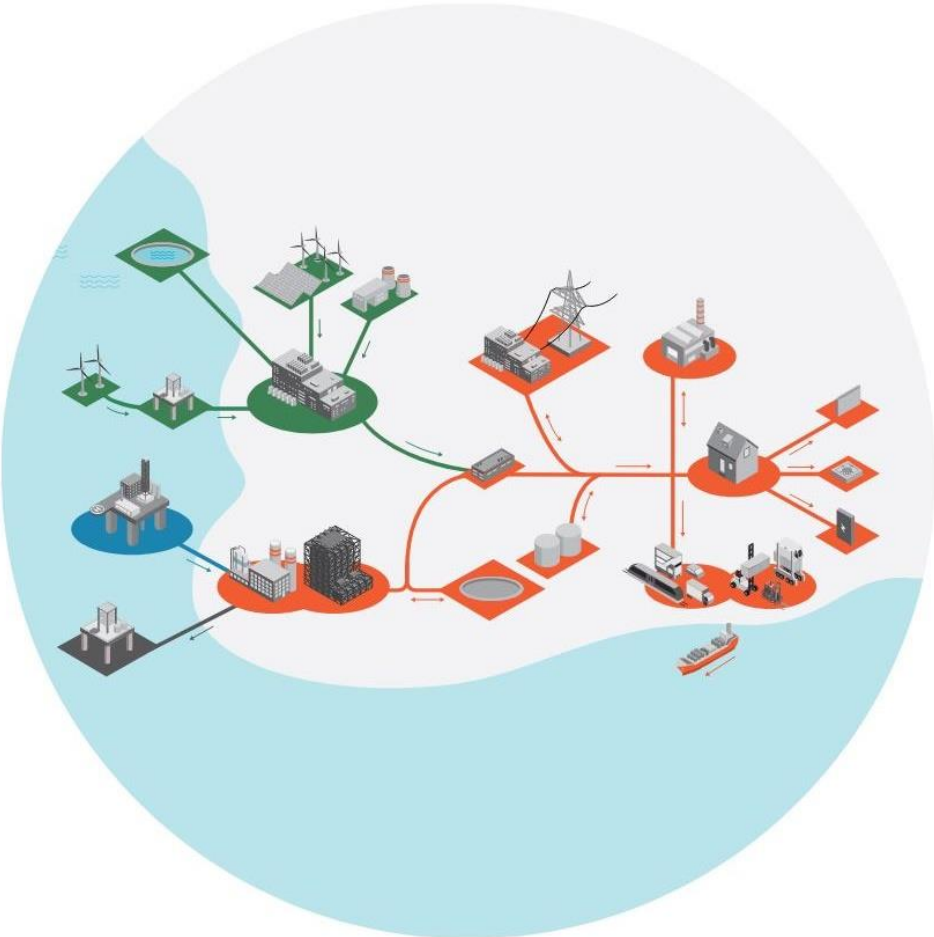
Appendix A1 – Demand Study Report

Northern Gas Networks

East Coast Hydrogen - Pre-FEED Study

Demand Study Report

Reference: 293805-ARUP-DMS
NGN Reference: REP 002
Rev B | 13 March 2024



Job number 293805-00

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1. Introduction

Northern Gas Networks (NGN) are the company responsible for distributing gas to homes and businesses across the north of England, an area covering West, East & North Yorkshire, the North East and Northern Cumbria.

East Coast Hydrogen (ECH) provides a solution to connect these industrial clusters with other supply points, such as the East Midlands Hydrogen Innovation Zone, and export hydrogen production across the North of England enabling the seamless conversion of businesses and homes to 100% hydrogen where it is best deployed.

This collaborative programme between Northern Gas Networks, Cadent Gas and National Gas Transmission (NGGT) represents an opportunity for the Government and the private sector to work together in delivering on our ambitious decarbonisation targets. ECH has the potential to connect over 7GW of hydrogen production by 2030, alone exceeding the UK Government's 10GW by 2030 target in a single region.

ECH can utilise the natural gas assets of the North of England, including existing natural gas storage and potential hydrogen storage facilities, and build on the hydrogen production in two of the UK's largest industrial clusters in the North East and North West and in turn ensure significant private sector investment in the UK's industrial heartlands.

ECH is a 15-year programme that will be carried out in multiple discrete phases to decarbonise industrial processes and domestic heating in the East Coast region. Proposed phases can be seen below:

Phase 1 - (2022 - 2026) - Completion of Pre-FEED, FEED Study and development of East Coast Cluster infrastructure

Phase 2 - (2024 - 2030) - Connection of Humber and Teesside clusters, and growth into Yorkshire and East Midlands

Phase 3 - (2028 - 2037) - Expansion from the industrial Clusters into Northern urban areas and the Midlands

Phase 4 - (2032+) - Connection of the network into further regions and future growth opportunities

NGN will look to trigger the Net Zero and Small Projects (NZASP) Reopener to undertake the subsequent phase i.e., FEED study

Arup have been commissioned by NGN to undertake a Pre-FEED study to support the Net Zero and Small Projects (NZASP) Reopener and subsequent project phases e.g., FEED study.

2. Purpose of Document

The purpose of this document is to describe the data collection and processing stages which have been undertaken to provide the modelling inputs for the ECH project. This document also outlines the assumptions made up to the stage of issue. These are also captured in the project assumptions register.

The information relating to the demand is correct at the date of issue of this document. However, it is expected that this information will be continually refined and evolve during the course of the different phases of ECH due to the fast-moving nature of the industry and upon continued engagement with users and emerging markets.

The process of demand data collection and refinement has been continual throughout the Pre-FEED stage of the ECH project and will continue into FEED. A high-level flow chart of the process which has been undertaken can be seen in (Figure 1).

