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OUTPUT

Hydrogen ...the fuel for our future?

Also in this issue:

News from the divisions

Will smart technology revolutionise our homes?

How the energy industry might transition to the circular economy

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ICOM Energy Association

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Regulars

Welcome

to the first 2017 issue of OUTPUT

We've got some thought provoking content in this edition of Output. EUA's President, Robert Murray, asks whether Smart technology is going to revolutionise our homes and his column certainly suggests that the smart home industry is on the cusp of some market changing developments.

EUA is doing a lot of work to raise awareness of the benefits of green gas and the role of decarbonising heat in meeting our climate change obligations. The gas grid currently reaches the homes of over 85% of the UK population and there is little appetite to simply abandon gas and start again with a new system, not to mention the enormous costs involved. Decarbonising the gas flowing through the grid offers an obvious solution. Using a range of green gases – biogas and bioSNG, offers a cost effective way of meeting the UK's 2050 carbon reduction targets. Ultimately, Hydrogen could be the fuel of the future and as our cover story this issue, we explore some of the science, research and projects going on around the potential of this fuel.

Todays linear 'take, make, dispose' world relies on large quantities of cheap, easily accessible materials, but is a model that is reaching its physical limits. A circular economy is an attractive and viable alternative that big business is already using. Philippa Roberts of WRc asks how the circular economy might be relevant to the energy industry.

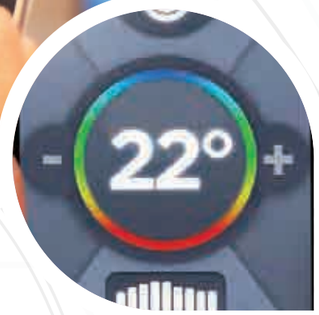
Our Leading Voice this issue is John Morea, CEO of the Gas Distribution Network, SGN Ltd. John was the first employee of SGN when it formed in 2005 and in his thoughtful interview he shares some great insight into the 'SGN Way' and details innovative projects challenging the business.

I hope you enjoy this issue. If you have any news you would like us to feature or articles you would like to see appear, please don't hesitate to get in touch caroline@eua.org.uk

Caroline Haine,
Editor, OUTPUT

Features

Utility Networks News



ALL SYSTEMS

"Go Live"

Another year in the Smart Metering Implementation Programme has commenced with the industry yet to start the mass rollout.

The DCC (Data and Communication Company) has "gone live" with release 1.2. This means that, in addition to the pre-existing Services they offer, DCC is now operationally live to communicate with meters on its production platform in the North, Central and South Regions.

However, there is still a huge amount of end to end testing using meters to be done. The energy suppliers are looking for concrete assurances from DCC before they put customers onto the DCC system.

DCC is still consulting with SEC Parties on a plan for delivering more functionality (known as Release 1.3).

The SMDA (Smart Metering Device Assurance) Test House has now been appointed after a lengthy (although for very valid reasons) procurement exercise. NMI was appointed in December and will be up and running shortly. The meter manufacturers are actively reviewing test specs and working closely with the Scheme Operator and going forward NMI, to ensure the test facilities are available as and when required.

There is increasing pressure for BEIS (Department for Business, Energy and Industry Strategy – formally DECC) and the Secretary of State to revise the completion date as this has not moved from 2020 despite several delays in the start of mass rollout.

There are now only two and a half years in which to complete the supply and installation of the 50 million meters with very few new recruits being engaged and trained to carry out this significant task. Many industry stakeholders are concerned that there are just not enough resources available to be trained and not enough time to train those that are available, with over 10,000 dual fuel installers being required, to come anywhere near meeting the target.

BEIS and Ofgem are still referring to the current end date of 2020 but have recently stated they will be assessing progress in the early months of rollout and may review. Let's hope they step in line with the way the industry is thinking and become more realistic about an achievable end date.

The programme may be running late and still have certain hurdles to overcome, but it is proceeding and when complete will be the most ambitious and technically challenging smart meter system in Europe.

Members updated on R110 GD-2 by Ofgem

November's NEEG Group meeting saw presentations from National Grid, with updates on their robotic innovation projects, Reece Innovation, on cross sector innovative engineering solutions, The Home Builders Federation, on challenges to the utilities in the housing sector and an update from Achilles UVDB.

The group also received a presentation from Ofgem's Rupika Madhura, Head of Gas Distribution Policy, RIIO Gas Networks, on GDN RIIO performance and initial views on GD-2.

The upcoming RIIO reviews are expected to be launched in December 2018, and conclude by December 2020. It is unlikely that key strategic Government decisions – which will have a material impact on the requirement for UK network infrastructure - will be made before this review is completed.

Whilst Ofgem is clear that companies need to focus on delivering the current price control outputs for consumers, Ofgem has been encouraging them to continue to also work with their stakeholders to develop the outputs they want to see in the next control.

Internally within Ofgem, a strategy team has been set up within the networks division, dedicated to developing the next price control thinking. The lessons learnt from the current cycle, including through the annual monitoring of price controls will play an important part in this thinking.

RIIO GD2 current status:

- Dedicated strategy team – developing next price control
- Currently at high-level strategy stage
- Detailed development in due course, followed by formal consultation

Other Ofgem News

Future Regulation (IFR) project

In Spring 2016, Ofgem instigated the Insights for Future Regulation (IFR) project to help determine how, in the face of significant uncertainty, they can best protect the interests of current and future consumers. Last summer they worked with stakeholders to explore the drivers of energy system and market change that have the most material impacts on consumers and the implications for regulation.

They have since released the first in a series of "Future Insights" publications to provide an overview of the possible implications for consumers and regulation from changes in the energy system. Future papers will consider particular issues in more depth, such as the decarbonisation of heat and the prospects for local energy systems.

Consultations

The NEEG group is compiling an industry response to two key sector consultations - The Network Innovation Review, which is seeking views on the changes Ofgem are proposing to the Network Innovation Allowance (NIA) and Network Innovation Competition (NIC) and the Gas Safety (Management) Regulations (1996) Review (GS(M)R).

GS(M)R came into force over twenty years ago and since then, the gas landscape in the UK has changed considerably, to the extent that existing regulations are no longer reflective. The gas networks believe it is an appropriate time for these regulations to be re-examined and this review seeks feedback on the regulations and how they may change to support the gas industry we have today and into the future.

Gas Storage Operators Group at **Number 10 Downing Street**

GSOG Chairman, Roddy Monroe, Deputy Chair, David Dorsett and Josh Mills, EUA, visited Number 10 Downing Street to brief the PM's Special Advisor (Georgia Berry) on the issues around gas storage last November.

The meeting gave GSOG the opportunity to give an overview of gas storage in the UK to senior Government and the issue of business rates for gas storage operators was raised. GSOG's key ask was that Government commission a detailed review into gas storage.

In response, Georgia said she would be briefing the Prime Minister on gas storage very soon and that she would follow up on specific points with BEIS and the Treasury.

Gas 2016

The Energy Trilemma

On the 10th of November, Lords Cricket Ground in London was not subject to the normal bustling sounds of England playing a test match at the historic ground, but rather the sounds of the energy industry agreeing at Gas 2016 that gas has a future role and will be able to help us meet our 2050 carbon reduction targets.

Contributing to the packed programme of experts were:

- Mike Foster, Chief Executive, EUA
- Matthew Bell, Chief Executive, Committee on Climate Change
- Richard Howard, Head of Environment and Energy, Policy Exchange
- Chris Clarke, Director of Asset Management, Safety & Environment, Wales & West Utilities
- Jane Gray, Acting Editor, Utility Week
- Antony Green, VP Utilities & Infrastructure, DNV GL
- Dr Alan Whitehead MP, Shadow Energy & Climate Change Minister
- Andrew Musgrave, Head of Network Strategy, SGN
- Richard Court, Head of Regulation & External Affairs, National Grid - Gas Distribution
- Greg Dodd, Head of Asset Strategy, Northern Gas Networks
- Craig Mauelshagen, Head of Research: Risk Analytics, Business Modelling Associates
- Chris Brown, Head of Gas System Integration, Ofgem
- Andrew Keating, Marketing Director UK and Ireland, Baxi
- Professor Robert Lowe, Director, UCL Energy Institute
- Carl Arntzen, Chair, Domestic Heat Strategy Group

The event was well attended by representatives from industry and beyond, and the four main takeaways from the event were:

1. The lack of progress. This was highlighted by a number of speakers including the key note speaker, Matthew Bell, CEO of the Committee on Climate Change. The lack of progress was in relation to the decarbonisation of heat. Emissions from power are being reduced at a rate that decarbonisation of the sector could be envisaged by 2030, however the same cannot be said of heat. The challenge for industry and government is how to accelerate progress and what form it will take. Notably the solutions presented at the event all followed a similar theme.

