

# Fuelling the future

Wales & West Utilities Innovation Report 2017/18



# Customers at the heart of everything we do

I'm proud to once again present our innovation report, outlining our progress on 22 innovation projects in 2018 (21 NIA and one NIC funded). We've invested £1.8m in innovation this year and every project is focused on our customers.

The title of this report is apt. This year we've continued to split our innovation spending between projects that benefit customers today and will help fuel the future. Our cutting-edge Freedom project, in collaboration with electricity network Western Power Distribution, could be the decarbonisation breakthrough we've been looking for, with very minimal impact of any kind – financial or otherwise – on customers.

And for today's customers, the latest in our arsenal of rapid window cutters – this time for steel pipes – is making the work we do in communities less disruptive and more efficient and cost effective.

As we move towards the end of RIIO-GD1, the Network Innovation Allowance (NIA) continues to play a key role, not only supporting our work, but also benefiting small and medium enterprises. It's delivered very real benefits for our customers today and is helping us prepare for the future.



Graham Edwards



## Our year at a glance

**NIA PROJECTS STARTED THIS YEAR**  
5  
SINCE 2013  
67

**AWARDS COLLECTED THIS YEAR**  
2  
SINCE 2013  
8

**TOTAL NIA PROJECTS COMPLETED THIS YEAR**  
10  
SINCE 2013  
56

**CROSS SECTOR PROJECTS THIS YEAR**  
2  
SINCE 2013  
7

**ZERO-COST PROJECTS COMPLETED THIS YEAR**  
12  
SINCE 2013  
30

**ELIMINATED JOURNEYS**  
4,674

**AVOIDED CUSTOMER INTERRUPTIONS**  
3,774

**REDUCED LANDFILL DISPOSAL BY**  
1,273m<sup>3</sup>  
EQUIVALENT VOLUME OF 100 CONCRETE MIXERS



**AVOIDED EXCAVATION – SAVED DIGGING HOLES THE SIZE OF 8 TENNIS COURTS**



**COLLABORATION PROJECTS THIS YEAR**  
14  
SINCE 2013  
46

**LIVE NIA PROJECTS THIS YEAR**  
21  
SINCE 2013  
67

**TOTAL INVESTMENT THIS YEAR**  
£1.8m  
SINCE 2013  
£6.6m

**IDEAS ASSESSED THIS YEAR**  
140  
SINCE 2013  
680

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# OUR STRATEGY



## Strategy in 60 seconds

Our strategy is simple. We innovate to make sure we can deliver the highest possible levels of safety, reliability and service for today and tomorrow's customers.

For today's customers, our innovations have helped us deliver outstanding levels of customer service: reducing the disruption from our essential work while making us more efficient and cost effective and our network more resilient.

And for tomorrow's customers, our research projects and partnerships make sure we play our part in delivering reliable energy at affordable costs for customers, while helping the UK meet its decarbonisation targets.

### THIS IS WHAT WE DO

#### We have and will continue to seek projects that:

- maximise existing assets – exploring alternative methods to restore rather than replacing them
- overcome challenges and find solutions to problems defined in the national gas sector strategy and our own innovation roadmap
- maximise and unlock the benefits of proven, available technology for use today
- deliver real benefits to customers
- develop future energy solutions to meet UK decarbonisation targets

### THIS IS HOW WE DO IT

- We collaborate with others – sharing project cost, learning and benefits
- We have a small core innovation team of four that is supported by a large number of colleagues to lead projects and fully embed and embrace change
- We maximise available funding sources to invest in our project portfolio

Wales & West Utilities collaborate with others, sharing project cost and benefit – **67%** of projects completed with one or more networks

We have invested an average **£1.3 million** of NIA incentive each year in innovation

Our small core team is supported by our business – **53%** of projects are implemented to BAU

### THIS IS WHY WE DO IT

Our energy transition research and development projects have provided real and compelling evidence for future decision making and support for others' research\*