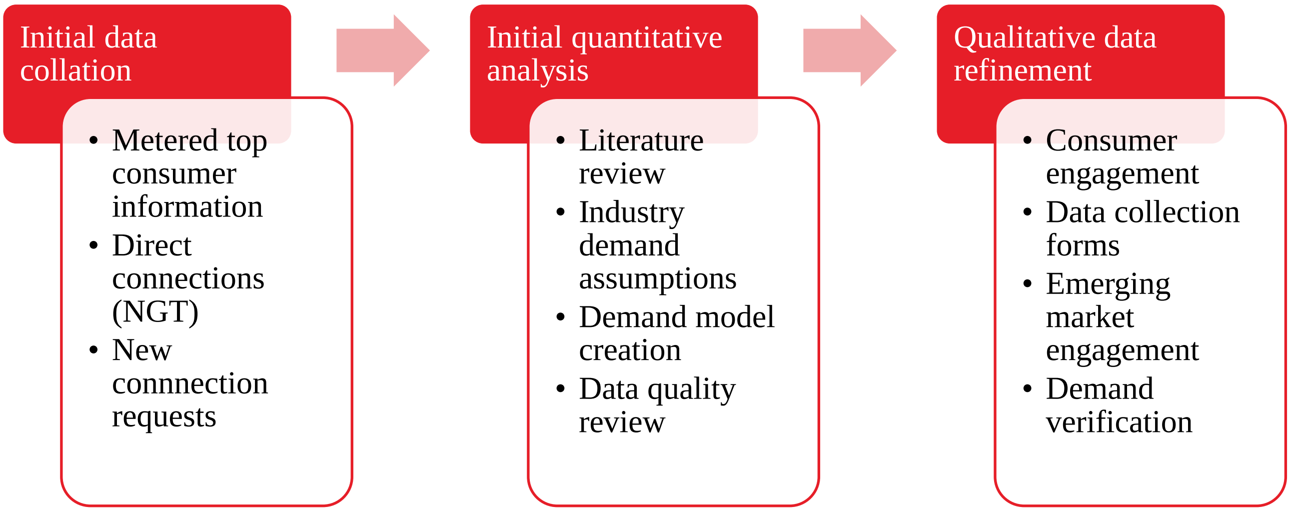


Figure 1: Data collection and refinement process

3. Data collection

3.1 Industrial and commercial gas users

To establish the potential demand for hydrogen in NGN's region, existing industrial and large commercial natural gas users who were likely to convert to hydrogen were considered, as well as potential new hydrogen users that were not already connected to the network. To evaluate the potential hydrogen demand from existing natural gas users, information on the top 250 consumers on the NGN network were obtained from Xoserve, who are responsible for metering and billing. The data provided included:

- Meter point reference
- Name associated with the meter
- Meter read frequency
- Meter point Annual Quantity (AG)
- Maximum metered daily demand from previous year (Sp Dm Soq)
- Pressure

This data was reviewed and updated by NGN and Arup to ensure information such as organisation name and parent company were up to date and there were no duplications or other anomalies. This was a continual process that took place throughout the Pre-FEED, improving data quality throughout the stakeholder engagement.

Where data was received by the user on consumption of gas per year, this was the figure used to estimate their gas demand. Where this data was not available, the Meter Point Annual Quantity (MPAQ) figure provided by Xoserve was used and assumed to be reflective of their actual annual consumption. For the latest issue, the 2024 data has been provided by Xoserve and this has been used in this latest report. Throughout the data collection and stakeholder engagement, the feedback from users is that their annual consumption is in line with the MPAQ figure.

Additionally, there are some connections where the user has a direct offtake agreement with NGN (not accounted for in Xoserve data), as well as anticipated new users who have made a connection request to NGN. Information on these users was collated throughout the Pre-FEED project and accounted for in the final Pre-FEED design. Together the top 250 users identified from Xoserve, large scale direct connections and proposed connections make up the ECH large commercial and industrial loads list. This is approximately 250 users, who account for the majority of the commercial and industrial consumption in the NGN network, the following figure demonstrates this.

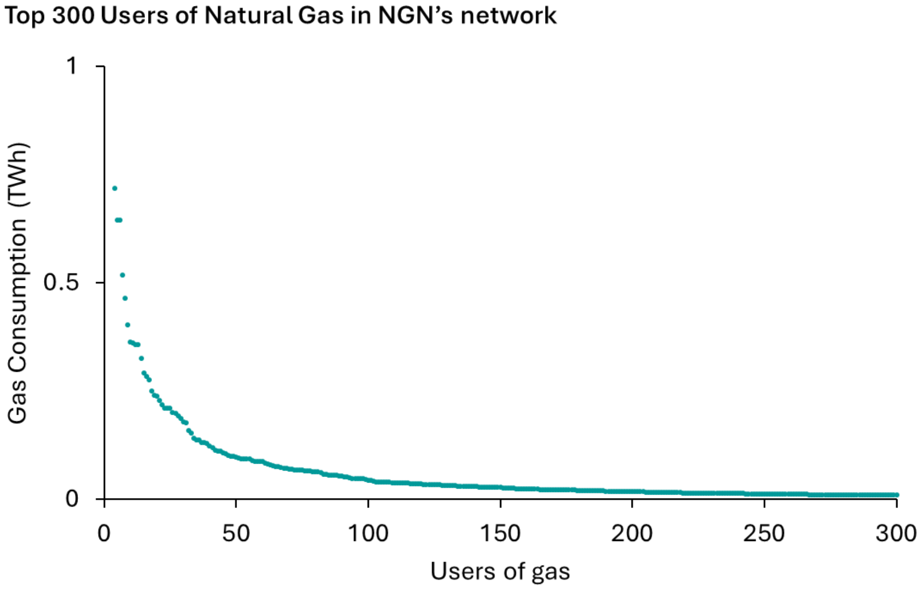


Figure 2: NGN top 300 users consumption chart

To further understand the potential demand for hydrogen, the following information was collated on all users:

- User industrial sector
- Primary natural gas use
- Site age
- Address
- Site specific plans which impacted demand (upgrades, decommissioning etc.)
- Parent organisation
- Net-zero plans of organisation or parent organisation
- Site potential for accepting a hydrogen blend
- Site plans for electrification or other alternative energy supply

- Potential alternative hydrogen supply

A data capture form was created to gather further in-depth information on the users plans and potential, this can be seen in Appendix A.1 of this document. This was used to obtain information on the users, once an initial meeting had taken place to explain the project and discuss the user's potential requirements. The stakeholder engagement was focussed on those within the feasible geographic area of ECH this Pre-FEED study is considering. When it was determined a user had potential to be connected, initial contact was made to understand their interest. If the user was interested, an initial meeting would take place to discuss the project. The user would then be requested to populate a data capture form.

Of the 250 users identified in the large industrial loads, 191 were within the geographic region to be assessed. Following engagement, meetings took place with 111 of these users and 105 said they were interested in hydrogen as a result. Of these, 37 returned populated data capture forms.

The geographic spread of the natural gas consumption of the top industrial and commercial users is shown below in Figure 3. As can be seen Teesside, Humber and West Yorkshire are the regions with the largest combined industrial and commercial use on the NGN network.

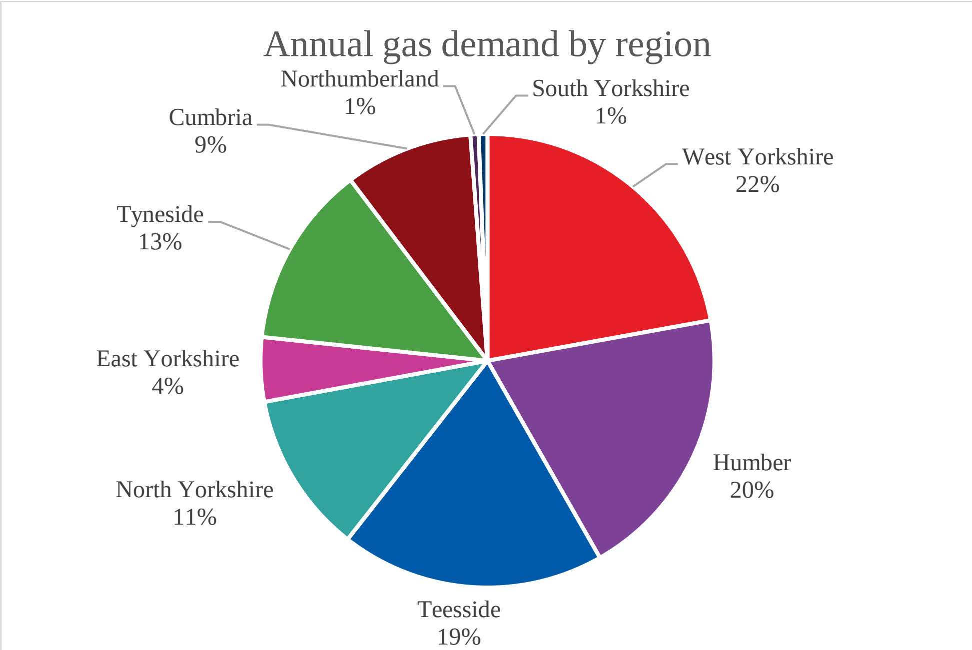


Figure 3: Natural gas usage of the top industrial and commercial users by area

During the data collection, parent companies of the users were researched. Of the companies within the top industrial and commercial users, less than one third is owned by a UK based company (Figure 4) based on their natural gas consumption.

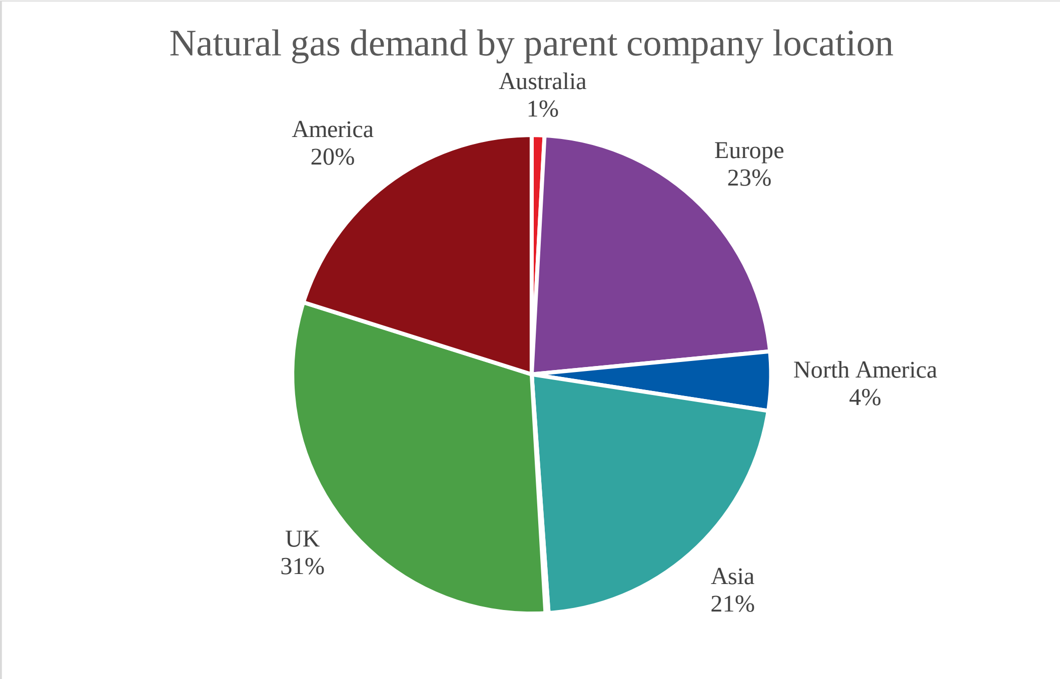


Figure 4: Natural gas demand by parent company location

The geographic distribution of large industrial users can also be seen on the map below, the usage within the industrial clusters of Teesside and Humberside can be seen as well as a spread across West Yorkshire. The radius of the circle is proportional to the user's gas consumption.

