

*TECHNICAL REPORT DOCUMENTING A
VISIT TO THE NORTHERN GAS NETWORKS
FACILITY IN WINLATON WHERE
HYDROGEN IS BEING TRIALLED AS A
POSSIBLE FUTURE CARBON FREE
ALTERNATIVE TO NATURAL GAS*

After being awarded an IET travel award I travelled from Hertfordshire in the Southeast of England, into London and then onto Winlaton in the Northeast of England. I travelled by train on one of LNER's Azuma trains which have more seats than a standard train of the same size and produce 35 percent less carbon emissions compared to the previous rolling stock used on this route.

Currently, the Hydeploy consortium are in the second phase of their project to blend 20% hydrogen into the natural gas network in a town called Winlaton, just West of Gateshead in the Northeast of England. An old British Gas research site in Winlaton has been repurposed by Northern Gas Networks and the site is currently supplying 668-meter points in the surrounding area including a large number of domestic properties, a church, and a school; the aim is to reduce carbon emissions from domestic and commercial gas appliances.

The main purpose of the project is to ascertain if the existing natural gas infrastructure, including around one hundred and thirty five thousand miles of buried pipework, connected via meter points, to over eighty five percent of the buildings in Great Britain, is suitable for the addition of hydrogen. The blended gas should be able to utilise the existing infrastructure without causing any degradation or similar issues to the existing system from the site of the blending unit right up until the point of use at the consumers existing gas appliances.

None of the current infrastructure has been replaced or updated and hydrogen is currently being delivered and stored in large commercially available containers and tankers. Northern Gas Networks explain that they are a transporter of fuel, so for them this research is purely based around the delivery of the natural gas and hydrogen blend rather than the most efficient method of producing the hydrogen itself, although space in the compound is available and there is the possibility of future onsite production of hydrogen via an electrolyser.

The hydrogen is delivered from storage through a purpose designed system including numerous safety controls and monitors to a purpose designed blending unit, which can be seen below in Figure 1.



Figure 1, the purpose designed and built blending unit

The bespoke blending unit has been constructed and positioned onsite to interrupt the current gas supply to the surrounding area, where under strict monitoring and control

measures, hydrogen is blended to a maximum concentration of 20% with several safeguards in place to remove any non-compliant mixture to a dump tank situated underground which stops it being supplied to the local network. The blending unit can be monitored onsite or remotely with two state of the art control systems, one bespoke to the unit and the other purposely designed to look more familiar to current staff members of Northern Gas Networks, who may need to interact either on site or remotely with the blending unit.

Unfortunately, due to the current situation I was unable to arrange a visit to any of the properties in Winlaton where the current blended supply is being received, but with the current requirements and the stringent safety measures that are in place along with the free gas safety checks being offered to the properties receiving the blend, no issues with the existing gas infrastructure or end users' appliances are anticipated.

The second part of my trip involved visiting the aptly named 'Hy Grove' situated on the same site containing two purpose built semi-detached houses which are fully compliant with current building regulations.



Figure 2, two domestic houses being supplied with 100% hydrogen

Both houses are being supplied with one hundred percent hydrogen from a small compound located a short distance away. Service pipework has been laid underground in a similar

manner to how an existing natural gas service pipe work would be laid to new build properties and connected to hydrogen suitable metering equipment. Identical installation pipework and appliance connections have been used, as would also be found inside a new build house being supplied by natural gas, but with the addition of one hundred percent hydrogen ready appliances.



Figure 3, two domestic boilers powered by 100% hydrogen

Two leading natural gas boiler manufacturers have provided hydrogen powered domestic boilers to be trialled in the houses which are successfully providing space heating and hot water to both houses.

One of the houses has been fitted with a natural gas hob and built-in under oven, both converted from natural gas to be powered by hydrogen.



Figure 4, a natural gas hob on the left converted to run on 100% hydrogen and on the right a purpose designed and manufactured hydrogen powered cooker

The second house has a purpose designed and manufactured hydrogen fuelled freestanding domestic gas cooker, with for me, one of the most visually interesting things of my visit.



Figure 5, the sunflower flame

When the hydrogen flame is lit, initially, it burns with a clear flame but after a short period it starts to burn with a vibrant orange and yellow glow which is now being referred to as the sunflower flame. As an experienced gas engineer, it seems hard to believe that such a visually impressive flame picture, producing so much heat is also not producing any carbon dioxide or carbon monoxide.

Both houses have also been fitted with gas fires that are very different to existing natural gas fires in operation and installation but once operating and warmed up it would be very hard, even for an experienced gas engineer like myself, to tell the difference between these

fires and a natural gas fire and, again, I had to stop and remind myself that the only product of combustion being produced was essentially water, just plain H₂O in the form of water vapour.



Figure 6, a purpose designed and manufactured 100% hydrogen powered gas fire

In conclusion, my experience visiting the repurposed old gas works and research site in Winlton was a very positive experience and a day filled with technical information provided by people with an obvious interest and enthusiasm for the future decarbonisation of the gas industry.

The enthusiasm and enjoyment shown by all involved on-site when answering questions and explaining the theory behind some of the processes that were used to supply a twenty percent blend of hydrogen with natural gas to the surrounding area of Winlton, and how these two very impressive houses that really should be being lived in, has made me think more about the future of an industry that I have been involved with since the day I left school; how I can inspire those entering the industry and pass information onto them so that they know that the gas industry isn't a dying industry, but far from it: an industry that is preparing to decarbonise and use its existing infrastructure to provide a fuel in the form of the third most abundant element on the earth's surface, hydrogen.