- At Wales & West Utilities we understand that if we are to thrive as a business, we need to meet today's challenges, and get ready for tomorrow
- Developing, testing and deploying new approaches is essential to stay on top of the major changes we will see in our energy system and deliver the best possible service to our customers
- We have committed leaders who believe that a culture of change will allow us to improve our performance year-on-year, evolving our corporate culture to maximise and support innovation to take full advantage of its benefits
- We use learning as a catalyst for change – sharing the learning in a variety of ways and making sure benefits can be gained by others
- We want an innovation portfolio that delivers value for money. Since 2013 we have implemented 21% of our completed NIA projects to business-as-usual (BAU) and 78% of our completed self-funded projects

\* research assisted, CCC (IMECHE), IWA, FES 18, Welsh Government, Community Energy Groups

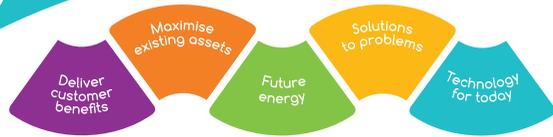
**21%**

of Wales & West Utilities NIA innovation projects have delivered great successes and are now BAU

**39%**

of projects developed by others are being trialled and tested at Wales & West Utilities and 12% are already adopted and rolled out

# CASE STUDIES



We use NIA funding wisely, when it is really required to support projects that bear uncertainty or to support decarbonisation. During 2017/18 we invested a further £1.8m across 21 projects registered on the Smarter Networks portal.

We have also invested significantly in more than 100 projects outside of the funding incentive programme since 2013.

## Freedom shows potential of hybrid systems

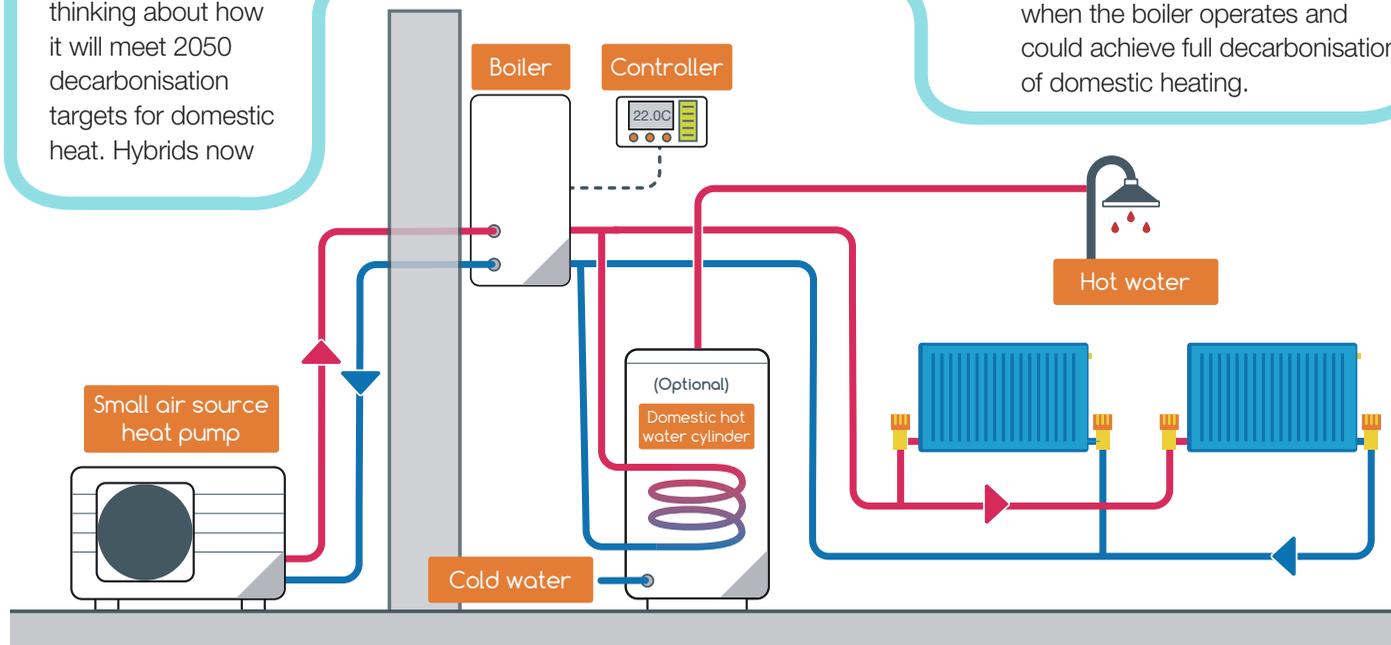
Freedom is a far-reaching innovation project that could pave the way for heating that is affordable, secure and low carbon.