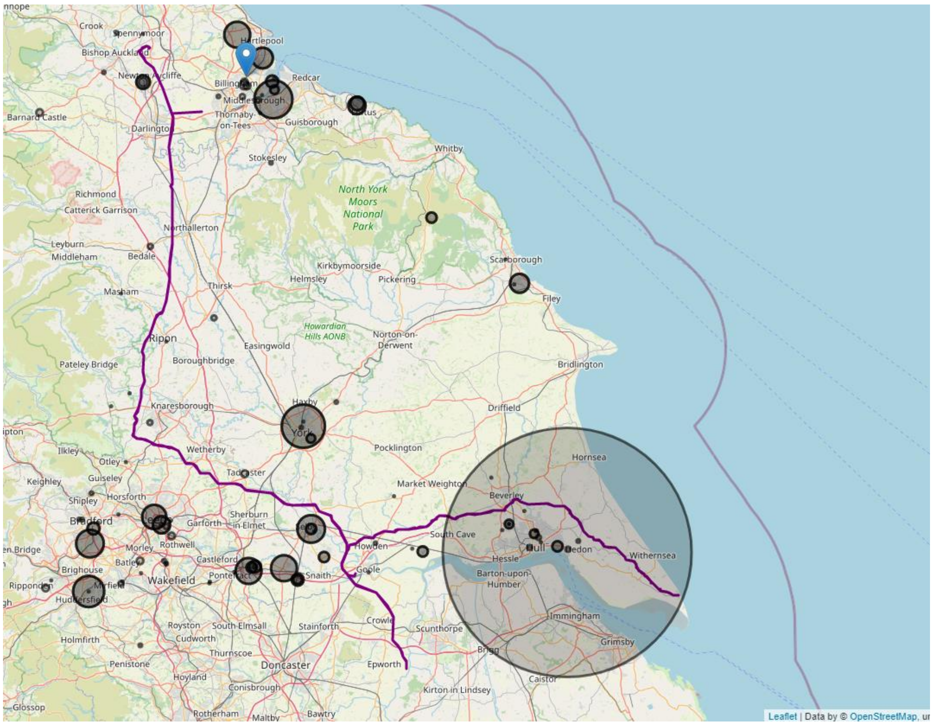


Figure 5: Location of large users on the East coast

Of the total demand from the large industrial and commercial users, approximately two thirds of this are from the top 40.

The distribution of usage by industry for the large industrial and commercial loads is shown below in Figure 6.

