Cadent
Your Gas Network

Decarbonising the UK
Transporting a blend of hydrogen and natural gas through the UK's Gas Network

Injection Locations of Interest

Version 1, Issued on 23rd June 2021

We are Cadent
Your Gas Network

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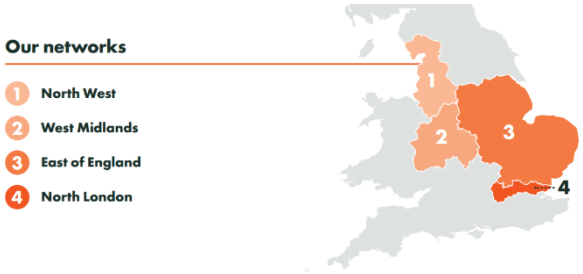
We look after the gas pipes for over half the UK's gas consumers. We are committed to keeping you safe and warm.

We bring gas to 11 million homes and businesses throughout the North West, West Midlands, East of England and North London



Hydrogen as a Replacement for Natural Gas

The UK Government has committed to a target of net zero greenhouse gas (GHG) emissions by 2050.

There is a clear role for hydrogen as a replacement for natural gas in providing decarbonised energy for heat, power generation, industry and heavy transport.

As part of the Government's 10 point plan a Green Industrial Revolution, a target date of 2023 has been set for completing the necessary testing to enable blending hydrogen into the gas network.

We are working with government and other bodies to ready the networks and ensure all necessary legislation and policies are in place to begin blending hydrogen into our gas networks from 2023 onwards. As an example, our HyDeploy Trial in Keele has already shown that existing domestic gas appliances can run on a blend of up to 20% hydrogen without any change to their performance, and with householders not noticing any difference at all.

This document indicates where sufficient capacity is likely to exist on Cadent's networks to accept hydrogen injection in bulk for blending up to a limit of 20% by volume.

The figures should be considered as indicative and illustrative at this stage to inform and gauge levels of industry interest. It cannot be considered as a firm commitment from Cadent to provide that capacity, and multiple organisations may be developing plans in the same area. Although it is in Government's plans, blending of hydrogen into the gas network is not yet permitted by law and there are some key steps that need to be in place before it can happen, including an enabling regulatory framework. Whilst Government develop the detail, including the potential roles for gas networks, we would like to work with hydrogen producers in parallel potential blending options.

For further information about blending, and to discuss any queries relating to this document, please contact us at **futureofgas@cadentgas.com**.

The tables on the following pages show, by geographic groupings, an indicative list of locations where we believe capacity for hydrogen injection is most likely to exist in the future.

Also included is a projection of an average daily hydrogen injection capacity at each site for a typical winter's and summer's day. These figures are based on the modal average capacity in an unconstrained network as derived from our network modelling systems.

For reference, we have also included an estimation of the total annual hydrogen injection capacity, in GWh per year, that would have been possible at each offtake between April 2020 and March 2021, given the demands and system configuration during that period.

It should be noted that domestic heating is the primary use for gaseous fuels in the UK, with air temperature being the primary driver of heating demand. A typical daily demand profile will see peaks in consumption around breakfast and tea times, with a cold winter's day leading to 10 times the demand of a warm summer's day. Total annual demand will vary year on year in line with the prevailing weather conditions. Demand will be high in a cold winter, and lower in a mild winter.

It is expected that seasonal storage will be required to help ensure that the percentage of hydrogen entering the gas network is consistent throughout the day, and to smooth out the disparity between winter and summer demands.

The data in the tables below is indicative of Cadent's preferred injection locations and likely hydrogen injection capacity, if blending becomes a reality. Additional capacity may be available at other locations.

North West Hydrogen Blending Group

Primary Hydrogen Blending Hubs

Blending at these locations is likely to offer the greatest capacity opportunity for producers and the optimal network configuration to maximise blending volumes across Cadent's networks in future.

Location	County	Theoretical Hydrogen Capacity for Blending on a Typical Winter's Day (GWh/day)	Theoretical Hydrogen Capacity for Blending on a Typical Summer's Day (GWh/day)	Actual Hydrogen Capacity for Blending April 2020 – March 2021 (GWh/year)
Blackrod	**Greater Manchester**	9.93	4.87	1501.15
Partington	**Greater Manchester**	4.00	2.07	243.79
Samlesbury	**Lancashire**	6.53	4.93	489.05
Warburton	**Greater Manchester**	5.33	2.87	1133.02

Secondary Hydrogen Blending Hubs

These locations could also offer bulk hydrogen blending capacity in future but will require network reconfiguration that may compromise potential capacity at Primary Hydrogen Blending Hubs.

Location	County	Theoretical Hydrogen Capacity for Blending on a Typical Winter's Day (GWh/day)	Theoretical Hydrogen Capacity for Blending on a Typical Summer's Day (GWh/day)	Actual Hydrogen Capacity for Blending April 2020 – March 2021 (GWh/year)
Audley**	**Staffordshire**	0.35	0.06	79.37
Eccleston	**Lancashire**	1.74	0.69	157.29
Holmes Chapel	**Cheshire**	0.88	0.39	177.66
Lupton	**Cumbria**	0.97	0.30	243.06
Malpas	**Cheshire**	0.03	0.01	5.34
Mickle Trafford	**Cheshire**	1.74	0.69	252.62
Weston Point	**Cheshire**	0.04	0.01	10.08

****Location also mentioned in the West Midlands Blending Group**

West Midlands Hydrogen Blending Group

Primary Hydrogen Blending Hubs

Blending at these locations is likely to offer the greatest capacity opportunity for producers and the optimal network configuration to maximise blending volumes across Cadent's networks in future.

