October

Cadent
Your Gas Network

Developing networks for the future

Long-Term Development Plan 2023

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We are Cadent

Your gas network

About Cadent

Our responsibilities and geographical reach

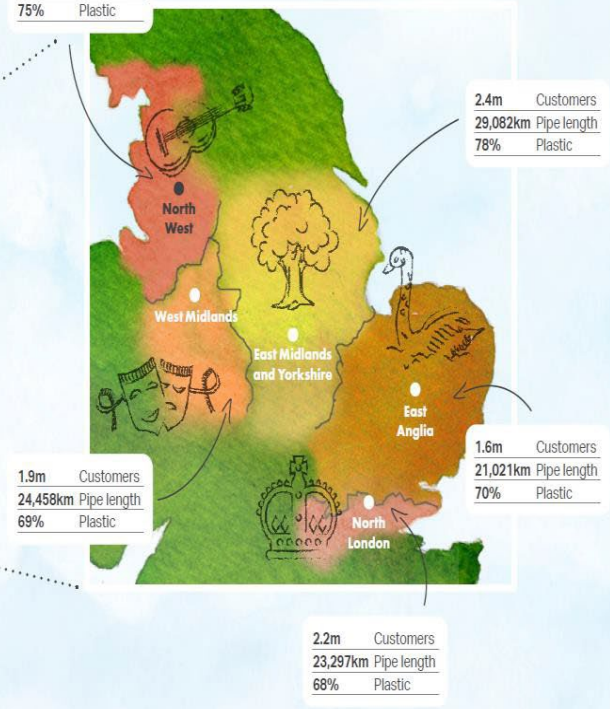
Cadent is the largest gas distribution company in the UK. We deliver fossil gas to 11 million homes and businesses throughout the North West, West Midlands, East Midlands, South Yorkshire, East of England and North London – helping keep consumers on our network safe and warm.

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	6,155	132,396km
homes and businesses connected to our network	employees helping consumers on our network keep safe and warm	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 our Long-Term Development Plan (LTDP) 2023

This document is intended to assist current and future customers to identify and evaluate opportunities for entry and exit connections to our gas network. It 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 of the network and taking net zero readiness into account.

Our business plan commits us to continue investment in our network to allow new demand to be connected, and increased volumes of low-carbon biogas to be transported. We have 42 biogas connections to our network and are investing to allow greater volumes in the future, with an ambition to serve 3million consumers by 2030. It also includes the continuation of our asset investment programme, notably the Iron Mains Replacement Programme (IMRP) 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 believe our gas network has a crucial part to play in the move to net zero and we have 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.

The last 12 months at Cadent have been an exciting one with several projects progressed and new ones initiated. We have been awarded funding to take our Digital Platform for Leakage Analytics (DPLA) project (funded by UKRI & Ofgem in partnership with the gas networks and Guidehouse and launching in the 3rd quarter of the year) to beta phase.

Hydrogen continues to take centre stage, with work being undertaken to support the government's Hydrogen Heat and Clean Energy appraisals. In addition to our work exploring blending hydrogen with natural gas, 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 last year has seen the launch of our East Coast Hydrogen, Capital Hydrogen & Hydrogen Valley projects that will support industrial decarbonisation across our network.

Supporting regional decarbonisation plans and Local Area Energy Plans (LAEPs) has also been a focus to ensure a clear pathway to delivering net zero and provide some crucial support to the local authorities within our footprint. We have embarked on some cross-industry collaboration to ensure a joined-up approach between gas and electricity distribution companies, in order to provide a concise view of what different strategies will mean for local authorities and their residents.

I hope you find this report informative, and we welcome any feedback, including suggestions for improvement. Please share your thoughts with us at cadentgas.com/ltdp.

Dave Moon, Director of Asset Investment

Our customers

Customer and stakeholder engagement

We have continued to engage with a wide range of stakeholders and customers to ensure that we support society's changing needs.

Stakeholders previously asked us to take a leading role in helping Britain 'build back better' by supporting the 'green economy' and 'levelling up' agendas. We have risen to the challenge, transforming our business operations, values and purpose, investing significantly in people, processes and systems to drive a future focused culture. Customers want businesses like ours to show our expertise in sustainability and support customer who are most vulnerable. Our Force for Good strategy, which is built on the premise of making life easier, fairer and greener for our communities is creating 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.**

Strengthening and maintaining relationships with multiple stakeholder and customer groups, putting them at the heart of all we do has contributed to embedding a positive culture, allowing a proactive and continuous response to changing customer needs.

Figure 1: Our customer engagement pathway

Our stakeholder and engagement strategy

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 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

As we continue our engagement journey, we are exploring and implementing various ways to engage with our customers and stakeholders. Each year, we review our enhanced engagement strategy with stakeholders and customers to ensure it is in line with their expectations and that their insights are delivering better outcomes. Below are some of the areas where we have expanded our reach or changed how we engage.

Customer forum

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.

Strategic relationships

Enhancing our relationships with partners remains a priority as our services have expanded in response to stakeholder feedback and evolving customer requirements. Our partnerships are grouped into categories: strategic, programme and project, depending on the breadth and longevity of the relationship and the associated activities. 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.

Inclusive and accessible engagement

We strive to ensure that all engagement we do is both inclusive and accessible. We use a variety of engagement methods to create opportunity for all our customers to have a voice. Our engagement has included both digital and non-digital methods such as online surveys, interviews (face to face and telephone), focus groups (online and face to face), stakeholder round tables, as well as webinars conducted via Teams and Zoom. We have also introduced ethnographic studies, during which participants complete activities over a period of time and share their feedback via a plethora of media.

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

Future Billing Methodology (FBM)

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.

FBM Project

Consumers may have different choices on how their homes are supplied with energy in the future, with natural gas potentially being replaced with low carbon gases such as biomethane and hydrogen. These gases have different properties to the natural gas supplied today. It is important that as this energy transition happens, consumers only pay for the energy they receive. The FBM project was a proof-of-concept project that has explored options for a fair and equitable billing methodology for the gas industry. 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 for hydrogen and biomethane.

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

This project has been helpful in establishing how blended gases of hydrogen and natural gas may be metered and billed in the future and has fed into the consultation on blending hydrogen for a decision by government.

How we consulted

Figure 2: FBM consultation summary

Recommendations

Following the consultation, the final project recommendations are:

- 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.

