

DEMONSTRATING HYDROGEN FOR HEAT



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- hydrogen gas as a replacement for methane
- electric heat pumps

HYDROGEN GAS AS A REPLACEMENT FOR METHANE

The key advantage of hydrogen over methane is that it does not release carbon dioxide during combustion, unlike methane and all hydrocarbons.

BEIS has commissioned a new programme looking at hydrogen for heat, Hy4Heat, to investigate the technical and safety case of converting the UK's gas network to run on hydrogen, rather than natural gas.

The Hy4Heat programme focuses purely downstream of the gas meter. A separate, Ofgem-funded programme looking at the possibility of re-purposing the gas network upstream of the gas meter has awarded the gas distribution network operators (GDNs) £10 million to research the technical and safety challenges of using hydrogen in the gas distribution system.

A FLEXIBLE, RELIABLE GAS NETWORK

It seemed that, up until a few years ago, the only pathway being considered seriously to decarbonise heat was via electrification and, in some high-density areas, heat networks.

However, as with decarbonising the gas grid, both of these options present significant technical and economic challenges when scaled to a national level, with the requirement to invest heavily in new assets.

The gas network during times of peak demand transmits over at least three to four times as much energy as the electricity network.

Replicating this level of flexibility, reliability and capacity with another form of energy would require

significant levels of investment.

The UK has one of the largest, most well-established gas networks globally, which over the years has been able to respond to spikes of demand across the day (with morning and evenings seeing heavier use), as well as seasonal changes in demand (with the colder months seeing much higher volumes consumed).

THE HY4HEAT TEAM

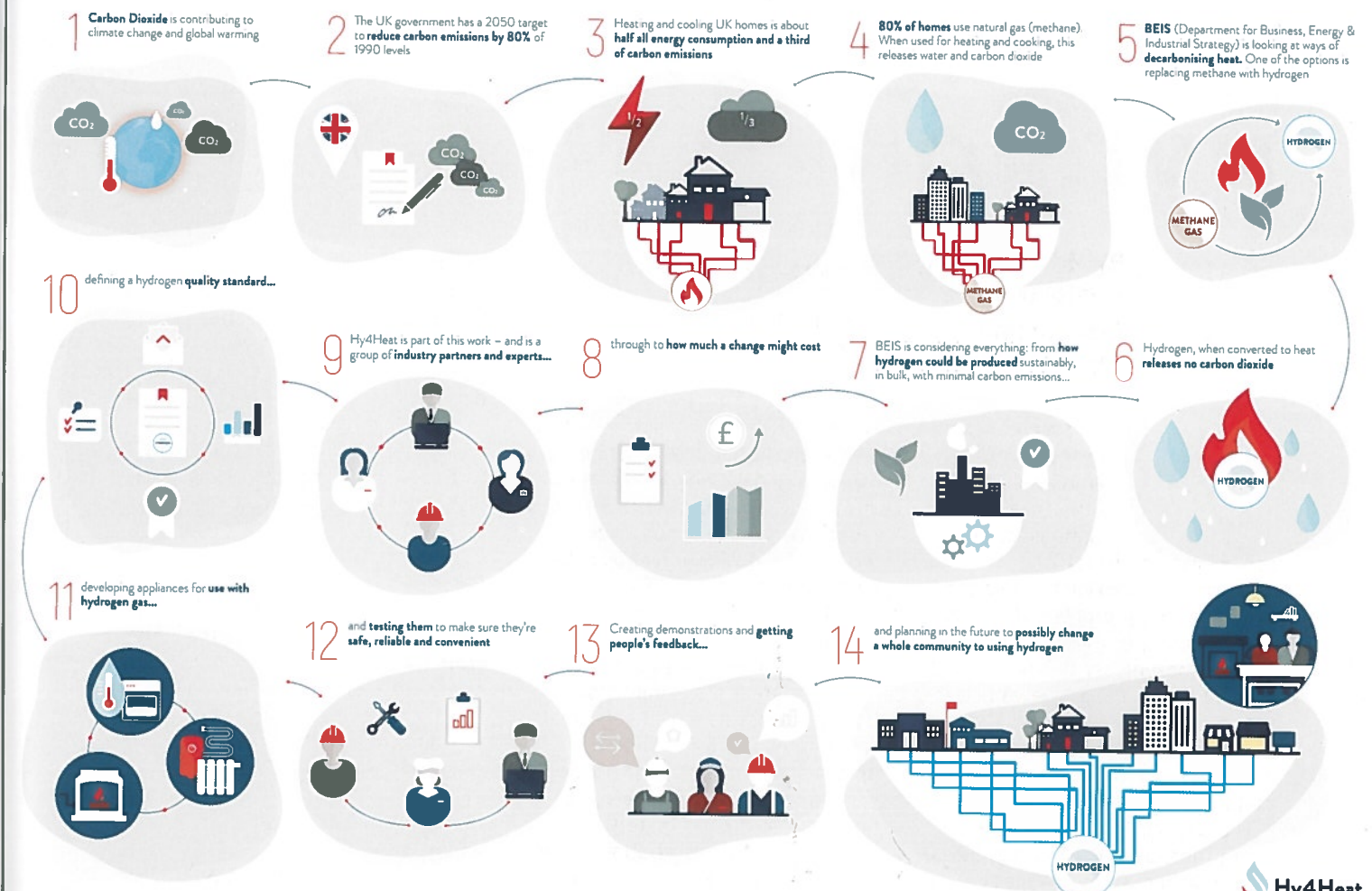
BEIS has appointed Arup as the programme manager for the delivery of Hy4Heat. As part of this, the Arup+ team formed includes technical specialists Kiwa Gastec, Progressive Energy and other experts. We are responsible for defining and managing the delivery of a number of work packages, which require the input of one or more contractors who will be appointed by BEIS.

