the cost (monetary value) associated with those consequences. The combination of these factors derives a statement of monetised risk for an asset base.

Asset data

We recognise the importance of asset data in the management of assets. Our Asset Data Strategy outlines how we will improve confidence in the quality of our asset data and define a holistic view of critical asset data, combining stock, location, health/condition and risk, ultimately enabling better asset management decisions for our customers. Our dedicated Asset Data Team own the delivery of this strategy and will continually drive improvements in our asset data across our four regulatory networks.

Creating local asset investment decisions

By implementing dedicated local Investment Planning teams in each of our four regulatory networks, we will drive efficiencies as part of the localised five-year Network Asset Management Plans for RIIO-2. These teams will establish close working relationships across the network, internally and externally, to ensure delivery across all our assets whilst implementing refined systems, processes, and revised monitoring regimes. This approach will proactively target replacement of mains to reduce leakage, identify efficient asset health related investment, enable hydrogen-readiness and support other network-specific and Cadent-wide initiatives, such as connecting gas-fuelled power generation sites. Our central Asset Investment team will provide the consistent asset management framework for each local network to work from and will define the longer-term asset strategies to support our low carbon ambitions.

Upgrading our networks for the long term

Our operating model gives us an opportunity to take a long-term strategic view on our replacement requirements for the next eleven years to the end of the 30:30 program in 2032 (all tier 1 iron pipes within 30 metres of a property are to be replaced with plastic over a 30-year timeframe). We will also consider future net zero scenarios.

Through network alignment, we have brought our design team together with our strategic planning team, providing us with the capability to take a holistic view of planned work. By investing in modelling tools and the accuracy of the network models, we are creating a model of the future gas network to the end of the 30:30 programme. By also considering low-carbon alternatives (including hydrogen), we will assess the potential requirements for a net zero gas network, and this will influence our overall strategy for asset investments.

We will increase our mains replacement by insertion, through proactive management of our operating pressures and identifying general reinforcements to bolster network capacity.

A whole network approach will create regional opportunities to help drive down costs for our customers into the future.

Higher insertion rates will also mean less disruption in footpaths and roads for our customers and local authorities.

We are committed to reducing leakage by identifying HSE policy mains with high leakage rates and will prioritise these for mains replacement over the RIIO-2 period.

Using our cost benefit analysis model, we will identify non-policy mains for replacement or remediation using innovative tools and techniques.

This not only benefits the environment by reducing our methane emissions, but also benefits our customers by reducing emergency work and interruptions.

Figure 15: Pipeline maintenance

This holistic approach considers all impacts on the local communities and local authorities to prioritise the mains for replacement under the 30:30 programme, including incorporating mains with low pressure due to water ingress or that are a part of the future hydrogen initiative. Early engagement with the local authorities is enabling a collaborative approach to manage the work activities within the highways limiting the impact on communities.

By the end of the 30:30 programme, our distribution networks will predominantly consist of plastic pipe, which can carry a wider range of gases including hydrogen. As these pipes also require significantly lower maintenance than existing materials, they will deliver a low-cost, low-carbon network which will play a central role in the UK's future energy system. You can see below how our networks will become hydrogen ready from our mains replacement programme from 2021 through to 2032. The darker the green the more plastic they are.

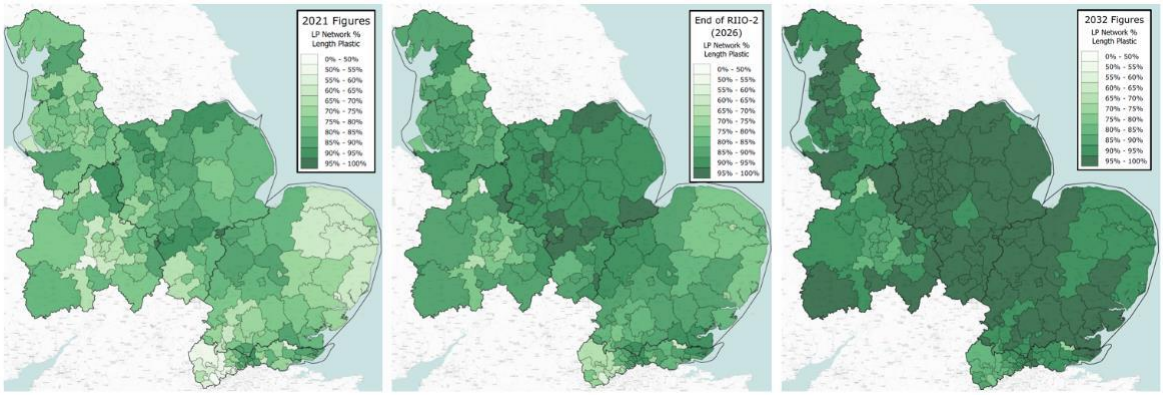


Figure 16: Plastic % of low-pressure networks from 2021 to 2032 across Local Authorities

Reinforcing our networks

Due to growth in housing and the rise in gas-fuelled power generation sites over the medium term, network capacity requirements are constantly changing. Housing developments on the extremities of our networks have continued to rise during recent years, with the fastest growth in the Eastern networks.
To ensure greatest value for our customers, we balance proactive reinforcements with optimising pressures to manage the integrity of the network and ensure we maintain supply to our residential, commercial and industrial customers.