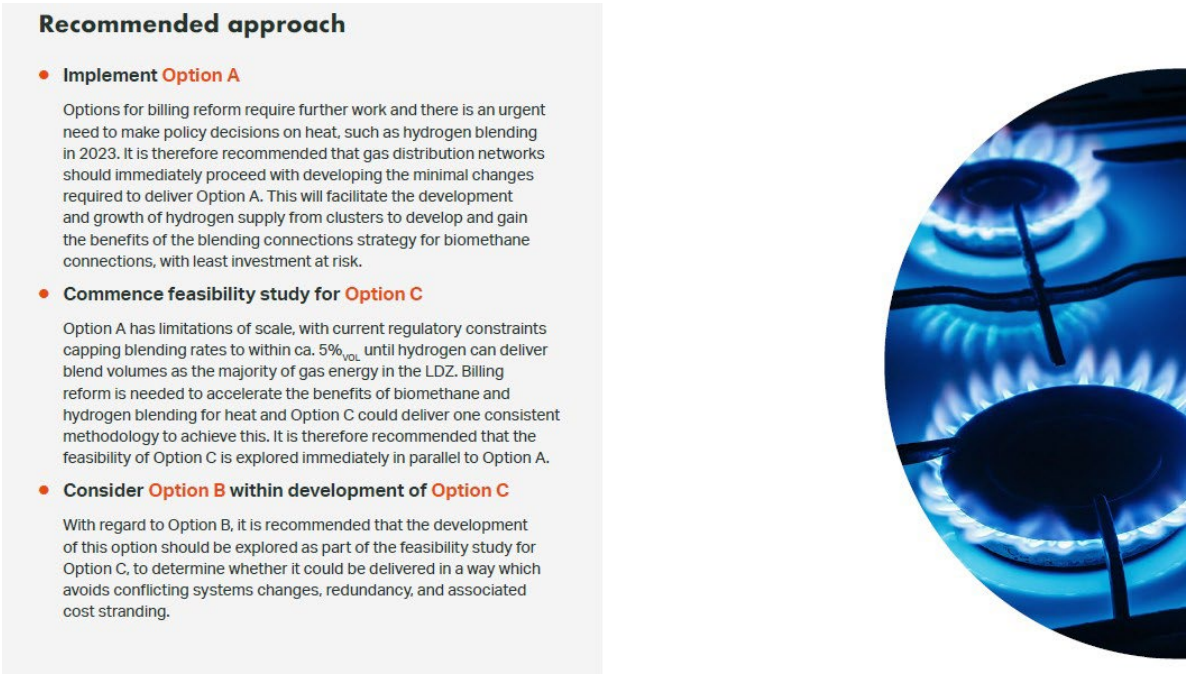


Figure 3: FBM reform options

All FBM consultation material from the second industry engagement are available on the Xoserve knowledge hub.

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 2022-23, we facilitated 11,308 new connections for our customers, a c.35% reduction from the previous year. This can be attributed to the increase in energy costs, contributing to the national cost of living crisis. In addition to this, there is an expectation that consumers have begun to explore alternative energy options whilst the uncertainty around the use of gas boilers in new homes and net zero ambitions remains as we head towards 2025. It is difficult to forecast past this date due to these challenges.

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 1,100 households at risk of fuel poverty in 2022-23. 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 increased showing the market segment is still strong and operators are continuing to invest in new sites within hotspot areas within our network. We currently have 165 power generation sites connected to our network, generating 2123.6 MW of electricity, and a further 46 accepted projects awaiting design and build. We have continued to work with the power generation community and Utility Infrastructure Providers (UIPs) over the last 12 months, providing support throughout the lifecycle of the projects with increased focus on their design and commissioning phases.

Connection Type	East Anglia	East Midlands	North West	West Midlands	North London	Total
Power Generation Sites	26	51	58	14	16	165

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 have recently embedded account management into our closure file process and will be looking to extend that into the rest of the customer journey. 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/services/3rd-party.

Off gas grid decarbonisation

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 future-proofed 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 trialing 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

Shrinkage

Shrinkage is gas that leaves our network without passing through a meter. While not physically measured, it is modelled and 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 gas prior to pressure reduction (own use gas) and gas that is stolen upstream of the meter (theft of gas).

Leakage is the largest contributing factor of greenhouse gas emissions from the gas transportation network. The leakage of natural gas therefore contributes to global warming. Shrinkage gas also contributes to customers' bills and so our continued drive to decrease the environmental impact of shrinkage also delivers customer savings.

To estimate leakage from our gas distribution system we use an Ofgem approved methodology and model. The model is continually reviewed with a view to enhancing calculation methods and improving the accuracy of the leakage assessment. It includes an assessment of emissions from mains, services, and above ground assets in addition to an estimate of leakage associated with specific mains interference damage incidents. The model applies pre-determined leakage rates but is updated annually for a number of activity-based factors. The most significant of these being the changes to asset lengths associated with our mains replacement programme, and the management of the system pressures.

Current performance

The chart below shows the split between the different leakage components, theft of gas and own use gas categories in 2022/23. We expect the mains leakage portion to continue to decrease year on year as a result of gas mains replacement activity. Own use gas and theft of gas are calculated as a factor of throughput and so will vary according to demand.

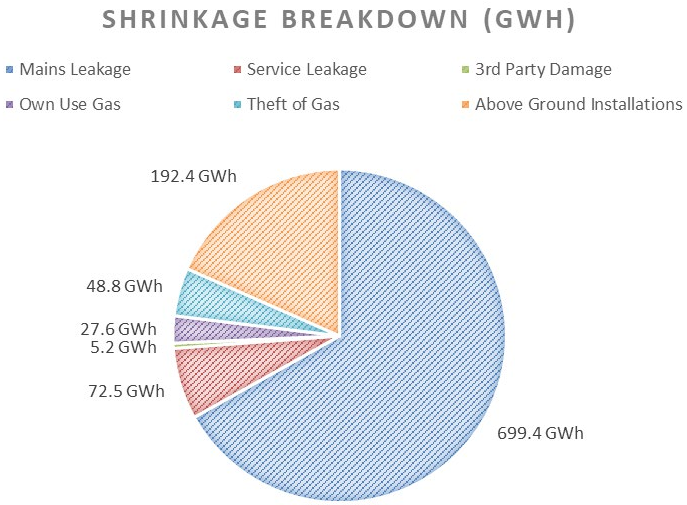


Figure 4: Shrinkage breakdown

A summary of the 2022/23 Shrinkage volume performance against the prior year is shown in the table below. Across our four networks shrinkage gas losses were reduced by 43.1GWh (4.0%). Based on an assumed typical annual consumption of 12,500 kWh, this reduction is equivalent to the gas usage of approximately 3,450 domestic houses. Reductions were achieved in all of our four networks as shown in the table below.

2022/23 PERFORMANCE	EASTERN	LONDON	NORTH WEST	WEST MIDS	CADENT
2021/22 Shrinkage Outturn (GWh)	**380.7**	**195.0**	**268.3**	**244.9**	**1088.9**
LP/MP Mains Replacement	(8.9)	(5.5)	(6.8)	(5.0)	(26.1)
Service Relays	(4.5)	(3.1)	(3.5)	(2.2)	(13.2)
Average System Pressure	2.9	(0.2)	0.1	(1.6)	1.2
Monoethylene Glycol Saturation	(0.4)	(2.3)	(3.1)	0.6	(5.3)
Interference Damages	0.9	(0.1)	1.0	(0.1)	1.8
Own Use Gas	(0.8)	(0.4)	(0.5)	(0.3)	(2.0)
Theft of Gas	(1.4)	(0.7)	(0.9)	(0.5)	(3.5)
AGI Asset Numbers	0.1	(0.0)	0.0	(0.3)	(0.2)
2022/23 Shrinkage Outturn (GWh)	**370.4**	**183.9**	**256.2**	**235.3**	**1045.8**
Year on Year Reduction (GWh)	(10.3)	(11.1)	(12.2)	(9.5)	(43.1)
% Reduction	-2.7%	-5.7%	-4.5%	-3.9%	-4.0%

Table 2: 2022/23 Shrinkage volume performance

Cumulative performance

We are proud of the progress made in reducing emissions since the start of the RIIO-1 regulatory period, which was achieved from dedicated focus in 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.

Network level cumulative performance is summarised in the table below, demonstrating latest reported performance against key regulatory dates.

Network	Opening	RIIO-1 Yr1	RIIO-1 Yr8	2022/23 Actual	Cumulative Reduction
Eastern (GWh)	517	478	394	370.4	(28.4%)
London (GWh)	272	257	200	184.9	(32.5%)
Northwest (GWh)	394	370	277	256.2	(35.0%)
West Midlands (GWh)	328	313	251	235.3	(28.3%)
Total (GWh)	**1,512**	**1,417**	**1,121**	**1,045.8**	**(30.8%)**

Table 3: Network level cumulative performance

Since 2012/13, Shrinkage volume reductions of 464.8GWh (31%) against opening baselines have been achieved. This is the equivalent to the gas consumption of approximately 37,180 homes.