Based in the 'Living Heat Lab' in Bridgend, Freedom is investigating the potential of multi-vector solutions in the lowest-cost decarbonisation of domestic heating. We're collaborating with Western Power Distribution (WPD) and PassivSystems on this project, alongside other partners: Delta-ee, Imperial College and City University.

We're studying the implications of deploying hybrid heating systems that can operate using either a gas boiler or an air source heat pump (ASHP). If successful, Freedom could go a long way in helping us solve the energy trilemma.

### KEY FINDINGS

The findings have been shared with the Department for Business, Energy & Industrial Strategy (BEIS) throughout the project and they are so convincing, they have influenced the Government's thinking about how it will meet 2050 decarbonisation targets for domestic heat. Hybrids now



feature as one of the options alongside hydrogen, biomethane and electrification. Their benefit and ease of application off the gas grid has also been compelling, with data showing a massive 80% reduction in LPG (Liquid Petroleum Gas) usage and a net £750 saving over the heating season.

Our pioneering research found smart-controlled hybrid heating systems with a boiler running on natural gas offer lower cost and lower carbon domestic heat when compared to electrified heat through ASHPs alone. The cost savings largely come from avoiding the reinforcement of the electricity network and peaking power generation. When it is cold and/or when there are capacity constraints on the electricity network, the heat load can shift across to the gas network to provide uncompromised heat. Also, we found the smart

control panel is able to switch between the two fuel sources and heating appliances according to cost, so decarbonisation could become affordable to the consumer without the need for a radical change of behaviour or major disruption to the homeowner.

Further testing in winter and future scenario simulations showed using renewable electricity in such a hybrid system could result in a 70% carbon reduction with minimal investment. In periods when renewable electricity generation isn't performing well, the fuel-flexible system falls back on gas. What's more, using renewable gas instead of fossil gas significantly improves the carbon reduction when the boiler operates and could achieve full decarbonisation of domestic heating.



### NEXT STEPS

We're about to begin a feasibility study into applying Freedom smart hybrid controls in non-domestic buildings. We are also supporting a project that is looking at the benefits of gas-fed hydrogen fuel cells powering ASHPs in a small number of homes. Also on the horizon for Freedom is a futuristic project with electronics giant Samsung that will investigate smart living where the hybrid heating system manages a home's entire energy consumption with controllable appliances.

While it's still early days, the project partners believe Freedom has made a compelling case for hybrid solutions, showing them to be cheaper, more flexible and more able to help the Government hit its decarbonisation targets than any other option.



# CASE STUDIES



## Rapid steel pipe cutter

Drawing inspiration from our pioneering project to develop a ductile iron pipe cutter – which was subsequently adopted in the UK, the US and Australia – we set out to emulate that success and invent a working solution for steel pipes as there was nothing suitable available.

We replace approximately 90% of the iron and steel pipelines in our network with mains insertion because we don't want to cut customers' gas supplies off unnecessarily. But to get them back on gas after replacement, we need to cut a window in the old pipe to connect their service pipe to the new plastic pipework. Our ambition was to take the learning from our groundbreaking ductile iron cutter project and see if we could apply it to the challenge of steel pipe window cutting.

### MAIN CHALLENGES

The only steel cutter being used on the network was time-consuming and expensive. It also required further excavation under the main, so was not an ideal solution. We also needed a way of minimising disruption to the customer, which means reducing the size and frequency of excavation and disconnection time.

Cutting steel pipes brings its own challenges – as with ductile iron, it can't be shattered, so requires specialist cutters.

### SOLUTION

From the outset, we quickly discovered we would need to adapt the ductile iron window cutter to reduce the risk of sparking and increase the durability of the blade if it was to work on steel. The innovative technological enhancements we applied included a new motor that operates at a low RPM and includes a water trickle feed, allowing it to remain spark free and safe to operate in a 'live' environment.