2. The future is green gas. The majority of speakers at the event were enthusiastic and confident that a green gas will be the key to reducing emissions from heat. This could be biomethane or bioSNG, as detailed by Richard Court from National Grid and others. Or from converting the gas grid to a hydrogen grid. Richard Howard from Policy Exchange spoke about how given all the alternatives the most cost effective and realistic way of decarbonising heat was to decarbonise gas. The speakers all agreed that action was needed if this vision was to be realised and that government support was key.

3. Electrification is expensive. Alan Whitehead and others presented on how the view that electrification may be the answer to decarbonised heat were misplaced. It was too expensive, too complicated and unrealistic. This was echoed by presenters through the day.

4. Reducing demand is vital. Robert Lowe from UCL gave an entertaining presentation on how improving the energy efficiency of homes is key to reducing emissions. However, current policies are not driving the required uptake and much of the work to date has not been to the required quality. More work is needed to improve how energy efficiency improvements are reported and targeted.

Delegate feedback showed the event was informative and useful and the tour of Lords, which followed the conference, extremely enjoyable.

Thanks to our sponsors and exhibitors **Baxi, Business Modelling Associates, DNV GL, SGN, Siemens, Wales & West Utilities and Tuffentech**, event supporters **Pipeline Industries Guild** and to all our speakers and delegates.

Photos from the event can be found on the EUA Facebook page: www.facebook.com/energyutilitiesalliance/

Gas 2017 will take place at the National Brewery Museum in Burton on Trent on 8 November 2017 so put it in your diaries now.

HWA News

New Solid Fuel Technical specification

launched by HWA and HETAS

The Hot Water Association, HWA, in conjunction with HETAS, the official body recognised by government to approve biomass and sold fuel heating appliances, has published a new Technical Specification entitled 'Hot Water Storage Systems for Heating by Solid Fuel Appliances - General Requirements and Test Methods'. The specification outlines the practical steps required to correctly connect a solid fuel appliance with a hot water storage system.

Martyn Griffiths of HWA and author of the new Technical Specification said "Whilst mains pressure storage systems are the popular choice for systems heated by gas, oil or electricity, it is still unusual for them to be heated by solid fuel and this situation is aggravated by the misconceptions that the G3 Building Regulations do not permit the use of solid fuel unvented systems and also that there is currently no available specifications covering the use and test of primary storage systems.

The principle compliance requirements for engineers to install and integrate thermal storage systems into solid fuel appliance installations are detailed in the current UK building regulations, in particular Approved Document G3. However until now there has been no documented or structured means in which to verify products manufactured on the market today in meeting this significant criteria. This new specification will address this and also promote the benefits and uses of biomass."

Calvin May, Projects & Standards Manager at HETAS said "HETAS together with the HWA recognised the need and importance of thorough product specifications for use with solid fuel appliances.

The new Technical Specification will provide the necessary guidance for HWA members to test their storage systems for use with solid fuel appliances and potentially allow a requisite for future listing in the HETAS approved products and services guide.

This will allow HETAS to provide the necessary guidance and specific product knowledge for listed systems to our registered installer base, mainly through our enquiries on the Technical and Consumer helplines. The HETAS guide is a readily available document, and provides good technical information for the appropriate installation of solid fuel appliances and ensuring associated products have been third party verified and meet the relevant requirements of Building Regulations."

To view a copy of the new Technical Specification please visit http:// hotwater.org.uk/uploads/580DC05E93116.pdf

By coming forward and taking responsibility for enhancing hot water cylinder manufacturing in the UK, HWA is recognised by UK standards authorities and government departments as being the leading authority on matters of water heater design, performance and quality, and subsequently has input into legislative, standardisation and policy decisions in this area.

MARC News

#LoveYourRad campaign warms up

Since joining EUA in January 2014 the Manufacturers Association of Radiators and Convectors (MARC) have been busy making plans. Top of their list was to launch a consumer campaign to strengthen radiators position as the heat emitter of choice.

Being the leading trade association serving the radiator and convector industry, they are perfectly positioned to illustrate the benefits of installing or updating radiators in the home.

To kick off the campaign, called 'Love your Rad', EUA's central communications team picked up the National Radiator Day baton and used it to launch a social media campaign which challenged the perceptions of the humble radiator and recognised the aspirations of today's homeowner.

From modern convector radiators being a prerequisite for new build properties and renovation projects, to radiators being the heart of any room, the messages are strong and clear.

Isaac Occhipinti, External Affairs Manager, MARC said; "Homeowners today aspire to create beautiful and unique homes that match their taste and lifestyle. A campaign like this is perfect for showcasing the modern day radiator as well as the variety of radiators available. Material, colour and design are just as important to members of MARC as functionality and effectiveness. We recognise that homeowners want something more than just a source of heat; they want a product that compliments their home."

'Love your Rad' will also provide an opportunity for the association to highlight the suitability of radiators for use with low water temperature systems, but this work goes beyond consumers and installers. MARC is engaging with architects, engineers, developers, designers, builders and those who inform them.

MARC are now busy preparing content to further support the campaign, this will then be used to create an online source of consumer information.

ICOM News

ICOM and many similar organisations have been considering and discussing fuels for the future...

In the UK for the past 40 years, we have had the stability of natural gas, a fuel that is supplied with a relatively narrow specification. This has enabled the gas heating industry to work on a solid base and develop appliances to the highest efficiency and emission standards.

Not just natural gas, but propane, butane and fuel oils have had their place in supplying fuel to heat homes and businesses in all areas of the country. Now we are in the situation where fossil fuels are considered bad for the environment, because they emit carbon dioxide which is a "green house gas" and these are bad news for our planet.

In the commercial/industrial sector, some savings have been made by improving appliance efficiency and reducing demand with better system operation, building structures and controls. The introduction of the Energy related Products Directive has introduced new minimum efficiencies for the lower output products which means that new installations and refurbishment of existing buildings now require high efficiency appliances, which in most situations would be condensing.

So, after so many years using natural gas, we find ourselves considering so many alternative fuels. The most straight forward answer is to have natural gas from non-fossil based stock. This would mean that the current grid would continue to supply gas within the current UK supply regulations and not cause businesses or end users any problems and would not incur any changes and costs in operating the infrastructure.

So, how do we do this?

Bio-methane

For some time we have been developing bio-methane manufacturing plants which can deliver high quality methane, in accordance with the new EN16723-1 standard for gas compatible with injection into the grid. Bio-digesters using sewage and food waste have been developed to generate an ever increasing volume of bio-methane which can either be used locally or injected into the grid.

Synthetic natural gas

Alternatively, synthetic natural gas is being produced at a trial level and looks very promising as an additional source of non-fossil generated natural gas. There will need to be considerable investment, but the process is proven and now needs the commitment to move forward and build larger plants to generate a valuable amount of fuel.

Hydrogen

Hydrogen on the other hand does offer a number of advantages in the battle to reduce greenhouse gas emissions. It burns cleanly, produces no carbon dioxide or carbon monoxide, with the main emission being water. This can be handled using the condensing appliance technology and means that there are no green house gases entering the atmosphere.

However, there will have to be major investment in the production of hydrogen and with appliance conversion/replacement if it stands a chance of becoming a reality. Initially, the need to do something with the electrical energy produced by wind and solar at times of low electricity demand got people thinking about ways to store electricity, which in a large scale is not feasible yet. So, the idea was born that this excess power could be used to manufacture hydrogen and then store the gas for future use. Two methods of production are available, hydrolysis of water and steam methane reforming.

Hydrolysis is the simpler and cleaner process as it only emits oxygen, whereas steam methane reforming has the by-product of carbon dioxide. This takes us back to the start where we said that we had to reduce the generation of carbon dioxide as it is a green house gas. In this instance the proposal is to capture the carbon and store it out of harm's way. This is a technology in it's infancy and the whole scheme will need a very large investment to develop the processes into a valid option.

Conclusions

The suggestion that hydrogen could be used in a 100 per cent hydrogen grid is being discussed, however the use of hydrogen in smaller sections of the grid, maybe for industrial processes is very much an option, as is a low percentage hydrogen mix in the grid.

The obvious answer is that no one particular option will be dominant, but instead, there will need to be careful balancing of all the proposals to work in unison to reduce the green house gas emissions, however, it is widely agreed that natural gas will still play it's part in the total gas scenario.

ICOM and its members are working closely with the relevant regulatory bodies to assess the potential impact of these and advise accordingly.

It's a GAS

HHIC News

Gas is changing and there's quite a buzz about the future

Steve Sutton, Technical Manager, HHIC takes up 'The Story'...

Behind every central heating system there is a much more complex system that's the key to keeping homes warm which ensures comfort for the occupants but is hidden from the view of its user. Similarly, behind every boiler design there is a much more complex system hidden in that white box that's fundamental to keeping heating engineers in business.

I know you know this. But how often do we think about the complex system beyond product design - the gas grid? Currently delivering gas into the homes over 85 per cent of the UK population the gas grid is one of the UK's biggest assets.