Forecast performance

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 25% reduction in emissions as the number of metallic mains in the network decreases.

The role of biomethane in achieving net zero

Contributing towards a green economy

The role of the gas networks is important to reduce emissions using renewable energy. We support cost-effective solutions to deliver emission reductions, through the growth of green biomethane plants, utilising gas for electricity power generation 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 through innovation.

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.

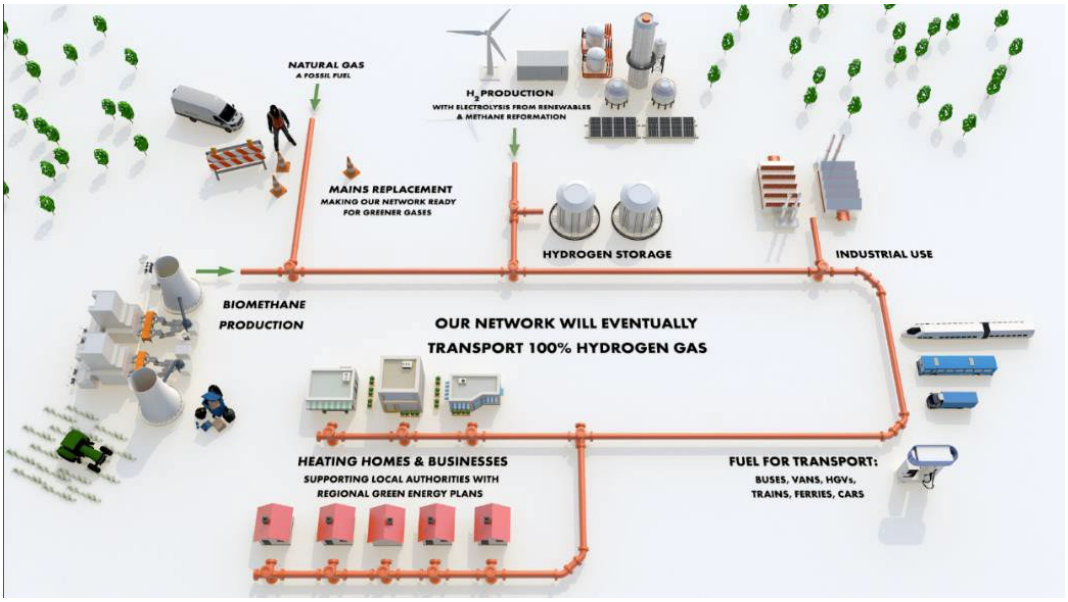


Figure 5: Introducing greener gases into our network for decarbonisation

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.

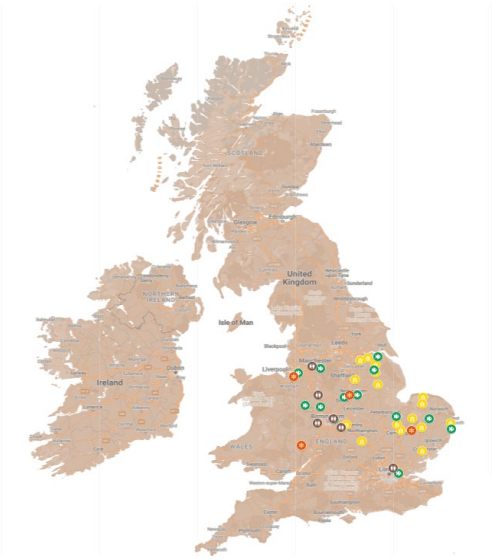


Figure 6: Biomethane sites on our network

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, we are developing a collaborative maintenance framework to meet our legislative obligations whilst the plant is operational and flowing biomethane into the gas grid.

We have successfully connected 42 biomethane sites to our network, which have the potential to heat up to 272,467 homes annually.

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 9 accepted offers with a gas to grid date confirmed for 2024/25. We continue to work with Industry and the UK government 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.

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	23/24
Sites connected	1	10	22	28	29	32	35	36	38	42	42
TWh Actual	0.07	0.64	1.44	1.78	2.03	2.38	2.52	2.62	2.80	3.08	3.13

Table 4: Total Biomethane connections and TWh production

Biomethane supply

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.

Facilitating distributed entry gas

Entry capacity remains a challenge for the growth of the renewable gas sector in some areas of the gas networks. We 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 the compressor has now been installed within our East Midlands network with final site works planned for completion and operational by November 2023.

This solution could also benefit already connected biomethane plants by enabling them 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 'Customer Entry Forum', to drive standardisation and growth of green energy for biomethane connections.

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

Decarbonising our fleet will be a major step towards meeting our net zero target. We have proactively moved away from fossil fuel vehicles to electric vehicles where practicable, e.g., our company vehicles and company cars, and are exploring ways to limit the carbon emissions from the rest of the fleet.

This includes a range of solutions including biomethane and hydrogen fuel cells.

Figure 7: Example units from our zero emission fleet

Decarbonising transport

We have been exploring 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 (in the short to mid-term) and hydrogen (in the mid to long-term) in delivering the fastest decarbonisation of transport possible. This was supported by the Government Hydrogen Strategy update in August 2023. 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).

Hydrogen future

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 refueling infrastructure is developed, as was identified in our NIA-funded Hydrogen Grid to Vehicle (HG2V) work.

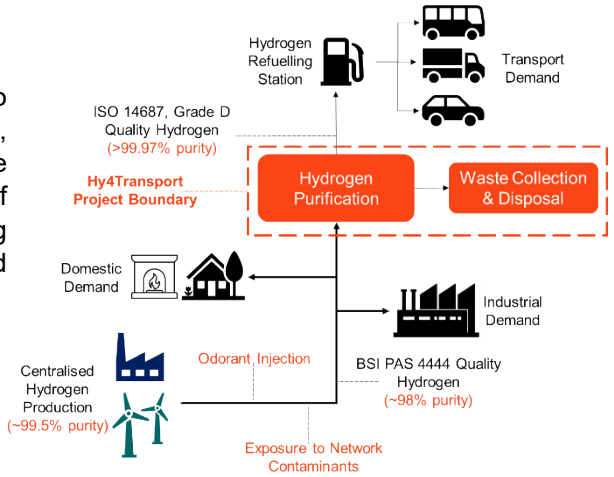


Figure 8: Hy4Transport Concept Diagram & Project Boundary

Our Hy4Transport project evolved from this and delivered essential evidence of the technical and commercial viability of purifying grid-supplied hydrogen, so that it can be used for FCEVs. The ambition was that the project 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.

Last year we were awarded £296k of funding by the Department for Energy Security and Net Zero (DESNZ) to conduct a full 8-month Feasibility Study, with our final report published in March 2023. Since then, we have supported National Gas Transmission's similar 'HyNTS Deblending' project, which was successfully awarded £9.9m of SIF funding for a full Beta-phase demonstration over 3 years, due to start in September 2023. This project, based at the Future Grid site in Spadeadam, will physically demonstrate the deblending & purification of hydrogen (from gas supplied by high pressure transmission pipelines) for utilisation in FCEVs across the UK transport sector.

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 Corby fueling station connected to our East Midlands network this year and is owned and operated by CNG fuels. There are twelve dispensers on site can fill up to 60 trucks per hour with a total capacity of more than 25 million Kg of Bio-CNG annually. If used at maximum capacity it will facilitate a reduction in greenhouse gas emissions of 180,000 tonnes per year.