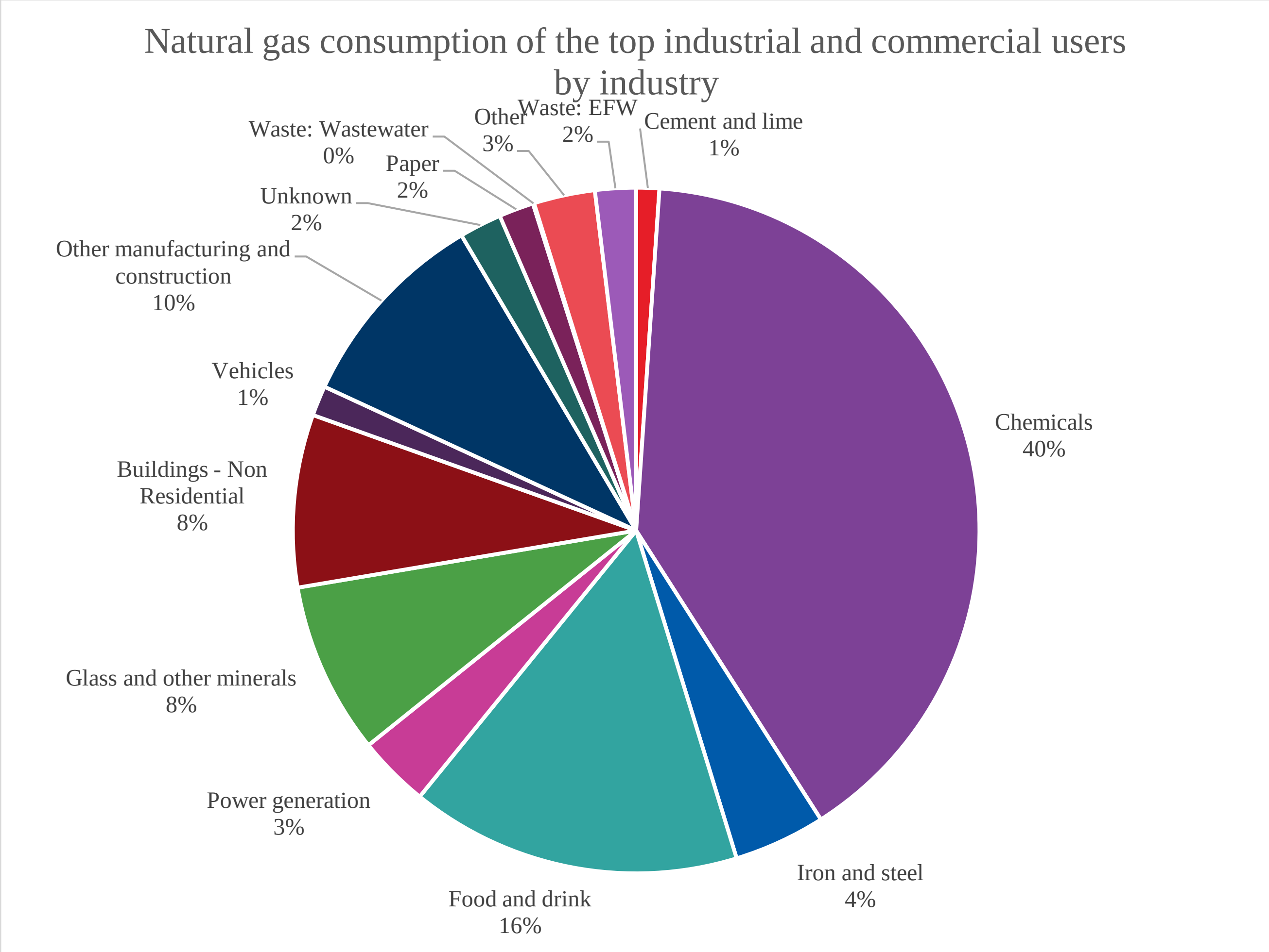


Figure 6: Natural gas consumption by industry

3.2 Domestic users

Domestic use was modelled using the village and town trials data provided by NGN. Whilst gas distribution networks await a government decision on hydrogen for heat in 2026, the ECH network has been developed to be independent of the decision and demonstrate viability purely based on the industrial and commercial loads. As such, this data was only used for potential sizing of the network, but the demand figured have not been included in the final solution. During the optioneering, the potential locations of town trials have been considered and where possible, the routing has been done to allow easier connections to the trial locations, should this be required.

The town trial area natural gas demand loads provided by NGN included for industrial loads within that area. To get an accurate reflection of the domestic natural gas demand in that area, any industrial users which are already under consideration for switching to hydrogen were removed from that demand, to avoid double counting.

3.3 Transport

Transport demand for hydrogen has been considered as specific locations for assumed refuelling stations. The assumptions of hydrogen uptake for transport are largely for road transport, of which heavy goods vehicles and depot-based transport are anticipated to be the majority of the demand. The assumption is that four hydrogen refuelling stations will be available within the 2027 to 2032 period, in the industrial clusters of Teesside and the Humber as well as in West Yorkshire and one location on the A1(m). The demand is expected to ramp up significantly within the three periods, but it has been assumed the number of fuelling stations will remain at four. The Committee for Climate Change (CCC) highlight hydrogen uptake being quick, with 77% of larger HGVs converting to hydrogen by 2035 [1]. The Hydrogen Transportation and

Storage Infrastructure report [2] reports the hydrogen demand for domestic transport from the UK Hydrogen strategy to be up to 6TWh in 2030 and 21TWh by 2035, excluding aviation. It has been assumed that of these UK demand figures, 25% of this will be within the ECH region, due to the prevalence of hydrogen production and the area being an early adopter of low carbon hydrogen. The demand has been assumed to be equally split between the four sites identified.

It is assumed that refuelling hubs will have on site storage, and as such will not have daily peaks above their annual demand average.

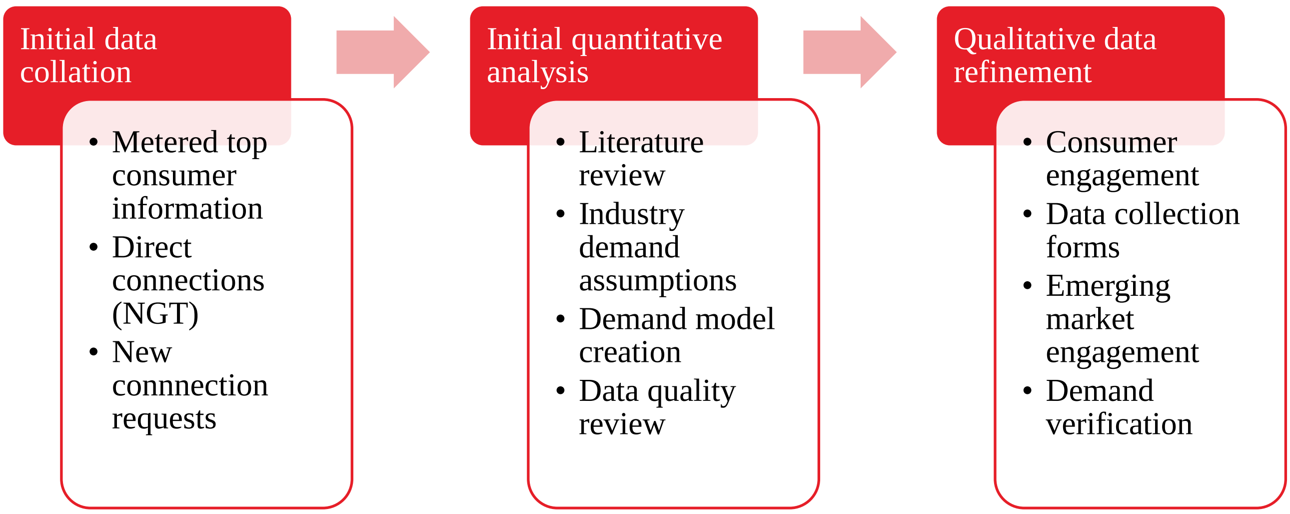
3.4 Sustainable Aviation Fuels

Hydrogen can be used to directly power aircraft jet turbines or through fuel cells. It can also be used to produce Sustainable Aviation Fuels (SAF) in the Power-to-Liquid (PtL) process. There are clear drivers for the increase of SAF production. The global aviation industry, through the International Civil Aviation Organization (ICAO), set targets in 2022 to achieve net zero carbon emissions by 2050. The UK set out its aviation targets in the Jet Zero Strategy, which similarly aims for net zero emissions by 2050 (Department for Transport, 2022). It also aims to deliver at least 10% sustainable aviation fuel in the UK fuel mix by 2030, and a target for domestic flights to reach net zero by 2040. In support of these aims, the UK government set up the Jet Zero Council to develop UK capabilities to deliver both net zero and zero emission technologies by:

- Developing and industrialising zero emission aviation and aerospace technologies.
- Accelerating the production of SAFs by investing in first-of-a-kind plants, supporting scientific research on a larger scale, and helping to drive down production costs.
- Working with the aviation industry to develop and deploy new technologies that can reduce emissions, such as electric aircraft and hydrogen-powered aircraft.
- Working with airports to develop the infrastructure needed to support zero emission flight for electric and hydrogen.
- Developing the regulations needed to safely operate zero emission aircraft and infrastructure.

Whilst there is a clear needs case for SAF and the low carbon hydrogen to produce it, the market is in its infancy. Some schemes are progressing to detailed design, such as the Willis Sustainable Fuels (UK) Carbonshift PtL SAF plant, which is planned to enter operation in 2026 and has received funding from The Department for Transport’s Advanced Fuels Fund (AFF). Currently the demand for SAF production has not been accounted for within the development of the ECH network. However, it is clear that an integrated transport network will be required to enable these markets to develop at the pace required to enable the UK to meet net zero targets by 2050.

4. Demand processing methodology



4.1 Potential hydrogen demand and natural gas reduction

The demand study aimed to determine future natural gas and hydrogen requirements for the existing large industrial and commercial users as well as potential new users, domestic loads and transport connections. Both the hydrogen uptake and natural gas decline are important to understand for the later project phases. All of the large industrial and commercial users were assessed, even if they were not anticipated to be included at every phase.

To assess the large industrial and commercial users potential hydrogen consumption, a three phase approach was taken to generate individual usage profiles until 2037. This was focused on three years, 2028, 2032 and 2037. The assessment was done based on the consumers ability to accept hydrogen and the assumption that a hydrogen pipeline was available for them to be connected to.

The first phase of the assessment was based on the hydrogen uptake for the industrial sector of the user. Each industry was assessed for its ability to accept hydrogen and was given a percentage uptake of hydrogen in the three years being considered, as well as a percentage uptake in electrification, to feed into the natural gas reduction profiles. The industry-based uptake assumptions can be seen in the table in Appendix A.2. These are based on information from various sources, including:

- Collated views from users within the industry groups
- Government and industry body predictions and pathways to net-zero
- Study of methane combusting technologies used and readiness to accept hydrogen or newer alternatives which can accept hydrogen

These percentage adoptions were applied to all large industrial users to generate a profile of hydrogen uptake and natural gas decline.

The second phase was based upon collated information from the further information gathering exercise. This tailored uptake based on information available such as user net-zero or sustainability reports and site plans for growth, potential of alternative hydrogen supply amongst others. These were used to individually modify the potential usage profile for each of the top 40 users.

The third phase of the assessment used direct information from discussions with the users or data capture form responses to modify their profiles based on their site plans or ability to accept hydrogen.

The assessment has been carried out with the ability to use the annual consumption for business case modelling and also to use peak daily flows to facilitate the network modelling.

4.2 Distance from supply

In order to further assess the feasibility of providing hydrogen to users during the three phases, they were assessed geographically, based on their proximity to pipelines which were anticipated to switch to hydrogen as well as hydrogen producers. This was done to provide a more refined estimate of hydrogen uptake and methane demand for the initial network modelling. The pipelines included in this assessment were:

- Feeder 7 - from Bishop Auckland to Susworth
- Feeder 6 - from Feeder 7 to Elton Offtake
- Feeder 29 - from Easington to Asselby

Cowpen Bewley was taken as a point where production pipelines would be connected. A map of this assumed transmission network and producers can be seen below in Figure 7.

