

Annual Summary
2017/18



Foreword

Beneath your feet runs 200 years of gas innovation; a network of underground pipes connecting 11 million homes and businesses. It's our invisible commitment to meet the UK's energy needs, today and tomorrow.

Our business owns, runs and maintains four of Britain's eight gas distribution networks. It's down to us to keep the energy flowing – so customers keep warm, safe and connected. We work closely with other gas networks and energy companies. And we pursue innovation at every turn. Because forward thinking means a brighter future for our customers.

www.cadentgas.com

Innovation that puts customers' needs first

As an innovation team working for 11 million customers, the most important question we ask is 'what value can this new idea or technology bring for our customers?'



Welcome to our fifth innovation Annual Summary under RIIO and the Network Innovation Allowance (NIA). This report brings together the work from our NIA and Network Innovation Competition (NIC) projects.

It has been a busy first year as our new company Cadent; and we have really invigorated the innovation portfolio across our three work areas: day-to-day operations, mains replacement and future role of gas

Our NIA expenditure this year is £7.4m. Some 27 projects were completed in the past year and 34 more are in development. Consistent with previous years, about a third of these are collaborative projects with other Gas Distribution Network Operators. We have three NIC projects in progress.

To support our day-to-day work, this year we have launched two new technologies into our operational teams to help them deliver quicker repairs for customers. Encouragingly, several projects have also progressed from early stage 'discovery' to testing and field trials. It's really important to thoroughly assess innovations to make sure they can deliver value across a wide set of circumstances.

Innovating to improve the processes around our mains replacement work is an area where we have been taking a different approach this year, pushing ahead with small ideas that can add up to a big difference. The upgrading work we do to replace old metallic gas mains with plastic pipes can be a headache for customers in terms of disruption. I'm pleased to say that this year we have rapidly advanced some of these smaller solutions which have a wide appeal.

Our role exploring the role of gas in a low-carbon future has been an area of significant growth for us this year. We have several ambitious projects which are focused on making the best use of our network, assets and customer knowledge to support a green future. This work is vital to deliver cleaner air for UK customers through decarbonising energy use, for domestic and industrial customers. One example of this is our HyNet project. It focuses on energy intensive industrial gas users and has carefully assessed the geography and economic make-up of the North West region to find the most low-cost and deliverable programme to meet customers' needs. It's an exciting project and one we look forward to developing over the coming years.

2018/19 has also seen the launch of the joint Gas Distribution Network Innovation Strategy. This is a real step forward to maximise the benefits of innovation across all of the networks for gas customers. You can read more about this later in the report.

I am looking ahead to next year with confidence and optimism. We have a number of projects which are almost ready to deliver into our business for measurable day-to-day improvements. Our longer-term ventures offer real promise; and we have a renewed industry focus on working together to maximise the benefits of innovation for customers and the environment.

Huw Sullivan
Innovation Delivery Manager
Cadent

Innovation is evolving. It's now more than just great new ideas – it's responding to customers' needs with measurable solutions that fit into the wider energy, economic and social picture.

Innovation helps us deliver a better service for our customers

Cadent is the UK's biggest gas distribution network. Our pipes sit under congested roads, busy city centres, rural areas and growing commuter towns.

We have a good record of delivering gas safely and efficiently, but like every good business, we're always looking for better ways to do things. We're focused on pursuing new ideas and technologies through innovation, so we can continue to meet customers' needs in a fast-moving world.

To reflect this, our innovation work is focused on three areas:

- Day-to-day operations
- Mains replacement
- Future role of gas.

Day-to-day operations





Mains replacement

These ideas might be to improve how we repair pipes, so we can do the job more quickly. Or it could be a faster and easier way to switch out old pipes for new ones, so we reduce the disruption to customers from digging up roads.