With any hand-held tool, hand-arm vibration is a key consideration. So when designing our prototype, we made sure the blade had low-vibration characteristics and included a guide frame so our innovation wouldn't be at the expense of our workforce's health and safety.

### KEY BENEFITS

This advanced equipment marks a turning point in the industry as, previously, there were no network-approved steel cutting tools that allow rapid access to inserted PE

pipe. Being able to cut a window in a steel pipe is a huge step forward, not just for service connections, but also for the retrieval of live heads and mains connections.

We expect this innovative solution will be extremely beneficial to our

replacement programme planning as well as for ad-hoc steel cutting – and it will mean we can continue with Live Mains Insertion on all metallic pipe replacement projects – saving us time and money and reducing disruption for the customer.

### NEXT STEPS

Following successful field trials of this cutting-edge piece of kit and an in-depth benefits analysis that backed up the business case for its

development, we have rolled out the rapid steel pipe cutters on our network and will continue using them for steel mains insertion window cutting and one-off connections of new properties.



# CASE STUDIES



## Above and beyond

We're spearheading a cross-industry, pioneering project to establish a standard, network-wide framework for drone use that could revolutionise the way we monitor and maintain our assets.

Launched in April 2018, this pathfinder project brings together gas and electricity networks and key industry partners Callen Lenz, the Civil Aviation Authority (CAA) and the Department for Transport (DfT) to look at how drones could transform the way energy networks perform vital inspections and aims to shape the future for drone applications.

Specifically, the project will develop the standards and define the regulatory environment so drone technology can be deployed by our industry. It will produce a set of principles to be adopted that mean the Civil Aviation Authority (CAA) will allow the industry to fly drones beyond visible line of sight (BVLOS), something only the military can do at the moment.

### KEY BENEFITS

The advantages of using this kind of flexible, futuristic airborne technology to monitor network assets are clear. Wales & West Utilities currently uses helicopters to carry out video inspections of its infrastructure every four years and unrecorded, manual inspections every fortnight. These are expensive and have environmental and health and safety implications, so drone inspections will offer an ideal solution if we can use them for out of sight operations. Using drones will also enable us to perform more regular video inspections, which will improve the quality of the data we can collect.

When this project is complete, our industry will be able to use drones for operations currently prohibited by the CAA. It will also deliver a toolkit that will define a range of variables such as distance, equipment, film quality, pilot competency requirements and drone weight as well as a system for planning flights. By setting out the acceptable regulatory parameters for BVLOS drone flights, the project has the potential to unlock even more applications for the technology in the energy industry in future.

## NEXT STEPS

Preparations are now under way for the first trials of drone operations at the end of 2018. This involves defining what the industry needs and identifying areas where trials can take place.

In winter, the first Trials in Segregated Airspace – essentially in designated 'no-go' zones for independent flights – will start. Trials in Non-Segregated Airspace – where there is likely to be interaction with light aircraft and other operators – are due at the end of 2019.

While unlikely to start seeing the fruits of this project for more than two years, once delivered it will allow the industry to take its network monitoring and maintenance to another level. Beyond that, the sky really is the limit.



# CASE STUDIES



## Efficient rollout to BAU

We continue to encourage the development of new ideas, driving innovative approaches across our business that have tangible benefits for us, our industry and our customers. But we don't just innovate for the sake of it. In the past year, we have rolled out new technology that's helping us drive improvements and has been adopted by the wider industry too. Here are eight examples of projects that have delivered cost savings and will help us avoid future costs as they become business-as-usual (BAU) and of course they also improve safety, reliability and service, and are better for the environment.

### CUTTING WITHOUT CUTTING OFF

To reconnect customers after live mains insertion pipe replacement, we have to make a service transfer window in the old pipe. That's easy for cast iron pipes as they can be cracked, but ductile iron requires specialist cutting equipment.

Traditional methods were time-consuming and costly, so we needed a radical new approach. The Ductile Iron Window Cutter, which we developed with Steve Vick International, introduces a

revolutionary alternative, typically cutting a window in ductile iron in less than 15 minutes – around 50% faster than traditional equipment.