Figure 9: Vehicle fueling with CNG

Network	East Anglia	East Midlands	North London	Northwest	West Midlands	Total
CNG Fuelling Stations	1	4	2	5	1	13

Table 5: Total CNG connections to the Cadent network by area

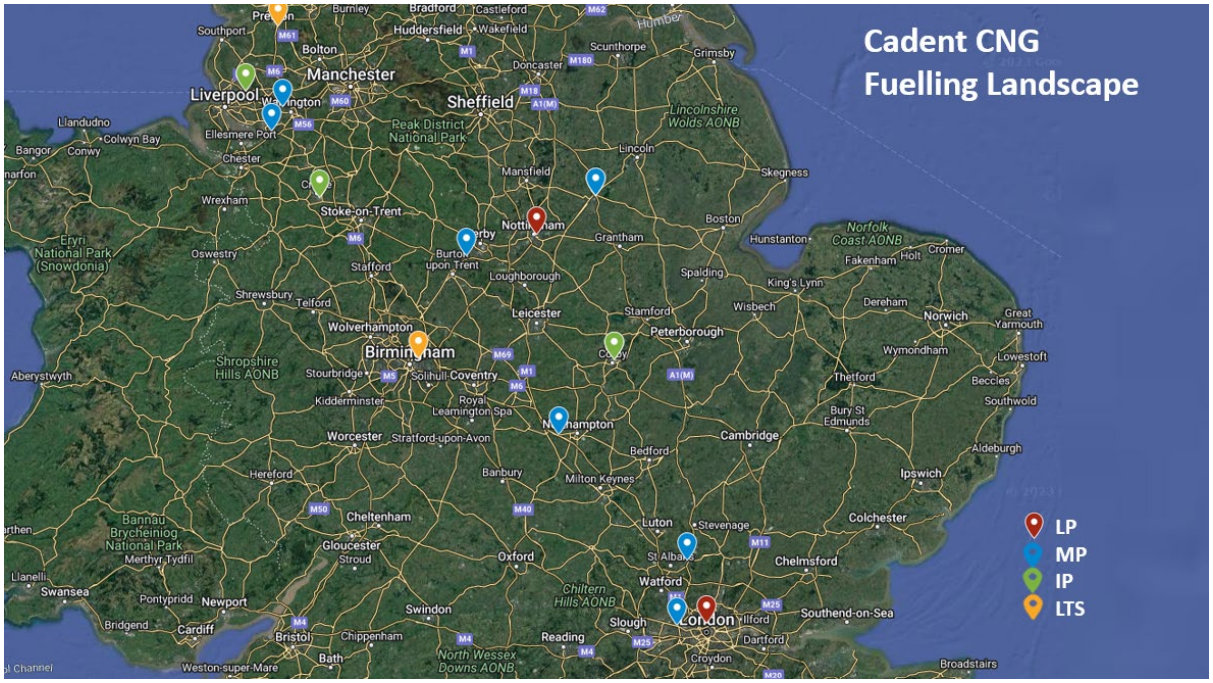


Figure 10: Cadent CNG Fueling Landscape

There are roughly 130,000 articulated lorries on the roads today in the UK and only 1% are fuelled by CNG. This market is now rapidly growing and is expected to double over the next year to 2600 lorries using CNG. In addition to the thirteen connected fuelling stations shown in the table above, we have a further four CNG fuelling sites in East Midlands in progress.

Many big brand companies are increasing their CNG fleet. John Lewis has 160 CNG lorries in its fleet at present and is aiming to phase out all 600 of its diesel lorries by 2028.

Delivery company Evri has placed an order for a further 70 CNG lorries which will bring the total number of these in their fleet to 160. They estimate that, collectively, these 160 vehicles will reduce its annual CO2 footprint by some 24,000 tonnes annually.

Royal Mail is also expanding its use of these with an addition of 29 CNG lorries to its fleet.

Figure 11: Logistics company utilising CNG vehicles

Not only are logistics companies using CNG vehicles for their delivery fleet but there is also a growing market with bus companies.
Nottingham Transport has the largest bio-gas bus fleet in the world with 120 buses and as these buses use bio-methane it means they produce 3.5 million kg less CO2 per year.

Providing those we serve with a safe, reliable, value for money, integrated, public transport network which has the least impact on our environment

Nottingham City Transport

120
World's largest fleet of bio-gas buses

15 million miles
Service since appearing on Nottingham's streets five years ago

3.5 million
KG less CO^2 emitted per year

Electrification of our fleet

Towards the end of 2019 we commenced operational trials of electric vans (EVs) for our North London First Call Operative (FCO) fleet. Expanding from this, we have now rolled out EVs across all four of our networks - and we intend to replace our entire FCO fleet (of around 1,100 vans) with EVs by 2026, in line with our Environmental Action Plan.

Figure 12: EV charging point

As at March 2023, we had 441 electric FCO vans in operation and have a target of 500 vans mobilised by November 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*.

We'll also replace around 2,500 commercial vehicles - around 950 of which will be EVs. 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 networks to green gases

Over the past year we have played a leading role in raising awareness and educating customers and key stakeholders on the role hydrogen can play in meeting the UK's net zero ambitions. Recent events in the wider political landscape and the resultant impact on energy supply has highlighted the importance of energy resilience. Working with leading bodies, we have been exploring the positive economic impact of hydrogen's use for heating and as a source of resilience, particularly during periods of low renewable energy (i.e., limited wind or sun). Our ambition is to actively support the development of a hydrogen economy in the UK. This will aid the decarbonisation of industry, as existing high gas demand users are acknowledging the need for hydrogen, where electrification is cost prohibitive and may lead to them relocating their business(es) outside of the UK. We are therefore working with industry to identify and develop future hydrogen industrial clusters, similar to our flagship hydrogen cluster in the Northwest, HyNet.

We have also continued to champion the role of blending hydrogen into our networks, as we recognise the immediate impact this has on reducing carbon emissions from domestic heating, without the need to make significant changes to infrastructure. Our Hydeploy2 project seeks to provide the HSE with the safety and technical evidence needed to support their recommendations to government.

Hydrogen can play a key role in the UK's energy resilience

The past year has seen a significant period of turbulence with rising energy prices and increases in the cost of living more generally. This has increased the focus on achieving net zero in a way which ensures the security and resilience of energy supplies and in response, the Government doubled the hydrogen production capacity target for the UK from 5 to 10 GW.

Low carbon hydrogen has a key role to play, as it is incredibly versatile, capable of being made right here in the UK from a variety of different sources of energy, it can be stored for long periods of time, and then converted into numerous forms of energy. This means it is not just capable of helping meet the UK's climate goals, but also doing so in a way that increases resilience and reduces our reliance on energy imports.

One great example of hydrogen's versatile role in ensuring energy resilience can be seen in the electricity sector, where it can be produced from excess renewable electricity currently wasted when supply outstrips demand when it is either very windy or very sunny. This hydrogen can then be stored and used when renewable electricity production supply is not enough to meet demand, either directly to make heat or supply transport, or turned back into electricity to meet demand.

Kick-starting the hydrogen economy through blending

Hydrogen blending can rapidly increase growth in hydrogen production, begin to reduce curtailment of renewable power generation and start to make significant reductions in greenhouse gas emissions from all users on the gas grid. This year, our HyDeploy2 project, in collaboration with Northern Gas Networks, successfully completed a ground-breaking trial where a 20% hydrogen blend was delivered to over 700 households and small commercial buildings in the village of Winlaton over an 11-month period. This has demonstrated that no changes are required in consumer homes making hydrogen blending a low cost, relatively quick, low regrets solution to begin to decarbonise the gas network. This unique opportunity means that blending can be a flexible off-taker of hydrogen allowing production to scale while demand develops, supporting the UK governments target of 10 GW by 2030. We have worked in collaboration with the Energy Networks Association and the major gas distribution/transmission networks to publish the blending opportunity across Great Britain. Nationally, 60 TWh of hydrogen could be blended into the grid per annum, the equivalent of fully

decarbonising 5 million homes and saving around 10 million tonnes of CO_2 per year. The UK government recognise the strategic value blending can provide across the entire energy system and are expected to make a policy decision on the future of hydrogen blending in 2023/24.