Many of us in the industry are guilty of being complacent when it comes to the supply of gas, we can't remember a time without it and so we assume it will always just be there. And it will, the question is how will it be supplied and what investment is required?

In a recent column I talked about 'green gas' and its potential contribution to helping the UK maintain its own supply of gas, which in turn means that we import less from overseas, making it less carbon intensive and more secure. If the supply is more secure the price will fluctuate less as we won't be competing with other nations to purchase it.

In the UK considerable resources are being spent on ensuring better and more efficient delivery of gas, particularly in the R&D of Hydrogen. The ins and outs of these R&D projects may seem unconnected to a heating engineer's day job, but actually the future of the industry relies upon them.

Acceptable levels of hydrogen are currently specified in the HSE Gas Safety Management regulations and are very low with less than 0.1per cent being allowed. Some studies suggest that up to 20 per cent might be feasible.

Current studies

Northern Gas Networks are conducting a feasibility study into 100 per cent hydrogen through the gas grid. Their Leeds 21 study is arousing considerable interest on the basis that it envisages using the existing gas grid, conventional heating systems such as central heating in the home but in a completely carbon-free way.

A further study at Keele University is planned to commence in April 2017. Northern Gas Networks, Keele University, ITM Power, Health & Safety Laboratory and Progressive Energy have come together for the HYDelpoy project which aims to demonstrate that natural gas containing levels of hydrogen beyond those in the current HSE GS(M)R specification can be distributed and utilised safely and efficiently in a section of the UK distribution network. Keele has its own private gas network which is seen as ideal for testing different levels of hydrogen with the appliances that are installed on what is a private network.

Under investigation

Appliances - There are many considerations and areas which require testing when it comes to hydrogen gas injection. The safety and performance of appliances must be closely monitored. We have to remember that there are still a lot of older appliances in use that may not be as versatile as today's high efficiency gas boilers.

One of the issues with using a hydrogen gas mix is that the flame profile in gas appliances will increasingly flatten as the hydrogen content increases. The implications of this will need to be investigated for old and new appliances.

Odour - Professor Rui Chen from Loughborough University recently gave a presentation to HHIC members on his proposed project to review odorants that can be used for Hydrogen. Hydrogen is odourless, colourless, and tasteless, making it undetectable by human senses. The aim of his project is to develop suitable odorants for leak detection of hydrogen as a distributed fuel.

As a gas engineer you may think, we already have gas that has a recognisable smell, so why not recreate that? The problem with this is that today's odorants contain sulphur which give it a pungent recognisable smell but this can have adverse effects on the proposed technologies for using hydrogen which are catalytic burners and fuels cells. Nicer odorants are available and have fruit or caramel type smell but these may not result in the report of a gas leak. The alternative more offensive odorants have slight effects on electrical generation and so sensors put into the gas mix may be affected but the research project will evaluate these effects.

It's an area with many complex challenges but one the academics will resolve!

"There is a hive of activity going on 'behind the scenes'. Innovation can be disruptive but it must happen now... for the future and beyond!"

HHIC News

HHIC's boiler technical panel tackle **Combi boilers and non-return valves**

With some areas of the UK increasingly under "water stress" due to rising demand and limitations on supply, the growing number of water meter installations, along with other environmental measures such as grey water recycling, are beginning to highlight a potential issue for households with gas-fired combi boilers and water heaters - particularly those where the appliance has been installed for some time.

Members of The Heating and Hot Water Industry Council (HHIC) Boiler Technical group, who manufacture combi boilers and water heaters have reported an increase in customer calls arising from leakage of, or damage to, appliance components and some downstream plumbing fittings such as shower cartridges, ceramic discs in taps etc. Martyn Bridges, Chair, Boiler Technical Panel, tells us more;

"This issue is more predominant in the South of the country where the operator has been forced to fit water meters retrospectively so as the water losses between the point of use (the house), and the point of origin or the water works can be determined.

Within the water regulations the amount of expansion created by a Combi or instantaneous water heater is deemed small enough to be allowed to backflow into the supply pipe. This is on the provision that the supply pipe temperature remains below 25c. The problem affects existing Combi boiler installations where at the time of installation there was no water meter or non-return valve fitted to the mains. The installer of the boiler quite legitimately fitted the boiler without any provision for the expansion water as it was possible for the expansion water to flow back into the supply pipe.

The water company have then some time or even years later fitted a water meter with a non-return valve and cut off this route of expansion and not provided an alternative. The pressure in the pipework after a hot water draw can now reach excessively high levels, (dependant on incoming mains pressure, length of hot water draw off pipework, distance between the boiler and the water meter). This has caused damage to shower valves, tap washers, and sometimes boilers.

The HHIC boiler technical panel are working on a solution to address this problem."
Water UK has advised HHIC that, not all UK water companies specify the use of such valves when a water meter is fitted. However the increasing use of efficiency measures such as "grey water" systems means backflow prevention devices may be fitted with increasing frequency in future.

Stewart Clements, Director, HHIC

In view of the increasing potential for problems of this nature to occur, plumbers and heating engineers are being alerted to this issue. HHIC, in consultation with the Water Regulations Advisory Scheme (WRAS) and members of Water UK, are working together to collate some written guidance, which we hope to publish soon. Water UK have also agreed that they will ask water companies to place further details in their metering booklets or link to the guidance document from their meter application websites.

For more information about the Boiler Technical Panel or any of the HHIC working groups please contact Stewart Clements on 01926 513744 stewart@hhic.org.uk

NGV Network News

Natural Gas Vehicles

How do the numbers stack up in Europe?

A round up of vehicle numbers, type and the refuelling infrastructure from the NGV Network.

Natural Gas Vehicles have a strong position in Germany, France, Sweden, the Netherlands and Italy, created through a combination of good vehicle choice (popular small and medium car availability), infrastructure developments and clear Government targets/NGV strategy. Biogas is also supporting the environmental credentials of NGVs.

Vehicle Availability

Passenger cars (LEFT HAND DRIVE)
Audi A3, A4; Fiat Panda, Punto, 500L; Mercedes Benz B Class; Opel Zafira; Seat Mii, Leon; Skoda Citi go, Octavia; VW Up, Golf, Caddy Passenger; Volvo V60

LCV's (LEFT HAND DRIVE)
Fiat Fiorino, Doblo; Opel Combo; VW Caddy; Fiat Ducato; Iveco Daily; Mercedes Benz Sprinter

Trucks (some Right Hand Drive options)
Iveco; Mercedes; Renault; Scania; Volvo

Buses
Iveco; Man; Scania; Mercedes; Solbus

Key

1 Country rank by number of NGVS

Number of NGVs - passenger cars,LGVs and HGVs

CNG public refuelling stations

LNG public refuelling stations

Presidents Column

Bob Murray

Will SMART TECHNOLOGY revolutionise our homes?

Technology in the form of smart phones and tablets has completely changed the way we communicate and access information. As more and more smart household devices appear in our living space, smart technology could revolutionise our homes.

In the mid-Nineties the arrival of dial-up internet services offered an exciting new medium. Over the last decade, domestic Wi-Fi networks became increasingly common, allowing web-enabled devices to be used in any room of the house. But now we are entering a new era, one in which smart technology is interwoven into every aspect of our home life.

This starts at the front door. Web-enabled electronic locking systems could soon be more common. The latest smart locks, pair with apps that allow you to enter the home without a physical keyring. As you approach your house, the lock detects your phone and automatically unlocks. You can even send digital keys to friend's phones. Apple's Homekit uses the August smart lock. Tell Siri you're turning in for the night and your doors will lock.
It all might sounds like a potential security hazard, but these locks come are enabled with the same hi-tech encryption used by banks.

Stepping into the hallway, web-enabled smart air monitors and smoke detectors chirp when they sync with your phone. They can be silenced from an app, and will contact the emergency services if they detect a fire. They can even automatically order a new set of batteries when the power runs low – so you'll never again be woken at 2am by a low battery beep.

Moving into the kitchen, there's a wealth of smart solutions to make life easier. The Amazon Dash Button is a Wi-Fi-connected device that reorders your favourite product with the press of a button. Each Dash Button is paired with a product of your choice. When you're running low, simply press the button to order. The GeniCan rubbish bin allows you to swipe the item's barcode when you throw the packaging away and it will be added to the shopping list on your smartphone (in the US the Genican can even order direct from the Amazon Dash app!) The Tefal Actifry Smart XL is Bluetooth powered and you can send recipes directly from your smartphone or tablet. Samsung fridges can be bought with a WiFi Enabled LCD, your WiFi Coffee Machine can brew a stronger cup of coffee in the morning than in the evening, the Panasonic energy-efficient dishwasher has self-operating doors and runs near-silent. Or check your supper from afar with the Belkin Crock Pot WeMo Slow Cooker which your smartphone can turn on, adjust the temperature, alter cooking time and turn it off from anywhere that has a WiFi connection.