With
82,000
miles of pipeline
delivering gas to around
11 million
customers

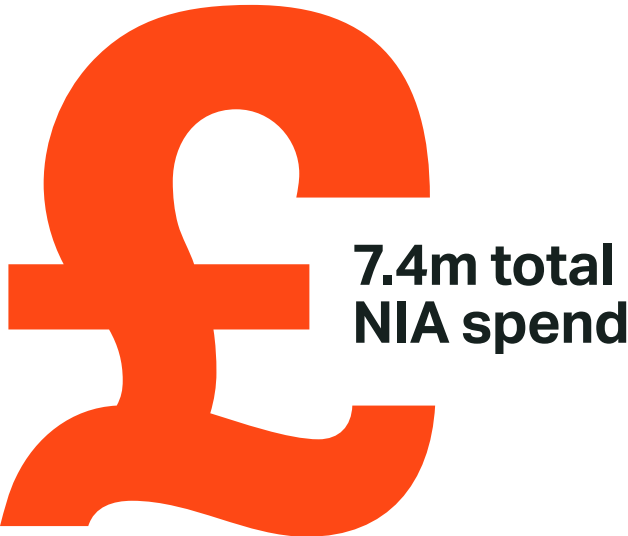


**Future role
of gas**

We're also looking much further ahead. Gas is likely to remain an important energy fuel for industrial and domestic customers as the UK reduces its carbon dioxide emissions. Going low carbon means thinking creatively today, so we can make the right changes that bring benefits for customers long into the future.

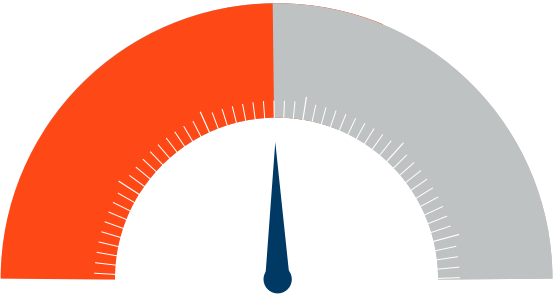
As an innovation team, we collaborate closely with colleagues across our business, as well as suppliers and other energy networks, sharing the brightest ideas and solutions. We are committed to working hard to move as many innovative ideas as possible from discovery to delivery, bringing the best results for our customers.

2017/18 In numbers

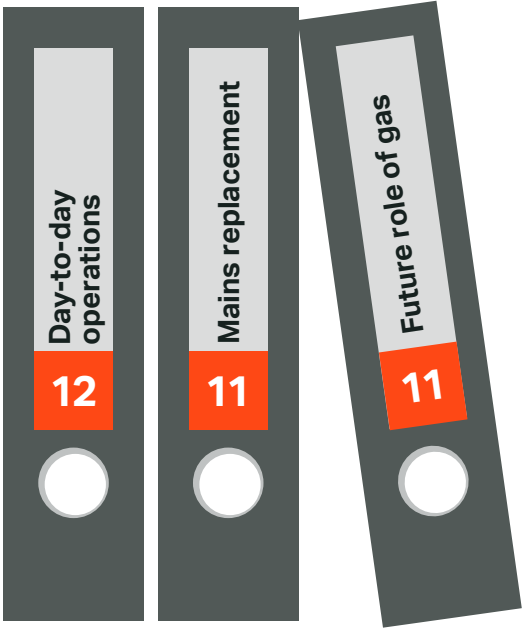


34 projects in development

These are made up of:



27 projects completed



061

**Total reportable
projects for 2017/18**

22

**collaborative
projects with
other gas
distribution
network
operators**



**2 projects ready for
implementation**



**8 projects to go into
further development**

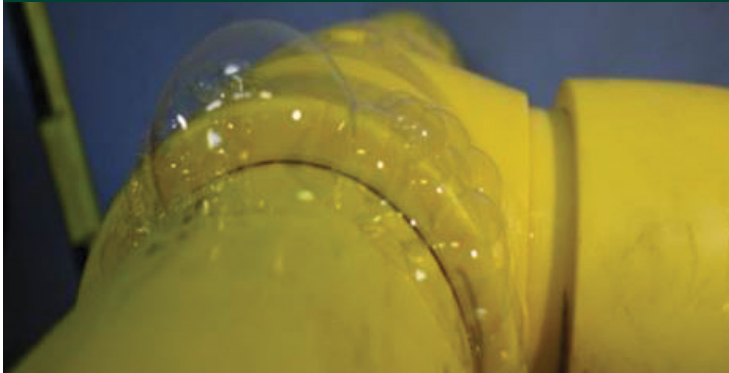
Day-to-day operations



A toolbox of solutions for pipe repairs

Smart solutions for cost-effective repairs

Polyethylene Repairs



If a plastic pipe needs repairing, the only option for our repair teams is to cut out and replace that section of pipe.