Demonstrating a safe transition to hydrogen

We continue to develop evidence to support hydrogen conversion, including leading on the ENA End User Safety Evidence Program and network materials testing program. More recently we collaboratively developed a safety case framework for a village trial, which has been positively received by the Health and Safety Executive (HSE).

The Hydrogen Experience Centre

In support of 'education' around hydrogen's use in the home, we opened a dedicated experience centre for members of the public and stakeholders to visit. This allows people to see hydrogen appliances in action. This has involved the construction of Cadent's first hydrogen installation that supplies hydrogen to the appliances (which includes two boilers, two fireplaces and two cookers with ovens and hobs). The installation is also supporting our thinking around future skills and competencies for our workforce, as we prepare our business for a transition to hydrogen in our networks. The centre opened in October 2022 and has attracted over 700 visitors to date.

Figure 13: Hydrogen Experience Centre, Whitby

Planning new hydrogen infrastructure

We have continued to progress a range of regional development opportunities, through the delivery of feasibility projects. The resultant programmes will now look to progress to Technical Feasibility, pre-FEED (Front End Engineering Design) and FEED programmes over the next few years. It is anticipated that these programmes will lead on to be part of our capital delivery programme in support of a new hydrogen infrastructure in the UK. The initial stages of these regional development programmes are supported by funding from Ofgem in RIIO-2.

The initial stages of these programmes are focussed on delivering low carbon hydrogen to heavy industry, gas-fired power generation and heavy transport sites, to enable those organisations to transition away from natural gas and other fossil fuels. This will be primarily through new build hydrogen pipelines, to enable the natural gas networks to continue flowing for as long as required.

The 2026 heat policy decision by government will clarify the extent to which hydrogen for domestic and commercial heating will be supported. This decision will drive whether or not we will be expected to convert towns and later entire network regions to hydrogen through the re-purposing of existing pipelines. Should hydrogen for heating not be supported, we may still be required to convert sections of its network to hydrogen to enable deeper decarbonisation in the industrial, commercial and power generation sectors.

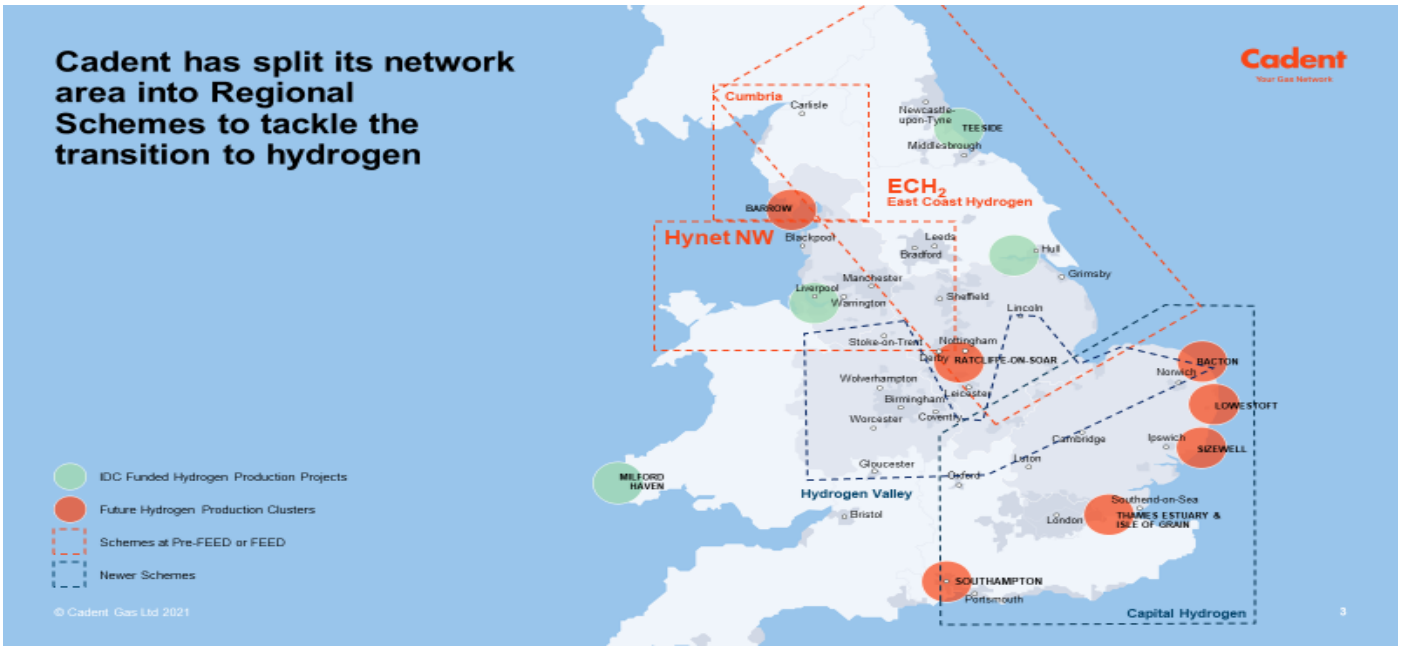


Figure 14: Footprint of our regional development schemes

East Coast Hydrogen

In 2021 we established the East Coast Hydrogen programme, a joint programme with Northern Gas Networks and National Gas. The aim of the programme is to demonstrate where and how the conversion of the gas networks in the East Midlands and the Northeast to hydrogen might start, using a multi-staged approach over the next 15- 20 years.

The programme would involve the construction of a brand-new pipeline that will allow 100% hydrogen to be transported from production centres in the Humber, South Yorkshire and East Midlands to heavy industry, power generators and transport hubs. The proposed pipeline route crosses from northern Lincolnshire to South Yorkshire and south from there to Northamptonshire.

An initial feasibility and technical feasibility study were undertaken in 2022, which have informed the current stage of the project, a Pre-FEED, which involves the initial FEED for the pipeline. The pre-FEED will determine the optimum pipeline routing and sizing to meet customer demand.

In support of the project, we have engaged extensively with heavy gas users in the region to understand which companies want to decarbonise their operations by fuel switching to hydrogen. As a result of this work, almost 30 hydrogen forecasts and signed Memorandum of Understanding (MOUs) have been received from companies in the East Midlands network area. Initial forecast demand data indicates circa 5 TWh per annum of hydrogen demand across 93 sites in the East Midlands network area.

The wider East Coast Hydrogen Consortium Group has grown to include over 50 companies, many of which are existing our customers from the heavy industry and power generation sectors.

Capital Hydrogen

Our Capital Hydrogen regional development programme, in partnership with SGN and National Gas, is now well underway. The programme seeks to explore how to convert the gas networks of East of England, the Southeast and London to hydrogen. The initial step has involved a feasibility study, which identified how much hydrogen might be needed in London (the biggest demand centre in the area) over the next 30 years, where it would be produced and stored, how it would be transported and what the benefits would be of such a programme. The feasibility study also helped identify near-term opportunities to deploy hydrogen in London, for use in sectors such as heavy industry, transport and district heating, in order to help achieve London's net zero by 2030 target.