We estimate this innovative solution has already saved us more than £430,000 since its large-scale rollout. And it's proven so effective, it's been adopted by other UK gas distribution networks and utilities in the US and Australia. What's more, the success of this project inspired us to develop a similar tool for steel pipes (see pages 8 and 9).

### TO HAV NOT

We are always striving to improve the health and safety of our workforce and one of our main issues is



The Hornet

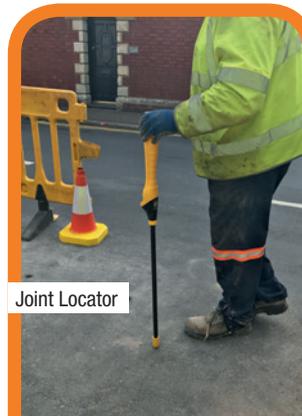
how to reduce hand/arm vibration syndrome (HAVs) when operating our equipment.

On escape jobs, we need to drill holes in the ground to identify the source of the escape. We presented this problem to a team at the Energy Innovation Centre and, working with them, identified a ground-breaking solution from MBW UK.

The Hornet is a compact, lightweight piece of kit that takes the drill out of the hands of the operator. We now deploy at least one per region across our network, dramatically reducing HAVs associated with rock drilling.

### JOINT VENTURE

Innovation isn't always about developing new



Joint Locator

technology; it can mean applying it to a new challenge. And that's what we did to tackle the issue of how we locate pipe joints.

We have taken landmine-seeking technology used by the military to help us find iron and steel joints on our pipes, where most gas escapes occur. The joint locators, which look like metal detectors, are now in use across our whole network and they are helping us to minimise the size and frequency of our excavations.

Aside from the obvious benefit of reducing reinstatement, we send less material to landfill, spend less time on site and reduce the impact of our works on road users and the local community.

### SEAL OF APPROVAL

When the last solution to a problem was developed in 1927, you know it's probably time for some fresh thinking. So we have looked to SGN's project – 'Self amalgamating tape' for inspiration to solve the issue of how to temporarily repair pipework and reduce cut-offs.

The innovative sealant Duraseal replaces the use of traditional products, which required constant monitoring and was often not appropriate anyway. In field trials, Duraseal proved safer, quicker and more



Duraseal

innovative push-fit adaptor has solved this issue, meaning the job can be done by one engineer. This reduces time on site and disruption to the customer and ensures we continue to deliver a reliable gas supply.

effective, meaning we can reduce disruption of supply to customers and save money too.

More than 600 of our engineers will be trained to use this method of repairing above-ground pipes on our network before Winter 2018.

### ADAPT AND OVERCOME

Full adoption of an innovative approach to replace a leaking or corrosive meter service head adaptor has saved us more than £100,000, improved efficiency and made our operations safer.

A new meter box adaptor can be installed without the need to involve an engineering team to cut off and reconnect the gas supply to a domestic property.

A simple yet brilliantly



Meter box adaptor



The Copper Outlet assembly

### MAKING THE CONNECTION

Driving outstanding service for customers and assuring the safety of our workforce are two of the key reasons we innovate. Full adoption across our network of the pioneering copper outlet assembly, supplied by Continental Product Engineering, has helped deliver this – and saved us more than £45,000 too.

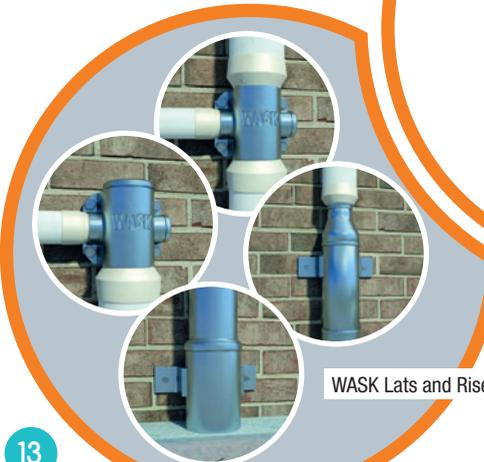
Used when we need to alter, move or isolate meters, this innovative, all-in-one fitting connects the meter outlet to the outside pipe so we no longer have to solder the

fittings together. As well as reducing injury risk, it has also cut time spent on site and causes less disruption to customers.