Cadent is leading a collaborative project with SGN to explore the best techniques to use for permanent repairs. We're focusing on methods that can be done without stopping the flow of gas, as well as solving a range of different problems, such as holes, cracks, and leaking joints and fittings.

We have completed an initial review of temporary repair techniques which are currently used on pipes. In the next phase, we will be testing real-life pipe samples to identify which of these techniques could be approved for permanent repairs.

Benefits

- Safer long-term repair solutions
- Reduced need to interrupt gas supplies to customers
- Repairs carried out in one visit.

As a project manager for these three projects, it is very rewarding to work with our operational repair teams and see solutions developed that could have a positive impact on the work they do for our customers.



Tatiana Prieto-Lopez
Project Manager,
Operations

33-55%

estimated cost savings compared to existing leakage repair options.



Managing different pipe materials

Management of Non-Standard Materials

The pipes under the ground today are a combination of old and new materials, and occasionally something a little bit different. Around 10% of the network is built from non-standard material, and this can be challenging to manage.

This project will help us find out more about defects in non-standard pipe materials. In the early part of this project, we've been looking at our records to find out more about the types of pipes we have.

Next, it's over to our teams on the ground to tell us more about what they find everyday and share the challenges they face when repairing these unusual pipes.

Benefits

Knowing when a pipe is made of a non-standard material will help us:

- Manage our assets more proactively
- Be ready with the right repair solution.



Faster repairs on complex pipe features

Composite Repairs to Complex Shapes

A collaborative project between all the gas distribution and transmission networks is looking at new ways to repair complicated pipe shapes.

Currently, when there's a bend in a pipe that needs repair, technicians have to order a solution that's tailor-made to fit that particular feature. This can be expensive and means longer waiting times and disruption for customers as gas pressure in the pipe is reduced or lost.

With an effective composite repair system, our engineers would be able to quickly repair defects on all kinds of complex pipe shapes, even in an emergency.

The project is in the final phase of testing.

Benefits

- Faster repairs reduce customer disruption
- Lower repair costs.

From ideas to action

A better way to remove water from pipes

Top Tee Siphon Adaptor

The Top Tee Siphon Adaptor is a new way to solve the problem of water in pipes. This can happen because of flooding or a burst water main and means switching off gas to local people while we do repairs.

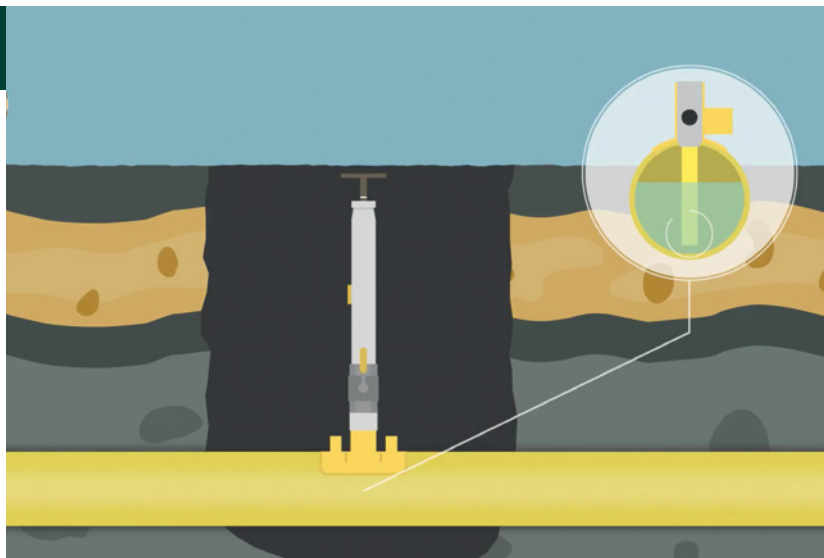
The Top Tee Siphon Adaptor fits directly on to a pipe without the need for any specialist equipment or fittings. This reduces the size of any excavation and speeds up the whole job, which means

customers can get their gas restored faster.