A consortium of more than 30 supportive organisations has formed to help inform the next stage of the programme, which for us will be a technical feasibility study for the 'East London Hydrogen Pipeline'. The need for this near-term new build pipeline was identified by the feasibility study to connect hydrogen supply from potentially 9 different companies in Thurrock to

a string of heavy industry along the North Bank of the Thames who could collectively consume more than 2TWh of hydrogen per year if they switched from natural gas. The technical feasibility, which started this year, will identify how supply, demand and storage could be balanced across this new, isolated section of network, and what it might take to achieve this.

Hydrogen Valley

We undertook a feasibility study, in collaboration with National Gas, to look at the vision for hydrogen across the West Midlands region and the steps needed to achieve it. The project, Hydrogen Valley, seeks to link up with other hydrogen infrastructure developments (such as HyNet, East Coast Hydrogen, Bacton and Project Union) to optimise the opportunities for bringing hydrogen into the area. The project will form the first stage of a multi phased programme to enable hydrogen usage in the region. The outputs of the initial study were shared in March 2023 at an event in Westminster.

HyNet

Over the past year we have continued to focus on delivering the design, engineering and DCO (Development Consent Order) preparation for a 125Km hydrogen pipeline forming part of HyNet industrial cluster in the Northwest. HyNet is made up of a consortium of organisations integrating hydrogen production with carbon capture and storage that enables energy-intensive industries to reduce their carbon emissions. Consortium partners are Progressive Energy, Essar, ENI, Inovyn, Hanson, University of Chester and Cadent. We have undertaken route design, a non-statutory consultation with the public, route and corridor refinement and a statutory consultation with stakeholders to help inform our final pipeline corridor selection, alongside ground investigations and environmental surveys to support this. We are now on track to firm up our designs ahead of our DCO submission. Works to progress wider requirements including the case for safety and operational readiness have been initiated.

Figure 15: HyNet Northwest

We have also started progressing an opportunity for early development of one phase of the pipeline network (Phase 1b), to aid hydrogen supply between a number of producers and heavy demand users.

What's next?

We will continue to support the government's ambitions for net zero, through the provision of any remaining evidence to support their policy decisions on heating. We will also seek to support industry as they look to develop their net zero plans.

A culture of innovation

We strive to deliver innovation and recognise the changing landscape of future energy across the world. Our priorities have not fundamentally changed in the last year and we continue to drive and support the UK's energy transition. We've set out our innovation strategy to utilise funding mechanisms alongside operational financial investment within our networks.

Innovations in the following areas have progressed significantly in the past year with a few examples detailed below:

- Supporting customers in vulnerable situations
- Improving operational efficiency
- Supporting the UK's energy transition

Supporting customers in vulnerable situations

We put our customers at the heart of everything we do. We are committed to doing the right thing and we work hard to ensure our customers and their loved ones are kept safe, warm and independent in their homes.

Low Power Hot Water

The project is aiming to achieve an alternative solution to current hot water heating appliances provided when a customer in a vulnerable situation is off gas and hot water is required. For example, a customer suffers from poor health or is on the PSR (Priority Services Register).

To date within the project, we have established that:

- Two products would be required, one for the bathroom and one for the kitchen. This removes the need to move one product between both rooms, thus reducing the risk of injury to the customer.
- The products would need to be powered by rechargeable battery, therefore keeping costs to the customer at the minimal level.
- The products should be a minimum of five litres in capacity.

Figure 16: Low Power Hot Water prototype

We have now agreed on the design of the potential solutions to take forward, both in the bathroom and kitchen, and these will now be taken to prototype design. The kitchen unit has been designed using CAD software. This prototype went into production in May 2023 and a physical prototype product is currently available for us to review.

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.

Gas Eco (GECO) Pump - North London Network

We are committed to reducing the environmental impact of our activities. As part of this responsibility, we have identified that when decommissioning and abandoning gas mains, the gas contained within them is vented to the atmosphere. This is the only current option available and has an adverse environmental impact - piped natural gas is 21 times more harmful to the environment than carbon dioxide. The primary purpose of the GECO Pump is to recover gas contained in assets that are due to be decommissioned that would under normal operations be vented into the atmosphere.

There are three distinct functions for the GECO gas pump:

- GECO allows the contained gas to be compressed and reinjected back into the gas network.
- There is also a particular challenge when pressure testing large diameter PE that has been live/dead-inserted within an existing main, as this is undertaken with bottled gas. The GECO gas pump can be used to test the newly inserted main with natural gas from the existing network preventing us from having to use expensive bottled gas.
- The third application is to reduce area pressures across closed line valves which typically involve medium pressure networks (>75mbar to <2bar), so pressure reduction is possible and safe working can be achieved without the need for venting.

Digital Platform for Leakage Analytics - Strategic Innovation Fund (SIF) Project

We have completed the Discovery and Alpha phases of the DPLA project. We are now proud to be working through the comprehensive planning of the Beta phase. Gas Distribution Networks (GDNs) and their customers face increasing economic and environmental costs due to the shrinkage and leakage of natural gas.

The key objective of the DPLA project is to greatly improve the GDNs' understanding, accuracy and granularity of where and how much their assets are leaking. This will enable them to optimise their maintenance and repair investment to accelerate reduction of leakage, hence reducing harmful methane emissions and customer bills. Improved reporting will allow the GDNs to better track their emissions abatement efforts and focus on the most effective measures. Alpha delivered a complete system architecture and design for the DPLA and recommendations for regulatory, technology & commercial options. DPLA can also play a leading role in better understanding and quantifying in-field hydrogen leakage right from the start of its rollout.