Location	County	Theoretical Hydrogen Capacity for Blending on a Typical Winter's Day (GWh/day)	Theoretical Hydrogen Capacity for Blending on a Typical Summer's Day (GWh/day)	Actual Hydrogen Capacity for Blending April 2020 – March 2021 (GWh/year)
Alrewas***	Staffordshire	3.20	1.13	478.57
Aspley	Staffordshire	5.47	2.07	671.26
Austrey	Warwickshire	6.13	3.07	370.27
Rugby	Warwickshire	5.07	3.07	818.80

***Location also mentioned in East Midlands Blending Group

Secondary Hydrogen Blending Hubs

These locations could also offer bulk hydrogen blending capacity in the future but will require network reconfiguration that may compromise potential capacity at the Primary Hydrogen Blending Hubs.

Location	County	Theoretical Hydrogen Capacity for Blending on a Typical Winter's Day (GWh/day)	Theoretical Hydrogen Capacity for Blending on a Typical Summer's Day (GWh/day)	Actual Hydrogen Capacity for Blending April 2020 – March 2021 (GWh/year)
Audley**	Staffordshire	0.88	0.39	43.37
Leamington Spa	Warwickshire	0.18	0.11	19.01
Lower Quinton	Warwickshire	5.07	3.07	174.25*
Milwich	Staffordshire	0.88	0.39	144.71
Ross on Wye	Herefordshire	0.37	0.24	132.14

*2019 figure used due to maintenance work in 2020

**Location also mentioned in North West Blending Group

East Midlands Hydrogen Blending Group

Primary Hydrogen Blending Hubs

Blending at these locations is likely to offer the greatest capacity opportunity for producers and the optimal network configuration to maximise blending volumes across Cadent's networks in future.

Location	County	Theoretical Hydrogen Capacity for Blending on a Typical Winter's Day (GWh/day)	Theoretical Hydrogen Capacity for Blending on a Typical Summer's Day (GWh/day)	Actual Hydrogen Capacity for Blending April 2020 – March 2021 (GWh/year)
Alrewas***	Staffordshire	6.40	0.33	537.95
Drointon	Staffordshire	6.53	1.80	882.36
Thornton Curtis	Lincolnshire	6.87	1.80	959.09

***Location also mentioned in West Midlands Blending Group

Secondary Hydrogen Blending Hubs

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Blaby	Leicestershire	0.26	0.10	159.54
Blyborough	Lincolnshire	6.67	0.60	284.56
Caldecott	Rutland	0.89	0.60	76.63
Gosberton	Lincolnshire	0.73	0.39	105.64
Kirkstead	Lincolnshire	0.03	0.01	8.06
Market Harborough	Leicestershire	0.17	0.10	21.55
Silk Willoughby	Lincolnshire	0.09	0.02	19.31
Sutton Bridge	Lincolnshire	0.04	0.01	9.60
Tur Langton	Leicestershire	5.87	0.60	525.55

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Primary Hydrogen Blending Hubs

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Whitwell	**Bedfordshire**	7.00	2.00	903.59
Matching Green	**Essex**	7.00	2.00	628.43

Secondary Hydrogen Blending Hubs

These locations could also offer bulk hydrogen blending capacity in the future but will require network reconfiguration that may compromise potential capacity at the Primary Hydrogen Blending Hubs

Location	County	Theoretical Hydrogen Capacity for Blending on a Typical Winter's Day (GWh/day)	Theoretical Hydrogen Capacity for Blending on a Typical Summer's Day (GWh/day)	Actual Hydrogen Capacity for Blending April 2020 – March 2021 (GWh/year)
Yelverton	**Norfolk**	4.80	2.00	366.15
Bacton	**Norfolk**	0.08	0.03	22.25
Brisley	**Norfolk**	0.13	0.09	18.57
Great Wilbraham	**Cambs**	0.77	0.27	200.65
Peterborough	**Cambs**	0.87	0.27	140.78
Roudham Heath	**Norfolk**	0.85	0.66	260.11
Royston	**Hertfordshire**	0.09	0.03	22.32
West Winch	**Norfolk**	0.35	0.22	81.42

Primary Hydrogen Blending Hubs

Blending at these locations is likely to offer the greatest capacity opportunity for producers and the optimal network configuration to maximise blending volumes across Cadent's networks in the future.

Location	County	Theoretical Hydrogen Capacity for Blending on a Typical Winter's Day (GWh/day)	Theoretical Hydrogen Capacity for Blending on a Typical Summer's Day (GWh/day)	Actual Hydrogen Capacity for Blending April 2020 – March 2021 (GWh/year)
Luxborough Lane	**Essex**	11.27	1.00	593.58*
Peters Green	**Hertfordshire**	17.73	5.20	2283.09

***2019 figure used due to maintenance work in 2020**

Secondary Hydrogen Blending Hubs

These locations could also offer bulk hydrogen blending capacity in the future but will require network reconfiguration that may compromise potential capacity at the Primary Hydrogen Blending Hubs

Location	County	Theoretical Hydrogen Capacity for Blending on a Typical Winter's Day (GWh/day)	Theoretical Hydrogen Capacity for Blending on a Typical Summer's Day (GWh/day)	Actual Hydrogen Capacity for Blending April 2020 – March 2021 (GWh/year)
Horndon	**Essex**	6.67	1.00	228.96*
Winkfield NL	**Berkshire**	3.33	1.00	0.31

***2019 figure used due to maintenance work in 2020**