Smart technologies in the living room are offering content on command like never before. Smart power and lighting devices mean you never have to leave your sofa to set the lighting mood or switch devices and lighting on and off.

Then, when you finally close your eyes, your entire night's rest can be monitored by sleep trackers, which will offer sleeping tips the next day.

These intelligent devices create a convenient, comfortable and cost effective electronic home ecosystem. And at the centre of that ecosystem will be the smart meter, a step change in home energy management that will give more control over electricity and gas usage than ever before – no more meter readings and estimated bills and a smart energy monitor that displays the cost of your daily energy use in pounds and pence.

Dixons UK and Ireland Chief Executive, Katie Bickerstaffe, said she expects that great changes will be driven in people's lives by connected technology, which is poised for take-off. In the last 12 months things have really jumped forward, she said. Two years ago the big Christmas present was a tablet and now it's about all the things you can do with it.

The connected home market is still a very nascent market and evolving slowly in many people's eyes. But analyst's predictions hint that the market is about to take off. Today, consumers own an average of eight connected devices in the home, although most of these don't communicate with each other. They believe this figure could rise to hundreds.

What I find particularly interesting is the different sectors lining up to take a piece of the market.

Telecommunications companies, utility companies and retailers are all sizing up the sector and manoeuvring into the space. You've got Amazon with its new Echo device, Apple has joined the connected home market with Homekit –a home automation platform that allows a variety of smart home products to be managed through one application on an Apple device. Samsung's Smart Home platform lets users connect and control their home through one app via their Samsung Smart TV or their smart phone and Google has positioned itself as a key contender with the acquisition of Nest. Even insurers and warranty providers are actively looking at this market and manufacturers are looking to build a direct relationship with the customer, not through the retailer. I think we could see some marked changes in certain markets and some fascinating takeovers and mergers in the next few years.

More than a billion smart phones (iPhone, Android) have been sold since 2008 but can the success of smart phones be replicated in the connected home? One of the drives of success for Apple and Google's business models is in the implementation of app stores, which allows innovators to create applications at a rapid pace, leading to loads of available apps. Both companies are helping create the home automation marketplace and motivating others to innovate within that space.

I read recently that the 2014 merger between Dixons Retail and Carphone Warehouse is part of a bigger project to build Dixons Carphone out from a products company, selling refrigerators, TVs and other electronic goods, into a technology services business. Interestingly, they are now piloting a new department in their retail stores designed to spotlight connectivity products that link to smartphones and tablets. The Currys and PC World owner envisages such products increasingly becoming part of everyday life. I think retailers are well placed to take a slice of this market. While customers don't actively go out and buy 'smart' products, they will seek out products that make their life easier.

Back to the smart meter, energy conservation is not a strong market driver in home automation. The key drivers are security, comfort, entertainment, and features geared to meet a customer need. Home energy management as a service can piggyback on these other services for which consumers are willing to pay, and this is where the energy suppliers might be well placed.

I really do watch this space with great interest.

The fuel for our future? Hydrogen

The UK recognises the importance of meeting the challenge of climate change and has resolved, by 2050, to reduce carbon emissions by 80 per cent of the level in 1990. In our journey to reduce carbon emissions, hydrogen as a vehicle fuel and energy source is being explored.

The chemical element Hydrogen is the most common element in the periodic table and scientists estimate that it makes up 75 per cent of the mass of the entire universe. The name hydrogen comes from the Greek words "water former", because it only produces water when it is burned. Hydrogen may be easily found on other planets but here on earth hydrogen is only found in compound form such as with oxygen to form water and with carbon to form compounds such as methane, coal and petroleum.

Hydrogen is odourless, tasteless and non-toxic and at room temperature is a transparent, highly flammable gas.

This issue we look at some of the facts, information and work that is taking place around hydrogen.

How hydrogen is formed

Since hydrogen fuel is not found naturally on Earth, it must be manufactured. Hydrogen fuel is a by-product of chemically mixing hydrogen/oxygen to produce electricity, water and heat. It is stored in a "cell" or battery. Hydrogen is usually produced through steam reforming or electrolysis. Steam reforming, which is the least expensive way to create hydrogen, involves separating hydrogen atoms from carbon atoms in methane. This method accounts for the majority of hydrogen production, but the process does create greenhouse gas emissions. In electrolysis, an electric current is used to split water into hydrogen and oxygen; then the hydrogen can be extracted and used.

Common uses

Hydrogen has a variety of uses, including:

- Refining and treating metals
- Processing foods, such as hydrogenating oils or fats (like what you might find in the margarine in your fridge!)
- Refining crude oil in the petroleum industry

What are the pros and cons related to using hydrogen energy

Pros

1. Renewable and abundant: While it may take some work to get to, there is no component in the universe as inexhaustible as hydrogen.
2. Clean energy fuel: Hydrogen's only by-product is water
3. Non-toxic: Hydrogen is non-toxic, which makes it an irregularity among many fuel sources. Nuclear energy, coal, and natural gas are all either dangerous or it's hard to get them in a safe manner.
4. More powerful than fossil fuels: Hydrogen energy is likewise influential and extremely proficient. It's effective enough to drive spaceships and more secure than using another type of fuel to do the same thing. Indeed, hydrogen is three times as powerful and useful as gas and comparable fossil fuels, which means that you're using much less of it in order to do more.
5. Fuel efficiency: Hydrogen energy is an extremely proficient fuel, because it delivers more energy for every pound of fuel.

Cons

1. Expensive: Hydrogen gas actually takes a considerable measure of work to free if from different components. If it were basic and simple to separate, everybody would be utilising it.
2. Transportation: Hydrogen can be tricky to move around. While oil is usually pushed through pipes, and coal could be conveyed in dump trucks, it's very hard to transport hydrogen (which is very light). It is extremely costly to move.
3. Storage: Hydrogen has a lower density than gasoline. It must be stored in the liquid state at low temperatures to maintain its effectiveness as a fuel source. This is the reason that hydrogen needs to be stored and transported under high pressure which makes the transport and widespread use of hydrogen not feasible.
4. Safety concerns: Hydrogen in itself has a lot of power behind it. Though it is less dangerous than gasoline, it is none the less extremely flammable. Unlike gas, hydrogen has no smell. Sensors must be used to detect a leak.
5. Though hydrogen energy is renewable and its natural effects are negligible, other non-renewable sources like oil, natural gas, and coal will be needed to split it apart from oxygen.

Hydrogen as a future fuel - H21 Leeds City Gate Project

To date there has never been a holistic solution presented for the decarbonisation of heat that is technically possible and economically viable. Led by Northern Gas Networks with partners Kiwa Gastec, Amec Foster Wheeler and Wales & West Utilities, a new project outlines the possibility and benefits of replacing natural gas in the gas grid with hydrogen, in the city of Leeds – a solution which could be rolled out to the rest of the country.

Dan Sadler, Head of Energy Futures at Northern Gas Networks and currently seconded to the Government as a Technical Advisor in the Future Role of the Gas Networks, outlined the H21 Leeds City Gate Project findings to Output.

Climate change, and how we tackle it, is the most pressing issue we are facing today. How we heat our homes, cook our food...each process of normal everyday life has a subsequent and lasting impact.

Heat currently accounts for over 30 per cent of our carbon emissions, and 80 per cent of domestic households in the UK use of natural gas to heat their homes. So how we decarbonise heat in a way that is affordable, reliable, sustainable and secure is potentially the biggest challenge the energy sector has yet to face.

Leeds was chosen as it is the biggest city in the north of England and the perfect choice due to its size, location, complex gas grid and high demand. 1.5 per cent of the UK population would be served by this one project, making it an ideal blueprint for rolling out to other cities.

The Leeds city area generates an annual demand of 6TWh, so the key to supplying this volume of hydrogen lies with steam methane reformers. The project would require four SMRs, located at Teesside with its large industrial heartland background and availability for carbon capture and storage.

The project shows that substituting natural gas for hydrogen is both technically possible, through a combination of appliance upgrades and steam methane reformation, and economically viable if financed through regulatory business plans.

The low pressure gas network already in place can be used to transport hydrogen because of the iron mains replacement programme which is changing the below 7 bar metallic mains network to polyethylene pipes. This makes the network compatible with transportation of hydrogen when complete in 2032.

In addition to capacity, the project undertook detailed analysis on just how to incrementally convert the city to ensure minimal impact on customers. This was done by considering the lessons from the original town gas to natural gas conversion that took place in the UK between 1966 and 1970 (40 million appliances were converted across 14 million households). A similar process would be adopted in a future hydrogen conversion.

Converting Leeds is expected to take three years, and would be done by compartmentalising the city into small segments, to ensure minimal disruption to the customers undergoing conversion while maintaining natural gas supply to the rest of the city.

A new range of hydrogen appliances and burners would need to be developed, there are already examples around the world of boilers, fires, hobs and cookers.