### LATS AND RISERS

Sometimes, overcoming an issue brings more benefits than you expect. That was definitely the case when we adopted the WASK Riser and Laterals system as our preferred method. It is a range of dedicated fittings that can be attached to the outside wall of a multi-occupancy building (MOB).

Installing the new plastic pipework instead of steel is cheaper, avoids rust and is quicker to install, as we expected. But as well as helping us deliver our priority of delivering value for money, it minimises the requirement of long-term maintenance and associated costs. As well as being easier to install for our engineers, it is also versatile and can be painted so it blends in to the building's appearance.



WASK Lats and Risers

### MINIMUM FUSS

A £17,000 innovation investment in a project to develop a revolutionary new way of stemming the flow of gas in metallic pipes so vital maintenance can be carried out has resulted in savings of more than £200,000.

MiniMuss Line Stop, from RadiusPLUS uses a bag made from a Kevlar-like material that, when inflated, stops gas flow in medium-pressure metallic pipes. Trials showed it to be just as effective as mechanical valve stoppers, but considerably more efficient.

It's a lightweight system that requires less specialist plant and equipment, eliminating many costly and time-consuming activities. This method enables us to complete flow-stopping works in half the time, minimising disruption to customers.



MiniMuss Line Stop

# LOOKING AHEAD

## Annual project summary

The pace of change is rapid and the need to innovate is only set to increase in the next decade. Guided by the publication of the first Gas Network Innovation Strategy, we will use innovation funding to build on existing projects and explore and keep pace with the critical changes brought about by a changing energy system.

Our ambition for 2018/19 is to continue to develop integral and trusting relationships with stakeholders internally and externally to build a network that feeds a well-balanced and resourced portfolio.

Our forward-looking innovation goals have been defined in our innovation roadmap and this is a very useful tool to support our innovation strategy detailing focus areas and projects that we will aim to deliver to unlock benefits for our customers.

A significant focus in our 2018/19 portfolio will seek to find solutions to decarbonise the gas network by examining the use of compression, reinforcement, data and storage to allow biomethane plants to connect and flow even in the lowest demand periods.

To complement our programme of transformational and organic improvements we will continue to work closely with other networks to implement their successful projects in our network where appropriate.

We are now working with more organisations than ever before – **335** and rising

NIA reference	NIA_WWU_040	NIA_WWU_043	NIA_WWU_035	NIA_WWU_033	NIA_WWU_045	NIA_WWU_038	NIA_WWU_044	NIA_WWU_036	NIA_WWU_039	NIA_WWU_034	NIA_WWU_042	NIA_WWU_021
<b>Title</b>	>7 bar Permanent Leak Repair Clamps	Alternative PE joint preparation	Climate change impact mapping	Development of a Risk Based Approach for Safe Control of Operations	Eye in the Sky	Flexible biomethane production using carboxylic acids	Gas Demand Forecasting	GPS Enabled Video in Route-Walk Surveys	Higher chain alkane gases from Anaerobic Digestion	Leakage Sealant Standards	Portable gas Reading Equipment (PRE)	SMART Pressure Sensor device
<b>Outline</b>	Understanding current and new methods of repairing the above 7 bar pipeline network to deliver a lower cost and risk solution	Understanding the issues surrounding PE pipe preparation for jointing, and assessing adequacy of new and current techniques	A full-scale demonstration project to develop climate change impact mapping for the Wales & West Utilities distribution geography	Developing an industry first process for managing operational tasks based on risk	Developing, through field testing, an industry standard for Beyond Visual Line Of Site (BVLOS) drone flights to inspect our assets	Researching a novel concept of energy storage to allow for flexible biomethane production in various networks throughout the year	A research study to develop a forecasting framework to accommodate a number of changes expected in gas demands arising from the decentralisation and decarbonisation of the energy system	To establish the feasibility of incorporating GPS embedded video data in different survey functions within a gas utility	Researching ways to improve the biomethane production processes to reduce the associated costs	Designing and developing new standards for innovative pipe repair solutions	A research project to explore three new techniques for surveying and detecting gas leaks	Developing a pressure sensing device that will allow digital measurement of test and installation pressures
<b>Status</b>	Live	Completed	Live	Live	Live	Live	Completed	Completed	Live	Live	Completed	Completed
<b>Collaboration between</b>	Wales & West Utilities, Cadent	Wales & West Utilities, NGN	Wales & West Utilities	Wales & West Utilities, SGN, Cadent, NGN	Wales & West Utilities, Cadent, NGN, NGGT, UKPN, SSE & NPG	Wales & West Utilities	Wales & West Utilities	Wales & West Utilities	Wales & West Utilities	Wales & West Utilities, SGN, Cadent, NGN	Wales & West Utilities	Wales & West Utilities
<b>Completion date</b>	November 2018	April 2017	July 2020	July 2018	January 2021	January 2020	December 2017	November 2017	April 2020	July 2018	January 2018	May 2017