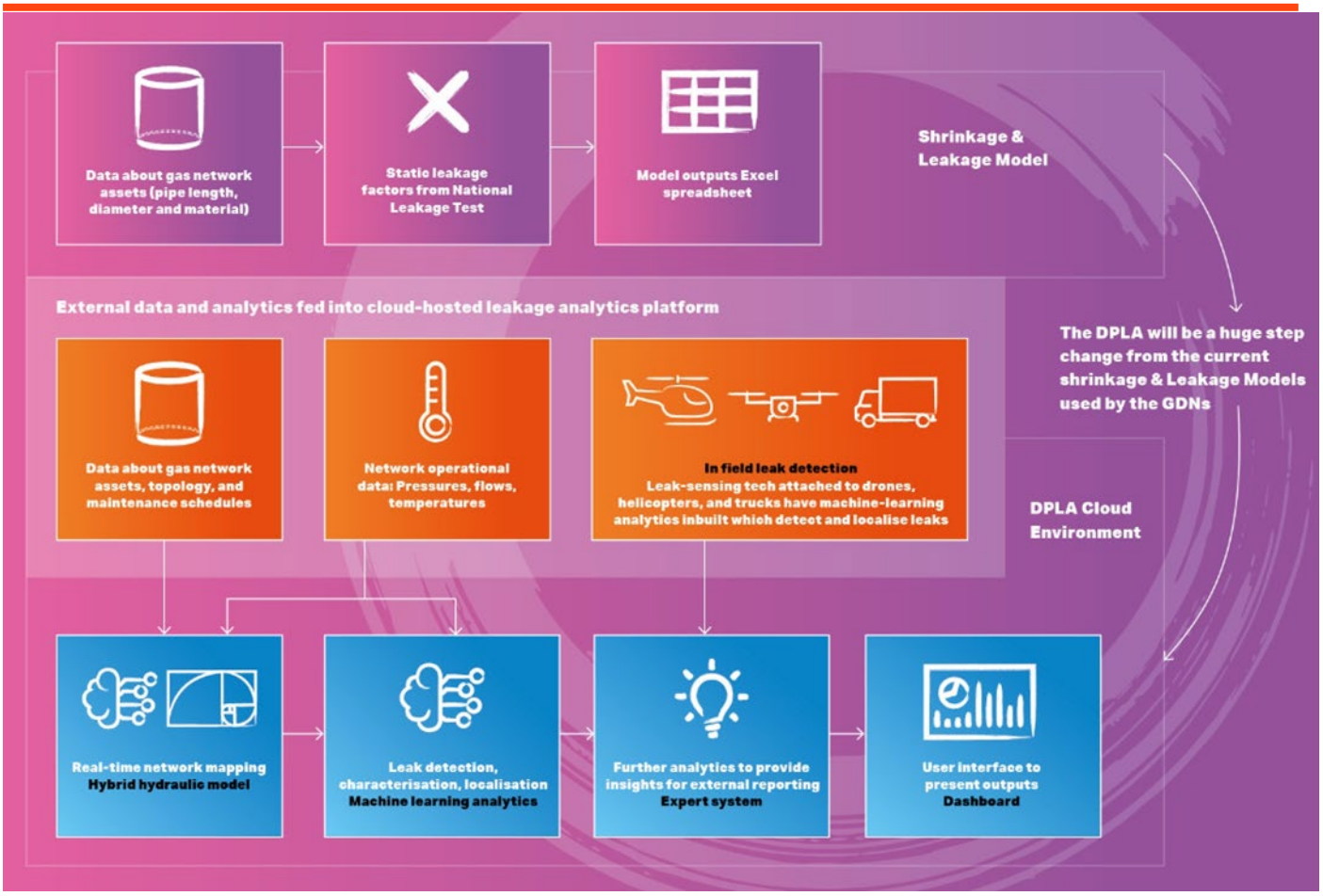


Figure 17: DPLA overview

Supporting the UK's energy transition

Use of Automatic Isolation Valve (AIV) Systems with Hydrogen -AIVs in LP and MP Services

This project seeks to confirm that AIV's remain a suitable safety measure for commercial properties, as already utilised with natural gas today. The project is focused more on the detection of gas and control philosophies, rather than the valves themselves. The experimental work has focused on the tracking of hydrogen and natural gas in different spaces from different leak sizes/configurations, and some exploratory Computational Fluid Dynamics (CFD) work will be carried out to compliment the experimental work.

Further information on these and other exciting projects can be found in our Annual Innovation Summary.

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 October 2023, ENA jointly held its second Energy Innovation Summit in Liverpool with DESNZ, Ofgem, UKRI and Innovate UK. Sector colleagues used this event to 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 that our customers and stakeholders urgently require 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 continued to enhance our regional development and net zero planning capability to manage the complex stakeholder relationships, to communicate the future role of the gas network, and provide joined-up and collaborative solutions.

Local authority engagement for whole energy system solutions

We continue to actively support 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 in their geography, including hydrogen. 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 active members of the ENA's Whole System Group, alongside our electricity and gas delivery network colleagues, to explore whole system solutions to facilitate local authority growth ambitions.

We believe the energy system of the future will build on the strengths of the networks we have today, to minimise the requirements for new infrastructure, and maximise the value of the assets consumers have invested in over many decades. We can do this by working closely with local bodies to deliver optimised decarbonisation plans that can identify practical and deliverable solutions.

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.

Regional System Planning

Ofgem are developing their thinking on how Regional System Planning (RSP) should work for the electricity and gas networks. This review was originally triggered by the work to develop the approach to flexibility markets and electricity Distribution System Operators but has now expanded to ensure it delivers sustainable whole energy system solutions. Whilst we are some way away from detailed conclusions, including whether the Future System Operator will also undertake the RSP duties, it does seem clear there will be a new entity established to coordinate and monitor local needs being fed into wider infrastructure and energy system planning.

We are working with our energy system colleagues to engage with Ofgem to shape these emerging proposals, and we still expect the energy networks to maintain a close and supportive relationship with Local Authorities that are actively managing decarbonisation strategies in their regions.

Supporting energy system resilience

Another great illustration of the value of whole system cooperation is the connection of gas-fueled 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.

In a future hydrogen economy, we would expect this whole system interaction to continued and even accelerate, as the need for dispatchable power generation will still exist.

We also expect the increasing levels of intermittent renewable power generation to utilise the production of hydrogen through electrolysis as a cost-effective longer-term form of energy storage.

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 gas distribution networks for the next decade.

Appraisal of scenarios

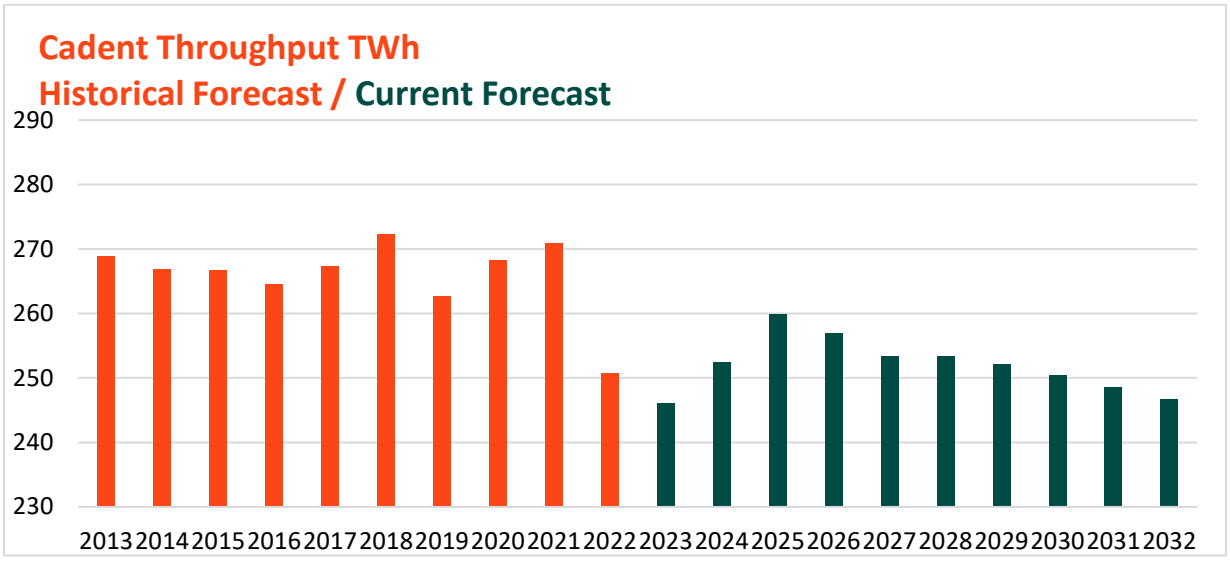
Our demand scenarios are based on planning assumptions we have derived from market observations and stakeholder engagement. The scenarios consider the need to reduce our carbon emissions, which is critical to meeting the UK's decarbonisation targets by 2050. They also include the views of specialist 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 going to be slightly lower than the previous year's forecast. This has largely been due to the impacts of the high energy prices last year. It is forecast that residential demand will bounce back over the next couple of years followed by the commercial demand which recovers slightly slower than the residential. There is predicted to be a slight decrease in industrial demands in the later part of the ten-year forecast as the government target announcements for the use of hydrogen in industrial clusters.