It is probably the least disruptive scenario to move to a low carbon economy because it would only involve an appliance upgrade in the house but would be unlikely to require changing the infrastructure and there would be minimal impact on the highways.

As with natural gas, hydrogen is a flammable substance that needs expert management. Town gas itself contained 50 per cent hydrogen but was used safely within the UK gas industry for 150 years.

The total cost to convert the Leeds city to hydrogen is estimated at £2 billion, split 50/50 between appliance upgrade around the city, and the building of hydrogen production and storage, and pipeline infrastructure.

Additionally there would be ongoing operational costs of £140 million (year 1) required for hydrogen production and carbon capture.

The H21 Leeds City Gate project provides a financing model for the scheme based on regulated business plans. This would result in minimal impact on customers' bills as the costs would be socialised across the country, as with the original town gas to natural gas conversion.

The economic impact would be significant creating jobs across the supply chain from appliance manufacturers to the gas transportation businesses, construction and the carbon capture infrastructure sector, as well as wider industries such as vehicles.

The project would also support decarbonisation of transport and localised electrical generation and establish the UK as a world leader in hydrogen technology and decarbonisation

For more information visit northerngasnetworks.co.uk/futures

"A new project outlines the possibility and benefits of replacing natural gas in the gas grid with hydrogen, in the city of Leeds – a solution which could be rolled out to the rest of the country."

"The total cost to convert the Leeds city to hydrogen is estimated at £2 billion."

Hydrogen history

1766 Hydrogen was discovered in 1766 by English chemist and physicist Henry Cavendish.

1783 In 1783, Jacques Alexander Cesar Charles, a French physicist, launched the first hydrogen balloon flight.

1800s In the 1800s English scientists William Nicholson and Sir Anthony Carlisle discovered that applying electric current to water produced hydrogen and oxygen gases. This process was later termed "electrolysis."

1838 The fuel cell effect, combining hydrogen and oxygen gases to produce water and an electric current, was discovered by Swiss chemist Christian Friedrich Schoenbein in 1838.

1920s In the 1920s German engineer Rudolf Erren converted the internal combustion engines of trucks, buses and submarines to use hydrogen or hydrogen mixtures.

1937 After 10 successful trans-Atlantic flights from Germany to the USA, the Hindenburg, a dirigible inflated with hydrogen gas, crashed upon landing in 1937. The mystery of the crash was solved in 1997. A study concluded that the explosion was not due to the hydrogen gas, but rather to a weather-related static electric discharge that ignited the airship's silver-coloured, canvas exterior covering, which had been treated with the key ingredients of solid rocket fuel.

1950s In the 1950s the USA formed the National Aeronautics and Space Administration (NASA). They began experimenting with hydrogen fuel cells. NASA uses the most liquid hydrogen worldwide, primarily for rocket propulsion and as a fuel for fuel cells. Today, there is ongoing research and development into making hydrogen more widely used.

1959 In 1959 Francis T. Bacon of Cambridge University built the first practical hydrogen-air fuel cell in 1959. Later that year, Harry Karl Ihrig, an engineer for the Allis-Chalmers Manufacturing Company, demonstrated the first fuel cell vehicle: a 20-horsepower tractor.

1974 The International Energy Agency (IEA) was established in 1974 in response to global oil market disruptions. IEA activities included the research and development of hydrogen energy technologies.

1997 In 1997 Daimler-Benz and Ballard Power Systems announced a research collaboration on hydrogen fuel cells for transportation.

1998 In 1998 Iceland unveiled a plan to create the first hydrogen economy by 2030.

1999 In 1999 Europe's first hydrogen fuelling stations were opened in the German cities of Hamburg and Munich.

2015 Hyundai i35 hydrogen car goes on sale.

2016 Toyota Mirai hydrogen car goes on sale.

Hydrogen for Vehicles

Hydrogen has the potential to make a significant impact on the world's transportation energy needs. The UK automotive industry now has several hydrogen vehicle models on the market - Hyundai ix35, Honda Clarity FCV and the Toyota Mirai – although there are only four publically available Hydrogen refuelling stations currently in the UK.

A hydrogen car isn't powered by an internal combustion engine. A hydrogen car is basically an electric vehicle, but instead of using power stored in batteries to run its electric motors, it generates its own electricity on the move. In effect this is a car that has the engine replaced by a fuel cell (a mini power station) that mixes the stored hydrogen from the fuel tank, with oxygen from the air to generate electricity. This is then used by the electric motors to make the car move. The only problem with using hydrogen in transportation is that it is expensive to produce and store.

The reality of hydrogen vehicles

Output caught up with Hydrogen refuelling experts, ITM Power to find out a bit more.

Why hydrogen for vehicles?

Hydrogen fuel is the cleanest fuel available. We generate it using surplus renewable electricity and water using an ITM Power electrolyser. This offers a renewable clean fuel, which can be made on-site at the point of use, eliminating the need for transported fuel deliveries.

Where are the stations?

ITM Power currently has three hydrogen refuelling stations (HRS) operating in the UK and a further four will be opened in 2017. The next will be the first to be located on a conventional forecourt. The station is owned by Shell and is the UK's largest service station, located at Cobham just off the M25 motorway. This will be opened to the public on 22nd February 2017.

How is hydrogen generated?

The ITM Power HRS uses water and surplus renewable electricity to generate the hydrogen on site via water electrolysis. This type of hydrogen infrastructure can be readily deployed across the widest possible geographical area, because it simply piggy-backs onto the existing electricity and water infrastructures.

Is hydrogen safe?

Hydrogen has several advantages over conventional liquid fuels. FCEVs are able to convert it to motive power at a much higher efficiency than diesel or petrol engines and without requiring combustion or causing pollution. Tests carried out by the German testing, inspection and certification authority, TüV Süd, have shown that hydrogen-powered cars are no more dangerous than conventional vehicles.

How do you refuel?

Very much the same as we do now. Drive up to the station, pop the nozzle into the vehicle, press the screen to fill, the station will run safety checks and then refuelling will commence. From empty, the refuelling process will take 3-5 minutes. Unlike battery electric vehicles, consumers experience no convenience penalty.

How much does it cost to fill a car with hydrogen?

ITM Power has hydrogen fuel contracts in place to supply Hydrogen at £10 per kg, so around £50 per full tank.

How many miles will the car go?

Depending on the vehicle, a full tank of hydrogen should take you 500-600 km. FCEVs are long range vehicles. Unlike battery electric vehicles, consumers experience no range anxiety.

How do Fuel Cell Electric Vehicles (FCEVs) work?

The FCEV is an electric vehicle with a downsized battery, a hydrogen tank and a fuel cell. The fuel cell drives the electric powertrain which is silent, automatic and does not compromise comfort. It consumes hydrogen, generates electricity and emits water vapour.

The hydrogen gas is stored in an on-board tank until combined with oxygen in a fuel cell, where the electrolysis process is essentially reversed, releasing chemical energy via an electrical charge. This electricity can then be used to power electric motors in cars, buses, boats, and other vehicles.

What hydrogen infrastructure is needed?

There are now many thousands of battery electric vehicles on our roads, but providing an electricity infrastructure that is capable of supporting a large number of these cars without causing excessive peak power demands is a major challenge. Conversely the electrolysers at ITM Power's HRS can be operated at off-peak times and during periods of surplus renewable electricity to produce hydrogen, which can be stored and dispensed to FCEV whenever their drivers decide to refuel. This decoupling of hydrogen production from consumer demand is extremely helpful to the electricity industry for grid balancing.

Images: Inside Power-to-Gas electrolysers, courtesy of ITM Power

Power-to-Gas Energy Storage

What is power-to-gas?

Power-to-Gas is the process of converting surplus renewable electricity into hydrogen and its injection at low concentrations into gas distribution networks.

The 'power' is electricity that's not yet used, the 'gas' is hydrogen and the process is simple electrolysis: separating the H2 and O components of water.

Electrolysers have been designed especially to handle the intermittency inherent in renewables like wind and solar.

The resulting hydrogen is easy to store – it can be turned back into electricity, converted to natural gas or used as fuel for hydrogen cars.

Power-to-gas offers two distinct value propositions. It provides the fastest (sub-second) response to electricity grid operators for balancing purposes and a 'green' gas stream to gas grid operators. The gas grid has an inherently large energy capacity and is well established; its utilisation by the power-to-gas approach to provide flexibility services to the electricity grid makes good use of existing assets and is preferable to deploying battery storage.

ITM Power

ITM Power's first Power-to-Gas plant injected electrolytic generated hydrogen into the gas distribution network in Germany with Thüga. It participates in the market for secondary control (grid balancing) meaning that when there is too much power in the electricity grid, the electrolyser can increase its output at the request of the transmission system operator. The plant then absorbs the power and converts it into hydrogen. In doing so, the electrolyser makes a contribution to the stability of the power grid while outputting hydrogen to the gas grid.