Due to the shift in working patterns due to the recent pandemic we will continue to monitor and review our reinforcement approach in order to manage any long-term impacts of an increased number of people working from home. This will ensure that there is an enduring continuity of service as we monitor the potential changes on the demand profiles in our networks.

- **Eastern Network:** There is an ever-increasing number of power generation sites looking to connect along with a large amount of new domestic homes requesting connections.
- **North London:** Due to refurbishment of historical buildings and new large-scale developments, we are carrying out general reinforcements which are typically road crossings.
- **North West:** There has been a rise in applications for power generation and biomethane sites in this area and we are taking a balanced approach of either pressure increases, or pipe laying to secure the network.
- **West Midlands:** The main area for demand growth continues to be in the Warwickshire area, with several reinforcements in the network planned this year. Likewise, Stoke will also require reinforcement in the near future. The network will be taking a more strategic and wholistic view to demand growth; with our long term ambition being to increase resilience proactively and reduce the need for reactive reinforcement requirements. We are starting to anticipate potential scenarios for hydrogen in the network and are designing our mains replacement over RIIO-GD2 with a balanced view of resilience and future proofing in mind.

Figure 17: West Midlands team performing essential mains replacement works

Supporting customers in multi occupancy buildings

We aim to carry out inspections on the gas infrastructure supplying medium and high-rise buildings. Our work done to date has enabled us to build a sound foundation for these core assets.

We support district heating schemes, which can save costs for customers by providing communal heat from a single central heating system. This can be especially effective in low, medium and high-rise buildings.

We will continue to help communities in multi occupancy buildings explore the best use of energy, and we are planning further specific stakeholder and customer engagement on this matter. We would welcome feedback on this proposal and would be especially interested to hear from anyone involved in regional district heating schemes. You can share your feedback with us at **cadentgas.com/ltdp**.

We have ensured we are replacing Multi-Occupancy Buildings in conjunction with the Mains replacement programme to minimise customer and local community impacts.

Closing statement

Thank you for reading our Long-Term Development Plan 2022. We hope you found the report interesting and informative.

We've given you an insight into:

- Our enhanced approach to customer and stakeholder engagement
- The developments we are making to our connections processes
- Our performance in the environmental emissions space
- How we are helping the UK achieve its decarbonisation targets to achieve net zero
- How we are driving change through innovation
- Demand forecast for our networks
- The investments we are making to enhance our networks.

Our development plans are driven by our ambition to set the standards that our customers love, and others aspire to. We will continue to develop our plans based on customer and stakeholder feedback. Don't forget to share your feedback at **cadentgas.com/ltdp** if you would like your views to be taken into consideration.

Further reading

Please follow the links below if you would like to find out more.

- **https://cadentgas.com/future-of-gas/our-green-print**
  - Our Green Print - Future Heat for Everyone
- **cadentgas.com/get-connected**
  - Further information if you are interested in connecting to our network.
- **cadentgas.com/digging-safely**
  - How to dig and work safely close to our gas assets.
- **cadentgas.com/news-media/document-library**
  - Information and research carried out/commissioned by Cadent, about the future role of gas in the UK energy system.
- **fes.nationalgrid.com**
  - National Grid's full Future Energy Scenarios documents and supporting information.
- **www.ofgem.gov.uk**
  - Homepage for the Office for Gas and Electricity Markets (Ofgem).
- **www.gov.uk/government/organisations/department-for-business-energy-and-industrialstrategy**
  - The Department for Business, Energy & Industrial Strategy – the government department responsible for business, industrial strategy, science, and innovation with energy and climate change policy.
- **www.energynetworks.org**
  - Homepage of the Energy Networks Association (ENA), 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.
- **www.eua.org.uk**
  - Energy & Utilities Alliance (EUA), a not-for-profit trade association that provides a leading industry voice to help shape future policy direction within the energy sector.
- **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.
- **www.gasgovernance.co.uk**
  - Home of the Joint Office of Gas Transporters. This site contains information about the Uniform Network Code and its ongoing developments.

Regulatory basis for document

This statement is produced for the purpose of and in accordance with Cadent Gas Ltd obligations in Standard Special Condition D3[1] 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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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.

Cadent Gas Ltd
Pilot Way
Ansty Park
Coventry
CV7 9JU
Registered in England and Wales
No. 10080864
cadentgas.com