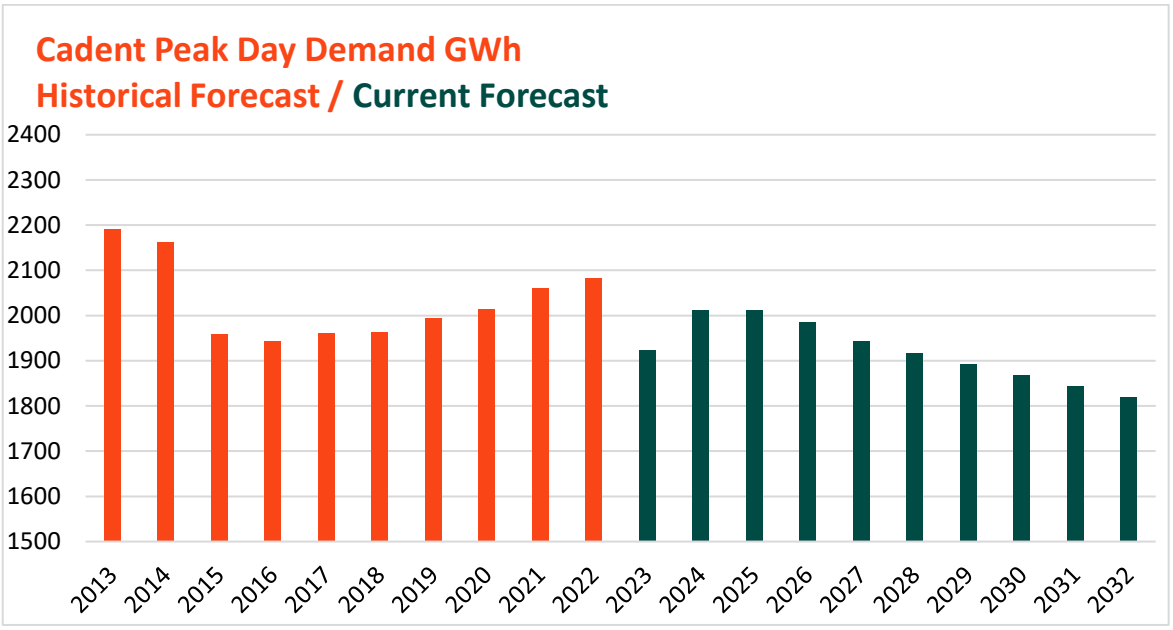
Graph 1: Annual throughput – 10 year historical and 10-year forecast

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 2023 document provides four scenarios in total which was based on the 2022 scenarios as it was agreed that there wasn't enough change to warrant new scenarios. The FES team have concentrated on making improvement processes this year and have also supplied us with an updated 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 hour demand - 10 year historical and 10-year forecast

For the last five years we have used Falling Short scenario to determine our ten 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 2032.
  - A comparison of actual demands during 2022 with the forecasts in our LTDP
  - Maximum and minimum demand days and forecasts for winter and summer 2022/23.

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.

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.

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 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 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 network asset engineers, integrity engineers (technical) and our Energy Control Centre (ECC) colleagues.

The purpose of any live data monitoring is to ensure on-day demand and supply within our networks is enough, and to identify any alarms/faults which require investigation. This also helps us to produce more accurate, granular trends.

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

Figure 18: 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 (NAMPs) 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 activities related to different asset classes such as pipelines, MOBs, mechanical assets, replacement of mains to reduce leakage, identify efficient asset health related investment, enable hydrogen-readiness and support other network-specific and company-wide initiatives, such as connecting gas-fueled 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. Within our central team, we are also considering low-carbon alternatives (including hydrogen) and will assess the potential requirements for a net zero gas network, and this will influence our overall strategy for asset investments.

Our efficient mains replacement programme helps reduce costs to our customers by managing our network pressures and identifying reinforcement opportunities to drive increased insertion rates.

From a pressure management perspective, we are reviewing our governors to test what is feasible from a pressure elevation perspective, which will enable further mains insertion without the need for physical pipe reinforcement – this supports our ability to manage the impact on customers through optimising the physical operation of our network.

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 as well as increasing their safety.

Figure 19: 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.

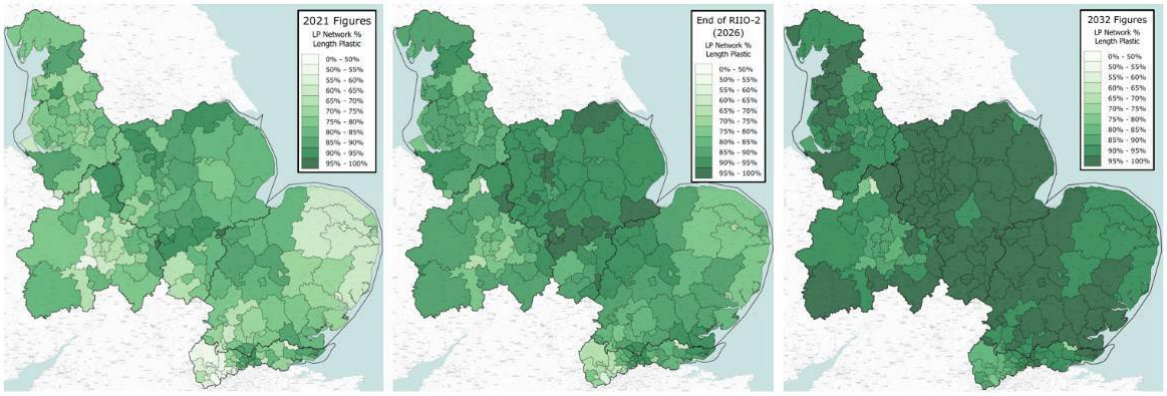


Figure 20: Plastic % of low-pressure networks from 2021 to 2032 across Local Authorities

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.

  A recent innovative development has been the introduction of Advanced Leak Detection Management (ADLM) through the use of proactive vehicle-based surveying. This is being piloted in our London network with an ambition of securing funding from Ofgem for an industry wide rollout of ADLM. The technology enables accurate detection of fugitive methane emissions from our network with the ability to prioritise the highest emitting locations from a maintenance (repair) perspective but also to use the data to further optimise our ongoing mains replacement programme. This drives significant environmental benefits through reducing methane emissions in an optimised manner as well as enabling a proactive maintenance programme for our gas mains network. Better utilisation of data and technology is central to our Operations 4.0 “Imagine 2033” aspirations to transform how we operate and maintain our networks, and ADLM is a good illustration of what is possible.

- **Northwest:** 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:** Reinforcements are going ahead across many parts of the area to increase capacity. Areas of particular investment include Congleton and Tamworth which includes a new low pressure (LP) to medium pressure (MP) governor due to growth in these towns. Over 6km of LP reinforcement is planned, as well as MP reinforcement in Wolverhampton to allow for a power generation site.

Figure 21: West Midlands team performing essential mains replacement works

Supporting customers in multi occupancy buildings (MOBs)

We 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. In addition, we build a robust investment plan to replace our MOB infrastructure in line with the outputs from the inspections to ensure we deliver a safe and reliable gas supply.

We have the Energy Exchange Programme where we look at removing gas from buildings where it would not be financially viable for us to replace the infrastructure, offering the affected residents compensation.

In addition, 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 MOBs to 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 MOBs in conjunction with the mains replacement programme to minimise customer and local community impacts.

Our inspection programme in the medium term will expand to include multi occupancy commercial structures as well as sites with large services. We expect these inspections will drive some investment requirements to ensure our network continues to deliver a safe and reliable supply.

Closing statement

Thank you for reading our Long-Term Development Plan 2023. 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
- 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.
- **https://www.nationalgrideso.com/future-energy/future-energy-scenarios**

  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).
- **https://www.gov.uk/government/organisations/department-for-energy-security-and-net-zero/about**

  Department for Energy Security & Net Zero– the government department responsible for securing our long-term energy supply, bringing down bills and halving inflation.
- **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.
- https://www.gov.uk/government/organisations/office-for-zero-emission-vehicles

  The Office for Zero Emission Vehicles (OZEV) is a team working across government to support the transition to zero emission vehicles (ZEVs).
- **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.

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