This technology is ideally suited to remote areas and islands with large renewable penetrations.
The Orkney Islands have over 50MW of installed wind, wave and tidal power and have been a net exporter of electricity since 2013. Now ITM Power have supplied of electrolysers via the 'BIG HIT' project (Building Innovative Green Hydrogen systems in an Isolated Territory). Energy used to produce hydrogen will come from community-owned wind turbines and will enable the mobility, heat and power demands of local schools and businesses to be met in a clean green manner.

A number of projects are being undertaken supported by various interested parties, looking at the adoption of hydrogen as a potential replacement energy for natural gas.

FACT FILE

Role of the gas networks in the future of heat

The ENA-Gas Futures Group investigated the relative economics and practicalities for the whole of the UK meeting its 2050 climate change obligations (80% reduction from 1990) by investigating four routes: one of them being Greening the Gas Network through conversion of much of the gas network to hydrogen with supporting biogas in rural areas.

Scenarios for deployment of hydrogen

E4tech, UCL and Kiwa Gastec carried out a study for the Committee on Climate Change, examining the potential role of hydrogen in contributing to meeting carbon budgets and the 2050 target.

Hydrogen Roadmap

An Innovate UK / BEIS / SHFCA / UKHFCA project that will pull together the major themes enabling the UK to maximise economic and social benefit from hydrogen.

Hydrogen appliances

Kiwa Gastec in collaboration with E4Tech researched the issues arising from appliances switching from natural gas to hydrogen to understand the technical challenges and costs of developing gas appliances to operate using 100% hydrogen, rather than natural gas, and to understand how these barriers might be addressed. For more information contact mark.crowther@kiwa.co.uk or iain.summerfield@kiwa.co.uk

HyDeploy

A three-year project, beginning 2017 will trial the use of hydrogen-blended natural gas. Partners National Grid Gas Distribution, Northern Gas Networks and the HyDeploy consortium - Keele University, The Health and Safety Laboratory (HSL), ITM Power, Progressive Energy, KIWA Gastec and Otto Simon, have been awarded £6.8 million funding under Ofgem's Network Innovation Competition (NIC) Keele University owns and operates its own independent gas network, which supplies 17 buildings and more than 100 homes for researchers and staff. A rigorous experimental testing and safety programme will take place using this network, injecting a maximum 20 per cent hydrogen mix into the existing natural gas network. For more information contact paul.mclaughlin@kiwa.co.uk

How the energy industry might transition to the Circular Economy

PHILIPPA ROBERTS, HEAD OF CIRCULAR ECONOMY AT WRC

The Circular Economy is a term that is much used right now but not necessarily well understood. We currently live in a linear world. We take resources from the planet, make products and packaging, and then dispose of those resources. A circular economy envisages a world where all resources are kept circulating at their highest value for as long as possible. This is more than just 'recycling on steroids', as one of my colleagues jokingly called it this morning. If we think of all resources, not just materials, but heat, electricity, water, labour and even intellectual capital, then the move towards a circular economy means a rethinking of how our economic system works.

The other interesting characteristic of a circular economy is that it aims to be more than just renewable; it aims to be regenerative or restorative. It's harder to imagine industrial or technical systems that can make this happen. The inspiration is nature, the ultimate circular economy. This is why you will hear more people talk about the transition to the circular economy. It's going to be a work in progress for a very long time, if not forever, as we keep radically changing and disrupting, and tweaking, the current system. While so many of the linkages in the current system are not well understood, the transition will be complex, take many wrong turns, and take time.

For those of us who work in the utilities sector, this kind of thinking is easier to understand. The systems that our businesses operate in are dependent on understanding resource flows and trying to find the most efficient way of moving those resources from place to place while investigating renewable alternatives to the finite parts.

It is worth remembering that the global demand for energy consumption will increase by 30 per cent by 2040.

At the same time, nearly 2 billion people still do not have access to reliable energy. A World Economic Forum article, published in the run-up to Davos states that: "We're in the midst of the Fourth Industrial Revolution, which…."builds on the digital revolution and combines multiple technologies that are leading to unprecedented paradigm shifts in the economy, business, society, and individually." Therein lies an incredible opportunity for industry, customers, and the broader society as we transform the electricity system."

For the energy sector, much of the excitement around the circular economy comes at the grid edge, whether this means hardware, software or new business innovations. Grid edge hardware is already well-developed, from distributed renewable energy generation, through to smart metering and building controls. The area with the most promise is probably around energy storage. The investment by companies like Tesla in its Gigafactory for electric car batteries and development of Powerwall energy storage, or Nissan through Nissan Futures, shows the importance of storage to companies with the ability to change the market.

Innovative software and the new business models come hand-in-hand with the grid edge hardware. The subsidies that pushed the renewable generation market brought with them a host of new types of ownership of these generation assets, particularly the rise of community ownership. Demand management is growing, enabled by the new technologies that allow real-time monitoring, especially for householders from their mobile phones. It is easy to imagine now a future where householders can choose how much energy they wish to use based on the price of energy at any given time, with those prices fluctuating in response to the market. Small-scale initiatives such as the Sunshine Tariff from the Wadebridge Renewable Energy Network are already demonstrating the demand for these types of services as well as how effectively different parts of the system can link up, with the renewables being supplied from PV owned by the community, on a site owned by South West Water.

The examples above appear to show that the transition to the circular economy has started in the energy sector. It is possible to see the progress that can be made along some of the paths described above in terms of hardware and software. What is less predictable are the new business models that may appear, taking advantage of the changes in technology. And this is linked to the even less predictable changes in consumer habits, and products that we buy or lease, and the impacts that these, in turn, have on our energy networks. Will we all be using driverless electric cars in the future and will these be mobile energy storage devices as well as transport modes, as Nissan Futures imagines? What other devices that use energy might also become energy stores or even generators?

For me, the exciting part of the transition to the circular economy is not knowing the answers. Let's wait and see what the world's innovators come up with.

For further information contact Philippa Roberts, Head of Circular Economy at WRc on 07779 655329 or philippa.roberts@wrcplc.co.uk

Leading VOICE

In this issue we talk to John Morea, CEO of SGN Ltd

About you

Career to date. What's been the most important lesson learned?

I've spent a very happy 30 years plus in the utilities sector, starting out as an electrical engineer when everything was nationalised. In the 90s UK utilities transitioned to private ownership, fundamentally changing the way our sector and our customers interacted. Change has been a common feature of our industry ever since, and I've learned to expect, welcome and embrace it.

What do you feel has been your greatest achievement?

My main aim since taking the helm in 2008 has been for SGN to be leader not follower in delivering gas safely and efficiently, and we're well on our way of achieving this ambitious goal. With the support of our professional and dedicated people, we've become a highly respected business with a reputation for pioneering innovative technology and implementation that benefits our customers, our industry and our environment. Last year we outperformed in almost every area of the business, leading the way in customer service and winning a number of external awards along the way, which is an extraordinary achievement. I'm immensely proud to work for SGN and the communities and customers we serve.

You were the first employee of SGN when it formed in 2005. What did your career history bring to this role?

I've been very privileged to have had a long and varied career in the electricity industry, progressing through many different areas of engineering. I believe bringing this in-depth experience across to SGN has given us a useful perspective and valuable head start in the gas industry.

How would you describe your leadership style?

Thespian! I can get into the detail when required or lift myself above the 'muck and bullets' depending on who I'm dealing with. I'd always hope I'm very approachable.

What do you do differently and bring to the organisation?

The future of gas is my key concern and everything we do commercially is geared towards safeguarding and developing our industry for years to come. By investing heavily, challenging conventional thinking and championing innovation, I'd like to think we're considered a powerhouse of creative thinking.

I needed every employee to buy into my ambitious vision. It took a while, but embedding a 'One SGN' ethos throughout the company has led to a seismic shift in employee attitude and us really listening to our stakeholders.

This was even more important as Ofgem's stringent RIIO targets have pushed the customer massively up our agenda, and we've become much more creative about how we deliver the optimum experience for them. We have a three-year customer experience transformation plan in place, and a digital strategy that supports both this operational efficiency and associated communications.

We regularly hold stakeholder panels and customer focus groups to listen and act on feedback. The results have been worth it, as our outstanding customer satisfaction scores and plummeting complaint numbers attest.

My role would be an impossible task without engaged employees supporting me, so I'm committed to empowering and developing our people, enabling them to make strong business decisions and give them the skills and insight to use innovation to drive the business forward, and make them proud to work for us.

I've put safety at the top of everyone's agenda, aiming to see no colleague, customer or member of the public getting injured through our work.

SGN

The 'SGN Way' and truly believing we're 'One SGN' is at the heart of how we understand ourselves as a company. The best way for our customers to understand who we are is for us to demonstrate our vision and values in everything we do. As a company we're committed to being positive, dynamic and responsible, and we want our customers and stakeholders to recognise that.

SGN
Your gas. Our network.

How are you instilling this ethos and how does it support SGN's day to day business operations?