Field trials have gone well, and the adaptor should be in use across our networks later this year.

Benefits

- Restores gas supply to customers more quickly
- Reduces excavation size
- Significant cost savings compared to existing methods.



The operation portfolio has progressed well this year with promising early results across several projects and others moving into business as usual, where they will start to deliver benefits for our customers. On the horizon are new projects to improve the information we hold about our pipe network, as well as innovative technology for pre-heaters.

**Rob Mitchell, Operations Portfolio
Manager, Innovation**



Optimising leak detection

OptoMole

OptoMole is a sensing system which can locate gas leaks in buried ducts quickly, accurately and safely.

It reduces the need for major excavations and keeps the network, the public and our workforce safer.

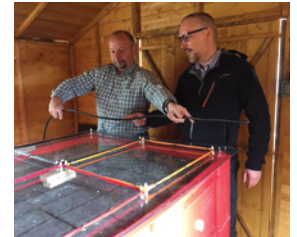
This year was the final phase of the project. Field trials have successfully demonstrated the full benefits of OptoMole and the new method of working has been approved. We are now starting to put OptoMole in place for our North West operations teams to use to improve leak detection.



Mind the cables

Phased Array

A Phased Array is a super-sensitive antenna which can identify tricky underground electricity cables known as 'pot end'. This piece of kit will be able to let our teams know that 'pot end' cables are there before they get to work digging.



This year we have been designing and testing whether a Phased Array could work to find electricity cables at a minimum depth

of 500mm. This early testing gave positive results and the project will now move on to further testing.

30-60%

estimated cost savings with OptoMole, compared to traditional methods.

Mains replacement



Innovating to improve how we upgrade the gas mains

We are developing – and putting into action – new ideas that will improve how we replace old iron gas mains as part of our UK-wide replacement programme. Finding ‘no dig’ technologies is a major focus to reduce the need for excavations and minimise disruption for our customers.

A quick, smart solution: Bonded Saddle

The bonded saddle device gives quicker and easier access to large diameter pipes – greater than 18 inches – and significantly reduces time and disruption on site.

It builds on an existing technique called ‘bond and bolt’ and sees a saddle-type attachment connected to the pipe with a high-quality adhesive.

Only the top of the main needs to be exposed, which reduces the overall size of the dig. Once the saddle is on, our teams can drill, tap and install new fittings as well as remove old ones.

After successful laboratory testing, we carried out a live trial on an 18-inch low pressure gas main this year. Even though the pipe dated back to 1880, the bonded saddle was up to the job.





Bonded Saddle field trials have been a real success, even where we have encountered some challenging pipework! The technology offers great potential for wider use in the future.

**Andy Newton,
Mains Replacement
Portfolio Manager**

Its successful installation meant a new housing development in London could get the gas service it needed. Further trials will take place in 2018/19.

Benefits

- Reduces the size of the excavation meaning less cost and disruption
- Uses off-the-shelf connections fittings so no additional specialist fittings need to be developed
- Long-term potential for wider use on smaller pipe diameters.

A model answer: Building Information Modelling (BIM)

We process hundreds of requests each year for changes to pipelines, additional connections and reinforcements. Designing and estimating the cost of this work can be difficult, and often has to be done by specialist consultants.

BIM could change all of that. It's intelligent software that brings together design and cost in one place to quickly identify the best options for upgrading, changing, or putting in new pipes.



The tool we've set out to develop will highlight multiple route options and provide 3D designs of the pipework. It will give us estimates on cost, programme length and carbon impact in real-time.

Benefits

In the future BIM technology could offer:

- Savings on design consultancy costs and the ability to let our customers know the best options for pipeline routes much more quickly
- Additional savings when combined with other digital technologies such as artificial intelligence.

Rethinking single-use pipe fittings

Mechanical Purge End Fitting

When we lay a new section of gas mains, the pipe must be pressure tested and purged (removal of air from the pipe) before it can be connected to the network. We use special end caps and purge tees to do this, which are welded on to the pipe through a process called electrofusion. Once the job's finished, these are cut out and can't be used again.