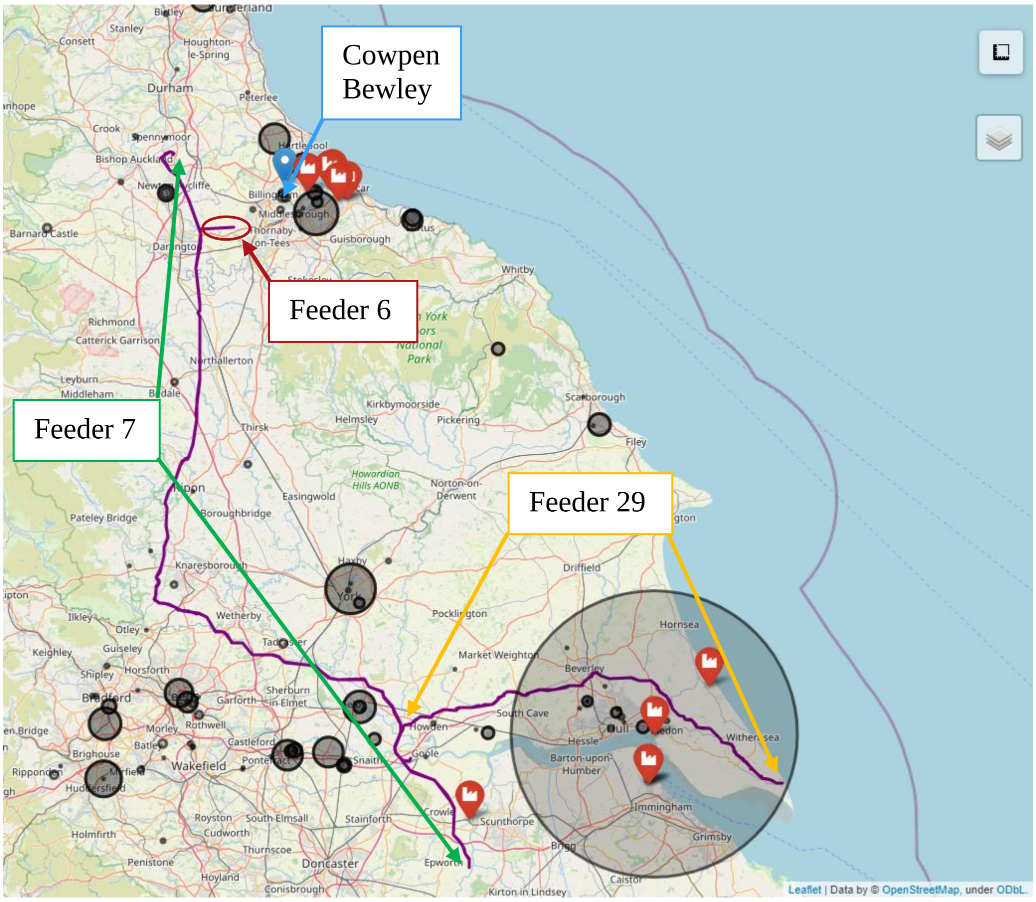


Figure 7: Assumed transmission network and producers

For the initial modelling, an initial base distance from feeders or producers was applied for each of the years, these were 2028 - 16km, 2032 – 20km, 2037 – 25km. These were then individually assessed to ensure that any key sites with identified high potential due to factors such as dual pipelines, or hydrogen readiness, were brought into the correct period.

4.3 Demand qualitative assessment

Following these initial assessments, the network modelling was undertaken on these demands. During this period, stakeholder engagement continued with the users and more qualitative information was obtained through discussions and from the responses to the data capture forms.

The qualitative data obtained was assessed against the assumptions made for the users in the initial phases of the project. These were found to be well aligned in most cases which provided verification to the figures used for the network development.

4.4 Key assumptions

A number of assumptions have been made to enable forecasting of hydrogen demand as detailed below:

- Transport demand within the project geographical area will be 25% of that identified in the UK hydrogen strategy
- Four hydrogen refuelling stations will be available within the 2027 to 2032 period, in the industrial clusters of Teesside and Humberside as well as in West Yorkshire and one location on the A1(m)
- Feasible distances for new HP pipeline in the project phases are 2028 - 16km, 2032 – 20km, 2037 – 25km
- Meter point Annual Quantity (AQ) figures are representative of annual consumption, where further qualitative data has not been able to be obtained from the consumers.

5. Results

5.1 Large industrial users

The energy profiles created for the combined top industrial and commercial users can be seen in the graphs below, with step changes at each of the defined stages required for modelling. These are optimistic assessments which assume all users within the defined distances at each stage will be able to be connected to a hydrogen network. The further modelling stages of the study will refine this uptake based on the amount of infrastructure which can be constructed or repurposed at each phase and therefore which users can be connected. The graph in Figure 8 shows the profiles with no location bias, this is solely based on the assessment of the user's ability to accept hydrogen. The graph in Figure 9 shows the profiles when the location bias is applied for each of the project phases, as discussed in section 4.2. This is the uptake to be considered in the initial network modelling phase, but it is anticipated this will be refined to incorporate the feasibility of connecting all users at each phase.

The calculated site energy profile represents the required energy consumption of all sites, based on existing consumption data, with modifications for any site-specific plans for growth or reduction which have been identified. The alternative hydrogen production profile represents any hydrogen consumption at the identified sites which will not be using the ECH network, this might be from onsite production or producers connected to the user with a private pipeline. The alternative energy profile is where it has been identified that the user will convert part of their consumption to other energy sources, such as electricity. The hydrogen energy profile represents the hydrogen energy requirements though the ECH network for the identified users. Finally, the natural gas profile is the remaining energy requirement that isn't expected to be transitioned to another energy source.

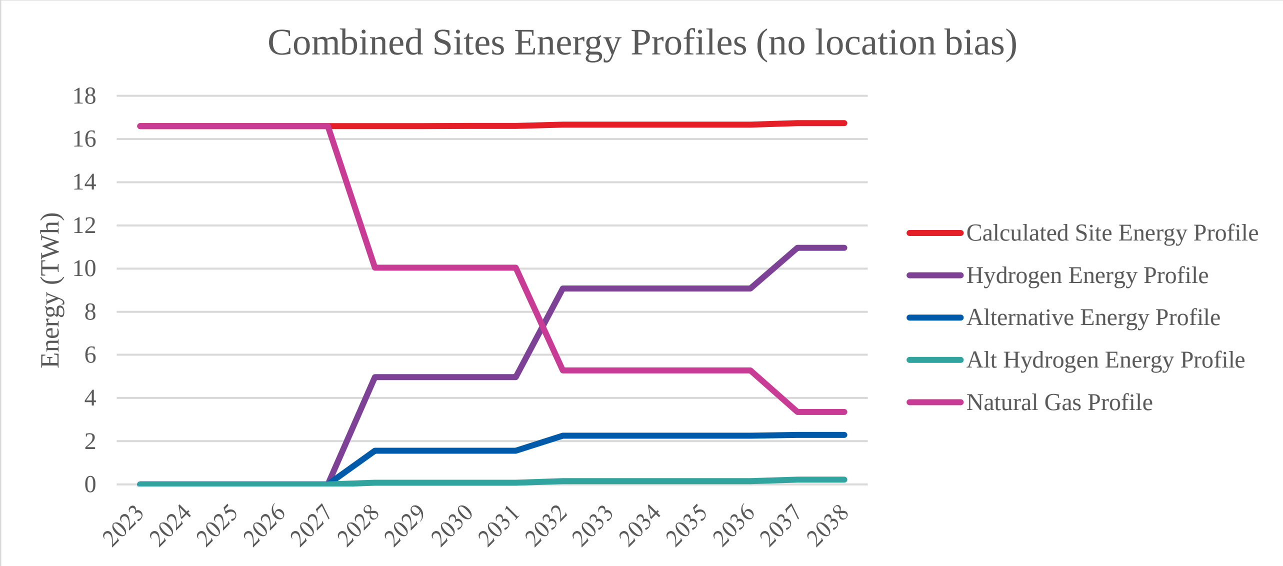


Figure 8: Combined energy profiles (no location bias)