It's really important I lead by example, communicate the message effectively, and I'm seen to be a proactive part of this strategy through getting out and about to our offices and depots. I record **Vlogs**, for our brand new SGNapp, write articles for our internal magazine, and host our Leadership conference and various safety workshops that we hold annually.

We've shifted colleagues' mentality from 'not my job' to behaviour aligned with 'One SGN' through training, workshops, and reward and recognition. Last year our Executive team approved four Core Behaviours to sit at the heart of a new training programme to create a more positive and aspirational culture (750 people managers took part initially).

We're a local company with 27 local depots across Scotland and Southern England. I want to contribute to and play an active part in the communities where we work and serve, and we can look after them best by proactively engaging with them. If we understand their issues, we'll be able to not only serve them better but also go above and beyond in contributing to their welfare. Our Community Action Programme gives every single employee paid time away from the day job to help a worthy community cause or charity of their choice. These one-off projects are frequently developed into longer-term partnerships.

What are the biggest challenges facing SGN now and going forwards?

- Our biggest challenge is probably our ageing workforce. It can be difficult to attract new talent and youth into the industry but since 2008 we've recruited 279 apprentices across a range of engineering disciplines to help address this. We currently have 147 trainees on our programme, which received a staggering 3,000 applicants last year. We won a coveted place on the 2015 list of Top 100 Apprenticeship Employers.

  Taking what was ultimately a heavily male dominated business in the recent past and making it a modern, inclusive business fit for the 21st Century. Diversity has been high on my agenda, encouraging a broader scope of people to become involved in areas of the business they may not have considered before. I'm particularly proud of the high-powered female employees who have taken on challenging management roles and are now being recognised internally and externally for their achievements.

- Secondly, how can we make our network of pipes fit for purpose far into the future using techniques/processes which complement the UK's low carbon agenda. As an industry we also need to understand better what decarbonisation of fuel will look like. This is why attracting good people with different thinking to join us is vital, and we've grown our hugely successful and

inspiring Innovation team from the fledgling six in 2012 to 24 currently. Innovation needs to be practical, incremental, collaborative and ultimately well executed.

- Getting our workforce to embrace flexibility to maximise productivity while keeping safety at the top of the agenda. Safety has to be part of our DNA, not an afterthought.

- Dealing with a continually shifting landscape of energy ministers, secretaries of state and government direction. Our industry moves slowly sometimes, so delivering my strategic aims when the goal posts are moved every few years is extremely challenging.

Innovation has been a key part of RIIO GD-1. How does SGN innovate?

We have 150 innovation projects in development (64 of them registered with Ofgem) and won 11 innovation awards last year. Highlights include:

- Our Osprey Pressure Validator was the first NIA project to be implemented and subsequently adopted by other networks.
- We made gas history when we injected the first load of Zeebrugge Liquefied Natural Gas (LNG) into the Oban network as stage three of our 'Opening up the gas market' project.
- Pioneering technology such as our gas preheating system is reducing our environmental impact by delivering a thermal efficiency of 85 per cent (a first in pipeline preheating) resulting in a 30-40 per cent reduction in fuel use and CO2 emissions.
- Our Large CISBOT robotic repair platform became business as usual when we deployed it in George Street, Edinburgh, and we've progressed our CIRRIS™ Robotics system through to business implementation.

In 2013 I introduced Greenplan (five goals with nine underpinning targets) designed to reduce our environmental impact.

We've reduced natural gas emissions by more than 10 per cent, energy consumption by 37 per cent, and now send under 1 per cent of our total spoil and depot/office waste to landfill. This is validated by our regular Carbon Trust audit and ISO14001 accreditations.

What future role do you think gas can play in UK heat policy?

I believe the gas networks will have a key role to support a future lower carbon economy. But to understand why the gas networks need to be a part of the solution for tomorrow, I think it's important to look at where demand is today. Currently gas meets around 80 per cent of total UK peak energy demand and over the course of a year, three times more energy is transported through the gas networks than the electricity networks. Without the gas networks we wouldn't have the means to transport the amount of energy homes and businesses need at peak times.

We know we need an energy supply which is clean and meets the country's 80 per cent carbon reduction targets by 2050. We also want it to be affordable and able to continue to meet peak demand on the coldest of days too. Gas is currently an affordable option as its unit price is a third of that for electricity. So for me, the challenge is to look at ways we can use such a fantastic asset as the gas network more efficiently and sustainably.

We've worked hard to support and develop green gas innovation, and we've become a leading authority on biomethane. We're also looking at hydrogen, which I believe in the short term could be blended with natural gas in the network. Longer term we're looking at the potential to convert the gas network to carry 100 per cent hydrogen. If we can deliver a solution to deliver the volumes of green hydrogen needed, we can use use our existing network to deliver low carbon fuel for homes and businesses.

We've invested heavily in our existing network and by 2032 it will be almost completely plastic, supplying 85 per cent of households. This is thanks to our ongoing mains replacement programme. This of course brings benefits in terms of safety, but also means we'll have a network of pipes capable of transporting more than just natural gas. What we'll be transporting remains to be determined, but what we can say is there's a bright future for a strong, flexible UK gas industry.

Projects

What are the consequences for the wider gas industry of your 'Opening up the Gas Industry' project – for both the networks and downstream?

Based on the results of our innovative project in the Scottish west coast town of Oban, we have recommended the GB gas regulations can be safely expanded to allow a wider range of gases to be used. This will reduce the need for expensive gas processing which currently costs £325 million a year. This in turn would allow supply companies to buy gas from a wider and more competitive range of sources, bringing down the price of gas sold to customers.

We have recommended the upper Wobbe limit in GB is increased from 51.40MJ/m³ to 53.25MJ/m³.

Doing this would allow access to 90 per cent of the LNG, compared to 10 per cent of globally available LNG which can be injected without processing currently. To allow this to happen we're working on the development of a new IGEM standard for gas quality.

Could you tell us a little about your 'Real Time Networks' project.

As new forms of green gas are injected into the domestic network, the UK's gas networks will need to measure the content of the gas in the grid, rather than just the traditional flow and volume. Gas network infrastructure will therefore need to employ new technology and become more flexible. With this in mind, we are now embarking on our latest and probably most ambitious innovation project, Real-Time Networks, which will meet the requirement for a more intelligent and flexible gas network.

We are carrying out an £8m Ofgem sponsored innovation project, to look at how new technology can deliver this increased level of flexibility. By installing sensing technology in a representative part of our network in Kent, we will be able to measure variables including flow, pressure, temperature and gas quality, as well as enabling greater volumes of renewable gas in the network.

What are your views on RIIO-GD2?

The regulator has a tough job to follow after doing a good job in RIIO-GD1 where innovation and customers have really benefitted. Going forward, a stable regulatory regime is crucial in order to secure the billions of pounds of investment required in gas networks during RIIO-GD2. Short term interventions risk discouraging investment and increasing costs for customers. I see the future of gas as a key issue and believe it will be crucial that the RIIO-GD2 framework reflects the fact that gas networks have a bright long term future.

SGN's strategy is to increase the volume of green gas entering your network. How are you doing? What has been achieved? Are you on target?

We already have 30 biomethane plants connected to our network, supplying enough green gas for the needs of over 160,000 homes. This means we're well on our way to achieving our goal of supplying 250,000 customers with green gas by 2021. We welcomed the recent announcement that tariffs for biomethane under the crucial GB Renewable Heat Incentive (RHI) will be raised again in April 2017 as Government recognised they had fallen too low to stimulate new projects.

NEW MEMBERS

We are pleased to welcome the following companies into membership:

British Compressed Gases Association (BCGA) is a Trade Association representing the interests of 80+ member companies. Established in 1971 the association previously existed as the British Acetylene Manufacturers Association. Members include manufacturers and suppliers of bulk liquid and cylinder gases, manufacturers of cylinders, vessels and tanks for their storage and distribution, manufacturers of equipment for controlling the application and use of gases, installers of distribution pipework and systems and providers of specialist safety, health, quality, inspection and training services.
http://www.bcga.co.uk

Northern Gas Networks Limited is responsible for distributing gas to 2.7 million homes and businesses in the North East, Northern Cumbria and much of Yorkshire. The company's headquarters is in Leeds. The company is owned by a consortium of three partners - Cheung Kong Infrastructure (CKI), Power Assets Holding Limited and pension fund, SAS Trustee Corporation.
http://www.northerngasnetworks.co.uk

Manchester Fluid System Technologies Ltd, trading as Swagelok Manchester, was established in 1978 as a leading solution provider of fluid system technologies. They supply innovative products and technologies, alongside practical information, know-how, tools, and speciality services to purchase, manage, and apply them successfully.
https://manchester.swagelok.com

Wales & West Utilities operates the gas distribution network across Wales and South West England, supplying gas to around 2.5 million households and businesses. The company is owned by the Cheng Kong Infrastructure (CKI) Group. **http://www.wwutilities.co.uk**