In this project, we're developing new fittings that can be used as

both end caps and purge points multiple times. This year, we designed, built and tested the new fittings; and we'll shortly be moving on to field trials.

Benefits

- Save time and money when laying new pipes by reducing or removing the need for electrofusion
- Reduce the amount of material sent to landfill.

Mains replacement

Isolating gas supply in an emergency

EZ Valve™

Repairing a gas leak in a multi-occupancy building used to involve large or multiple excavations and a shutdown of the gas line. This could leave all residents without gas until the repair was completed.

EZ Valve™ solves this problem, allowing our engineers to construct a Pipeline Isolation Valve while the line remains live.

Adapted from water industry technology, the valve allows as many properties as possible to remain on gas while repairs are done. It can be used in emergency situations to isolate the gas supply or on planned jobs to upgrade pipe systems.

Following successful field trials in 2016/17 on four-inch and six-inch diameter valves, this year we have been focused on off-site testing for smaller valves. The next phase of the project will move into field trials of the smaller valves.

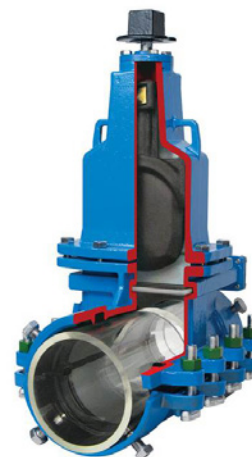
Benefits

- An EZ Valve™ installation reduces the size of an excavation by around 50%, which brings significant cost savings
- Keeps as many customers as possible on gas while repairs are carried out
- Can be installed under pressure and removes the need to bypass supply.



Multiple-occupancy buildings often need specially designed solutions. We have several projects underway to make our work in this area more efficient. These will help us repair and replace pipework more quickly, keeping customer disruption to a minimum.

**Andy Newton,
Mains Replacement
Portfolio Manager**





Reducing customers' time without gas

NuFlow epoxy lining

NuFlow epoxy lining allows us to refurbish pipes with a technique that uses air to blow through a new lining. This seals any corrosion or leaks and gets the pipe back into normal service quickly.

Progress this year

This year we successfully completed a live trial on a complex residential building in North London. Customers there had been without gas for several months, due to asbestos complicating replacement works. Using NuFlow meant we could turn the gas back on in just three days. This was the first time the technology had been used in the gas industry,

after it was originally developed in the US for water and sewage pipes.

Benefits

- **Significantly reduces customers' time without gas**
- **Less disruption on site with no drilling or scaffolding required**
- **Extends the life of the pipe, removing the need for a full replacement.**

Tackling corrosion

Pipe supports and wall anchors

Traditional pipe supports, which are used to attach external riser pipes to the building walls, are made from steel. Metal-on-metal contact between the riser pipe and its support can lead to corrosion.

We have developed a solution to this challenge with a shell that can be secured around the pipe with a plastic filling. This is used to keep the metals apart, removing the corrosion threat.

This is a simple innovation to solve a common problem. Successful field trials have been carried out this year and we are now implementing this into our everyday work.

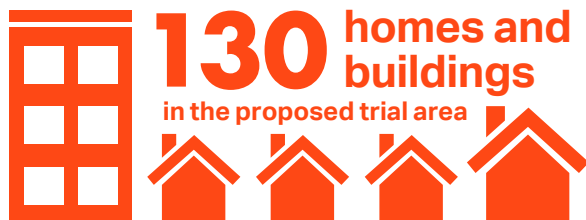
Benefits

- **Extends the life of the riser pipe, reducing customer interruptions.**



Gas for the future

Throughout the 200-year history of Great Britain's gas industry, it has constantly embraced change to keep the gas flowing safely and reliably to customers. Today, alongside electricity and transport, gas is changing again to meet the challenge of lowering Carbon Dioxide (CO₂) emissions and help customers move to green energy.



HyDeploy: Finding the evidence for hydrogen delivery



HyDeploy is a three year Network Innovation Competition funded project.