NIA reference	NIC	NIA_NGN_114	NIA_NGN_225
<b>Title</b>	H21	H21 Leeds Citygate	H21 – Field Trials Design
<b>Outline</b>	Studying the technical feasibility of converting existing gas assets to hydrogen	Studying the possibility of converting a major UK city to hydrogen using the existing pipes and equipment	The design and site selection of field trials to support the NIC project
<b>Status</b>	Live	Completed	Live
<b>Collaboration between</b>	Wales & West Utilities, NGN, SGN, Cadent	Wales & West Utilities, NGN	Wales & West Utilities, NGN, SGN, Cadent
<b>Completion date</b>	December 2020	April 2017	June 2019

NIA reference	NIA_NGGD0094	NIA_NGGD0087	NIA_CAD0002	NIA_NGGD0032
<b>Title</b>	Composite Repairs to Complex Shapes	I-0052 Optomole Phase 4	Impact of Biomethane on Gas Networks	Intelligent CO Monitors
<b>Outline</b>	Investigating the feasibility of novel composite repairs technology for the repair of complex pipeline geometries	Testing innovative fibre optic technology to demonstrate its ability to locate gas leaks in underground utility ducts quickly and accurately	A desktop study to review some of the challenges facing the biomethane production industry	A trial deployment of Smart Compliance Ltd sensors, which will allow the remote monitoring of CO alarms
<b>Status</b>	Live	Completed	Completed	Completed
<b>Collaboration between</b>	Wales & West Utilities, Cadent, NGGT, NGN, SGN	Wales & West Utilities, Cadent, NGN	Wales & West Utilities, NGN, Cadent, SGN	Wales & West Utilities, NGN, Cadent
<b>Completion date</b>	November 2018	November 2017	November 2017	June 2017

NIA reference	NIA_SGN0107	NIA_SGN_0113
<b>Title</b>	IGEM Gas Quality Standard Working Group	Gas Quality Impacts on Industrial and Commercial applications
<b>Outline</b>	A desktop study to understand how flexible the network can be in relation to gas quality	Studying the impact of gas quality and engaging with industrial and commercial users to assess any impact to them
<b>Status</b>	Live	Live
<b>Collaboration between</b>	Wales & West Utilities, Cadent, NGN, SGN, NGGT	Wales & West Utilities, Cadent, NGN, SGN, NGGT
<b>Completion date</b>	January 2020	September 2018

NIA reference	NIA_WPD_023
<b>Title</b>	FREEDOM – Flexible Residential Energy Efficiency Demand Optimisation and Management
<b>Outline</b>	A demonstration project, building on our Bridgend Future series, investigating a whole energy system approach to achieve carbon reduction targets
<b>Status</b>	Live
<b>Collaboration between</b>	Wales & West Utilities, WPD
<b>Completion date</b>	January 2019



**WALES&WEST**  
UTILITIES

Wales & West House, Spooner Close, Celtic Springs, Coedkernew, Newport, NP10 8FZ  
Visit our website: [www.wwutilities.co.uk](http://www.wwutilities.co.uk)  
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