We believe that the success of the programme will be reliant on the collaboration and positive input of the industry. As such, a Hy4Heat stakeholder advisory board has been established with representatives from across the industry, and a co-ordination group has also been set up with representatives from GDNs to ensure we are aligned to other work being carried out in this area.

Much of our activity in the early stages of the programme has been to explain what is involved and to encourage companies to consider bidding for the contracts in the various work packages. Several stakeholder engagement events have been held across the year to ensure the industry is familiar with the programme. We've been encouraged by the number of people that have attended so far and hope that interest and engagement will continue to grow.

HY4HEAT WORK PACKAGES

The focus of this £25 million innovation programme is to overcome two of the biggest challenges with hydrogen; the safety issues associated with using hydrogen in buildings, and the need to modify and develop new appliances to burn hydrogen rather than methane. Hydrogen has very



different combustion characteristics to methane, so current appliances are unsuitable to use with hydrogen. This is a similar challenge to the one faced in the 1960s, when the gas network was converted from 'towns gas' (a blend of 50 per cent hydrogen with methane and carbon monoxide) to 100 per cent methane.

The Hy4Heat work packages will cover:

- A hydrogen gas standard, defining the purity of the gas and the odorant to be added
- Hydrogen appliance testing standards and processes, to allow for the safe certification of a new generation of appliances
- Development of community trial-ready domestic hydrogen appliances, including gas fires, cookers and boilers
- Research into the variety of industrial and commercial appliances and the issues to be addressed in their conversion or replacement with hydrogen appliances
- Safety issues related to hydrogen in properties, such as ventilation and leakage detection

- Establishing a demonstration trial, in an unoccupied property

Several of the work packages are underway. Contracts for the research into the variety of industrial and commercial appliances has been commissioned by BEIS as well as work to define hydrogen gas standards.

The largest work package, worth around £9 million, is the development of certified domestic hydrogen appliances. Applications to take part in the small business research initiative (SBRI) competition closed on 5 October 2018. Manufacturers are bidding to develop and certify a range of appliance types for use with hydrogen gas, including boilers, cookers and fires. There's also a category called 'innovative domestic appliance', which is the chance for manufacturers to bid to develop something more creative and innovative. Ultimately, the prototype appliances developed will be used in the demonstration trials in an unoccupied property.

The Hy4Heat team is also responsible for selecting a location, or locations, for potential community trials, in the event the government decides to proceed to this stage.

TELLING THE STORY

While it's easy to explain the technology and science to colleagues in the energy industry, we believed that a simpler narrative would be more compelling to engage a wider audience - something that will be useful at the demonstration trial stage of the programme.

So, a simple storyboard infographic has been created to explain Hy4Heat to a non-technical audience and encourage debate and discussion around the subject.

Of course, proving the safety case for hydrogen is a fundamental part of the programme and would need to be determined prior to any wider communication. In the meantime, we have established several information channels (a website, social media and newsletters) to keep those in the industry up to date with our progress. ■

■ Find out more about the Hy4Heat programme at www.hy4heat.info. Tweet Hy4Heat @hy4heat or email hy4heat@arup.com for more information

With over 35 per cent of the UK's CO₂ emissions coming from the combustion of natural gas (methane), the government is looking to solve the carbon footprint problem this causes.

The majority of these CO₂ emissions are from heating people's homes and cooking. In fact, the gas network last year supplied more than two-thirds of domestic energy, so finding a low carbon alternative to methane is a key challenge for the government.

The Department for Business, Energy and Industrial Strategy (BEIS) has a number of programmes running which are focused on exploring ways this might be achieved.

As outlined in the Clean Growth Strategy, published at the end of 2017, there are a range of low carbon heating technologies with potential to support heat decarbonisation but, at present, it is not clear which will work best at scale.

BEIS is working with industry and others to build an understanding of the different approaches and to prepare for decisions in the first half of the next decade about the long-term future of heat.

At the same time, BEIS is stimulating developments in a range of technologies which could form part of the solution to decarbonise heat. These include:

- energy efficiency and storage solutions
- carbon capture and use
- new nuclear technology

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