HyDeploy is a pioneering green energy trial where up to 20% of hydrogen will be blended into the normal gas supply to reduce carbon dioxide emissions.

The project aims to be the first in the UK to inject hydrogen into a natural gas network, with a one-year live trial taking place on part of Keele University's private gas network. It will determine the level of hydrogen that can be used safely by customers, and with no changes to their behaviour or their domestic appliances.

The results of HyDeploy could pave the way for a trial on a public network, and wider roll-out.

HyDeploy is led by Cadent as part of a consortium. Other members are Northern Gas Networks, Keele University, ITM Power, Progressive Energy Limited and the Health & Safety Executive (HSE).

2017/18 was the first year of HyDeploy and work has included detailed project planning and customer engagement.



Customers

Building a trusted relationship with local residents and campus users at Keele University is vital for HyDeploy as they will be the first customers in the UK to use hydrogen-blended gas. The engagement programme has included face-to-face meetings and drop-ins, digital and printed materials.

For customers whose homes are in the trial area, we have carried out gas appliance safety checks and tested their gas appliances with hydrogen-blended gas.



HyDeploy will be the first project to inject hydrogen into a natural gas grid in the UK.

Technical

This year, we've been focused on collecting the technical evidence to support an application to the HSE for an exemption to the Gas Safety (Management) Regulations. This is needed for the live trial to go ahead.

This evidence is a combination of literature, laboratory testing and the information collected from customers' homes about their appliances. We have also looked at detailed pipeline routing and what network modifications will be needed.

Looking ahead

In 2018/19, we will submit the exemption request to the HSE and, with the necessary approval, move on to construction and further customer engagement for the live trial.

Find out more at www.hydeploy.co.uk



We have several pioneering projects underway to explore how alternative forms of gas can help customers go 'low carbon' with minimal disruption. Our two exciting hydrogen projects will really accelerate knowledge on what hydrogen can deliver for heat and transport. It's a great time to be part of energy innovation in the UK.



Andy Lewis, Future Role of Gas Portfolio Manager



HyNet: a bold and ambitious clean energy vision for the North West

This year we published the next stage of our vision for an exciting hydrogen energy and Carbon Capture, Usage and Storage (CCUS) programme for the North West of England. This was supported by an independent assessment of the economic benefits HyNet can deliver.



How does HyNet work?

HyNet NW tackles the big issues. It can significantly reduce carbon emissions from energy-intensive industrial gas users, kick start decarbonisation of domestic heat without disrupting consumers, and open the door to a future for hydrogen transport.

The programme includes the creation of the UK's first CCUS infrastructure at low cost at the Liverpool Bay oil and gas field site. CCUS is technology vital to achieving the widespread decarbonisation needed to meet the UK's 2050 carbon reduction targets.

The programme can be delivered by 2026, with options for extension out to 2050. If successful, it could provide a model for similar programmes across the UK.

Working in the North West

The latest report builds on initial findings in 2016/17 that confirmed the North West was the most cost-effective and practical area to deliver HyNet. Spanning across Liverpool, Manchester and parts of Cheshire, the region has unique geology, an existing technical skills base for hydrogen, and a high concentration of industry. This makes it the ideal choice to lead on this first of a kind energy project. The region's proud industrial heritage, along with its commitment to innovation and clean energy, are also crucial to delivering the project successfully.

We have been busy engaging with industrial, government and other stakeholders across the North West and nationally to gather the support needed to deliver the full project. This work will continue over the next 12 months.



Liverpool Bay oil and gas fields have an estimated CO₂ storage capacity of
130 million tonnes

Over
1 Million
 tonnes of CO₂ savings

the equivalent of taking more than 600,000 cars off the road.

**5,000
 JOBS
 IN THE NW
 TO 2026**



10 energy intensive industry sites to receive up to 100% hydrogen.

Unlocking a low-carbon gas future



Unlocking the network

Future Billing Methodology (FBM) is a three-year Network Innovation Competition funded project. 2017/18 was the first year of delivery.

The goal of FBM is to maximise the amount of renewable or 'green gases' which can be carried in the gas network. To do this the project will explore how to update the commercial framework around how gas is billed.