ITM Power specialise in the manufacture of integrated hydrogen energy systems. Founded in June 2001, the company floated on the Alternative Investment Market (AIM) in 2004 and was the first United Kingdom-based fuel cell company to go public. ITM Power operates out of two premises in Sheffield, UK with further offices in Germany, France the USA and Canada. They join the Network Engineering & Equipment Group.
http://www.itm-power.com

Infomill helps improve service delivery for aftermarket operations. They work with many of the world's leading brands to help improve first-time fix rates and reduce incorrect parts ordering by ensuring that mobile technicians have access to the technical information they need, where they need it. Infomill produce PartsArena, a library of parts lists and services documents for appliances covering the UK heating industry. All data is sourced directly from and with the permission of the relevant appliance manufacturers. PartsArena can be used by engineers on mobile devices and by parts stockists via web interfaces. By utilising Infomill's end-to-end solutions, service teams have been able to achieve significant reductions in repeat service visits, while driving up customer satisfaction levels
http://www.infomill.info/about
http://www.partsarena.info/

hot water association
DEVELOPING HOT WATER

ACV UK Ltd
Advance Appliances
Altecnic Ltd
Ariston Thermo Group
Bosch Thermotechnology Ltd
Cotherm Ltd
Danfoss Ltd
Dimplex UK Limited
Gledhill Building Products Ltd
Heatrae Sadia
Heatrod Elements Limited
HETAS Ltd
Honeywell, ACS Control Products
Joule UK Ltd
Kingspan Hot Water Storage
McDonald Engineers
Newark Copper Cylinders Co Ltd
OSO Hotwater (UK) Ltd
Reliance Worldwide Corporation (UK) Ltd
RM Cylinders
Telford Copper Cylinders Ltd
Vaillant Group UK Ltd
Viessmann Ltd

ICOM Energy Association

A O Smith Water Products Company BV
ACV UK Ltd
Adey Professional Heating Solutions
Alpha Heating Innovation
Andrews Water Heaters
Bosch Commercial and Industrial Heating
Calor Gas Ltd
Cochran Ltd
Combat HVAC Ltd
Deep Water Blue Limited
Ecoflam UK
ELCO UK
Energy Technology & Control Ltd
EOGB Energy Products Ltd
Fernox
Ferroli Ltd
Flueboost Ltd
G P Burners (CIB) Ltd
Hamworthy Heating Ltd
Hoval Ltd
Ideal Boilers Ltd
Johnson & Starley Ltd
Lochinvar Ltd
Mikrofill Systems Ltd
Nortek Global HVAC (UK) Ltd
Nu-Way (Enertech Ltd)
Potterton Commercial
Powrmatic Limited
Remeha Commercial
Riello Ltd
Rinnai UK Ltd
Schwank Ltd
Sentinel Performance Solutions Ltd
Space-Ray Ltd
Spirotech UK Ltd
Stokvis Industrial Boilers (Intl) Ltd
Strebel Ltd
Vaillant Group UK Ltd
Vexo International Ltd
Viessmann Ltd
Weishaupt (UK) Ltd

HHIC HEATING & HOTWATER INDUSTRY COUNCIL

A.C.Wilgar Ltd
Adey Professional Heating Solutions
Aga Rangemaster Ltd
Alpha Heating Innovation
Altecnic Ltd
Anton Industrial Services
Ariston Thermo UK Ltd
Association of Gas Safety Managers (AGSM)
Atag Heating TechnologiesLtd
Atmos Heating Systems
Baxi
Be Modern Group
BEAMA Heating Controls
BEAMA Water Treatment
BFM Europe Limited
Biasi UK Ltd
Bosch Thermotechnology Ltd
Bowbros Ltd
British Gas
BSI Assurance UK Ltd
Builders Merchant Federation
Burley Appliances Ltd
Calor Gas Ltd
Carillion Services
Charlton & Jenrick Ltd
Crosslee plc
Crystal Fires Limited
Daikin Airconditioning UK Ltd
Danfoss Ltd
Delta Energy & Environment Ltd
Dimplex UK Limited
Domestic & General Group plc
Ecuity Consulting LLP
EDF Energy
Encore Energy
Enertek International Ltd
Fernox
Ferroli Limited
Flowgroup plc
Fondital Helpline UK
Gas Contract Services Ltd
Gas Tag Ltd
Grafton Merchanting GB
Grant Engineering (UK) Ltd
Ground Source Heat Pump Association
Grundfos Pumps A/S
Harvey Water Softeners Ltd
HETAS Ltd
Honeywell, ACS Control Products
Ideal Boilers Ltd
IDHEE Institute of Domestic Heating and Environmental Engineers
Infomill
Inspirit Energy Holdings plc
InstaGroup Ltd
Intergas Heating Ltd
Johnson & Starley Limited
Kamco Ltd
Kane International Ltd
Kiwa Ltd
Lettergold Water Treatment Solutions LLP
Logic Certification
Magic Thermodynamic box
Monarch Water Ltd
Morgan Lambert Ltd
NAPIT
Navien UK Ltd
Northern Gas Heating Ltd
Nu-Flame Ltd
OFTEC
Panasonic Manufacturing UK Ltd
Pump House Pumps
Qnergy Ltd
Ravenheat
Rinnai UK Ltd
Sentinel Performance Solutions Ltd
Sime Ltd
Solar Trade Association
Spirotech UK Ltd
Sustainable Power Ltd
Swale Heating Ltd
Teddington Bemasan Ltd
The Electric Heating Company Ltd
Thermoserv Ltd
Travis Perkins Group
UKLPG
Vaillant Group Ltd
Viessmann Ltd
Vokera Limited
Widney Leisure Ltd
Wolseley UK Ltd

MARC

Kudox Ltd
Myson Radiators
QRL Radiator Group
Stelrad Ltd
Zehnder Group UK Ltd

EUA Utility Networks

ALH Systems Ltd
Amec Foster Wheeler
AVK UK Limited
Balfour Beatty
Burdens Utilities
Buss Metering Services Ltd
ByBox
Calvin Capital Ltd
Centrica Storage Ltd
Cerro EMS
CNG Services Ltd
ControlPoint
Crane Building Services & Utilities
Develop Training Ltd
DI UK Ltd
DNV GL
EDF Energy
EDF Energy (Gas Storage Hole House) Ltd
EDF Energy Customer Field Services
EDMI Europe Ltd
ElectraLink Ltd
Elster
Energy Assets Ltd
Engage Consulting
Enzen Global Ltd
Fastflow Group Ltd
Ferranti Computer Systems NV
Fiorentini UK Limited
Fulcrum
Fusion Group Ltd
Fusion Provida Ltd
Future Energy Group
G4S Utility & Outsourcing Services (UK) Ltd
Gas Measurement Instruments Ltd
Gateway Storage Company Ltd
Generis Technology Ltd
George Fischer Sales Limited
George Wilson Industries Limited
GPS PE Pipe Systems
Gridbee Communications
GTC
Halite Energy Group
Harlaxton Engineering Services Ltd
Humbly Grove Energy Ltd
Inovyn Enterprises Limited
Islandmagee Storage Ltd
ITM Power Plc
Itron Metering Solutions UK Ltd
Landis+Gyr
Lightsout Computer Services Ltd
Lomax Training Services
Lowri Beck Services Ltd
LSC Group Ltd
Meter Provida Ltd
MeteRSit SRL
Mike Stratton & Associates Ltd
Morland Utilities Ltd
Morrison Utility Services
National Grid plc
Northern Gas Networks Ltd
P N Daly Ltd
Power Plus Communications AG
Providor Ltd
Radius Systems Ltd
Sarco Stopper Ltd
ScottishPower
Secure Meters (UK) Ltd
Sensus UK
SGN
Siemens
Silver Spring Networks UK & Ireland
SSE Hornsea Ltd
Storengy UK Ltd
The Clancy Group
The Murphy Group
Tuffentech Services Ltd
Uniper Energy Storage Ltd
UTL
Wales & West Utilities Ltd
Wolseley UK Ltd
WRc plc

NGV NETWORK

British Compressed Gases Association (BCGA)
Calor Gas Ltd
CNG Services Ltd
Element Energy
Iveco Ltd
National Grid plc
Northern Gas Networks
Swagelok Manchester
UKOOG
Wales & West Utilities

Corporate

Gemserv

GAS INDUSTRY AWARDS 2017

Tuesday
9 May 2017
Hilton Park Lane,
London

For further information
please visit
www.gasindustryawards.com

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IGEM Institution of Gas Engineers & Managers

2017 Award Categories

- Manager of the Year
- Company of the Year
- Engineer of the Year
- Gas Industry Leadership
- Gas Industry Safety Award
- Young Person's Achievement
- Gas Industry Innovation Project Award
- Gas Industry Innovation Product Award
- Energy Efficiency
- Customer Service Award