Currently, alternative sources of gas, such as low-carbon gases, must be pre-processed to meet current billing standards. This can be costly and can be a barrier to bringing green gases on to the network. The project will look at three different options for updating the framework.

Successful industry engagement

Cross energy industry support was needed to progress with the project. Our engagement with stakeholders provided useful additional input to help shape the three-year programme.

Moving into field trials

In the final months of 2017/18, we have been planning the field trials. These involve placing gas measurement kits at various street sites in Cambridgeshire to learn more about the flow of green gas from a local biomethane plant. This will help us to understand how far green gas flows from a source at different times of the year.

Field trials will start in 2018/19.

Find out more at <http://futurebillingmethodology.com>

Leading the world on waste-to-gas technology

BioSNG

2017/18 was the second year of delivery for the Bio Synthetic Natural Gas (BioSNG) commercial plant project, part funded by the Network Innovation Competition and the Department for Transport.

This project follows on from the success of the pilot plant, which showed the economic and technical feasibility of this technology.

BioSNG is a green gas produced by the thermal and chemical conversion of wastes and biomass. The gas can be used to heat homes and power vehicles. This project is focused on the commercialisation of this technology.

The project is being delivered by the core partners Cadent, Advanced Plasma Power and Progressive Energy, joined by consortium partners Wales & West Utilities and CNG Services.



Winner of the
Energy
Institute 2017
Technology
Prize



BioSNG
could provide
33%
of UK domestic
heating
demand

Joined-up thinking

Working closely with the other gas and electricity network companies will bring the best results for customers in the future. We collaborate on our challenges and share the solutions.

Joined-up thinking

This year, the first joint gas and electricity networks innovation strategies were published, supported by the Energy Networks Association. They set out the priority areas where network companies are looking to innovation to provide benefits to customers.

The Gas Network Innovation Strategy is based around seven themes: the future of gas; safety and emergency; reliability and maintenance; repair; distribution mains replacement; environment and low carbon; and security.

■ **Since funding for network innovation was first introduced, Great Britain's energy networks have developed a world-leading reputation for innovation. These strategies build on the impressive track record of energy networks in delivering innovation projects. These projects have the potential to develop a truly world-class Whole Systems Approach that brings the way our gas and electricity networks work more closely together.**

Huw Sullivan, Innovation Delivery Manager for Cadent and Chair of the ENA Gas Innovation & Governance Group



Sharing ideas and solutions

Low Carbon Networks and Innovation (LCNI) Conference



One of the most effective forums for network companies to share innovation with each other, and the wider industry and public, is at the annual LCNI conference.

This year's event included interactive sessions on streetworks and underground utilities, active network management and asset monitoring. Cadent presented case studies on our digital technology work and our Future Role of Gas projects.

Utility Week Live

Our innovation team was also proud to represent Cadent at Utility Week Live. We shared our technology and made crucial contacts for the next wave of innovation to meet the needs of our business. It was a great opportunity to creatively showcase the new Cadent brand, with visitors to the stand trying their hand at building a valve with virtual reality modelling, and testing the volume of excavations with a 3D scanner.



Cross network project: Drone technology

The Beyond Visual Line of Sight (BVLOS) project is a new and exciting initiative, supported by the Energy Innovation Centre (EIC). It brings together all of the Gas and Electricity Network Operators to understand more about how drones can be used to inspect assets, which is a costly, but essential job.

The project will focus on creating an operational framework for flying drones BVLOS that has been approved by the Civil Aviation Authority. It will include safety cases for specific network operations.

It is paving the way for everyday drone operations and has the potential to bring significant cost savings as well as improvements in safety and data quality.



We are absolutely delighted to be involved in this cross-industry project... these are important first steps in ensuring we get the framework and safety case right for a future where drones can take on the task of visually inspecting assets.

**Rebecca Payne,
Project Manager**



Get in touch

We are always looking for fresh ideas to improve the way we work. Our innovation team is committed to making the best ideas a reality to deliver value for our customers. If you would like to talk to us about any of our existing projects or a new idea contact:
box.gd.innovation@cadentgas.com

Notes

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