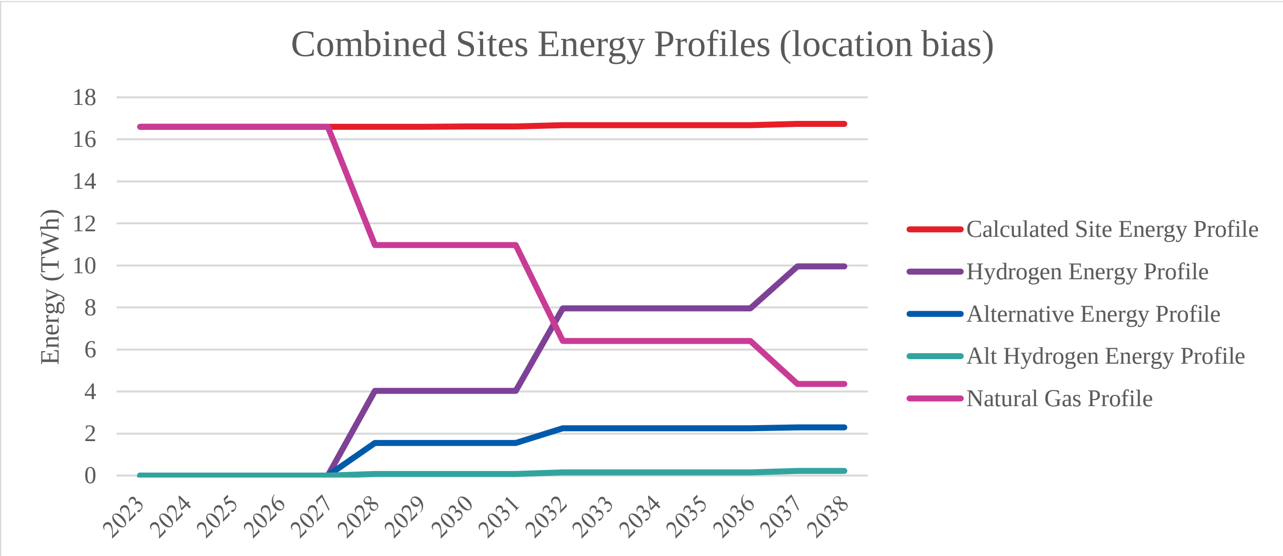


Figure 9: Combined energy profiles (location bias)

The chart below shows the change in viability of hydrogen consumption at different sites within the top industrial and commercial users. This is impacted by both the technical assessment and the location assessment, which becomes broader each period. The change is less pronounced than the hydrogen uptake profile since this does not account for the hydrogen used at each site. This shows that throughout the period the main driver for increasing hydrogen usage is the advancement in technology and ability to consume hydrogen on individual sites, rather than expanding the infrastructure to cover more sites. As such, the further study should focus on the users with the highest end consumption of hydrogen.

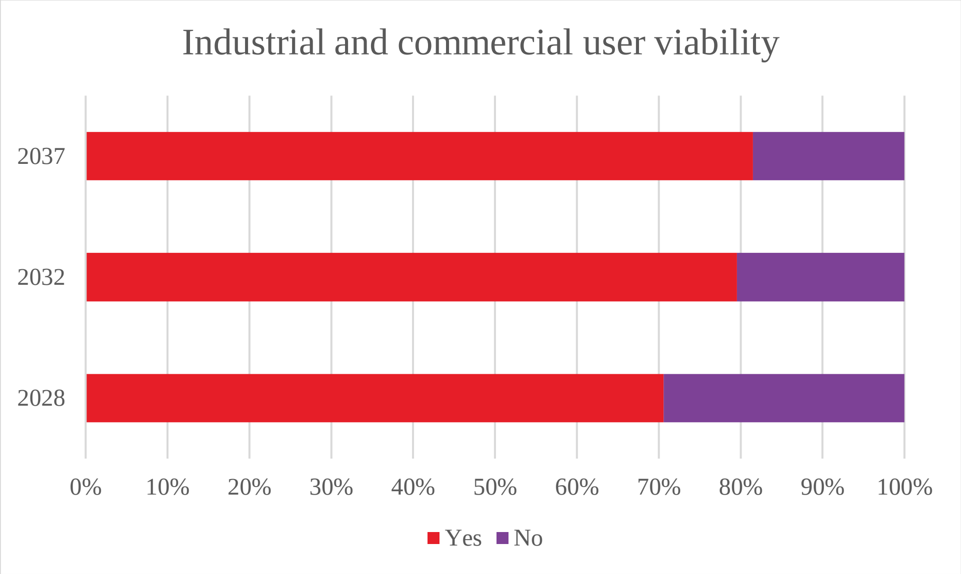


Figure 10: Industrial and commercia user viability

The hydrogen uptake of the top industrial and commercial users can be seen below in Figure 11. This has been split up based on industrial sector. Uptake in glass production, power generation and food and drink industries provide the bulk of the demand in the early phases whilst uptake in the harder to convert sectors such as chemical production, can be seen to increase in the later phases.

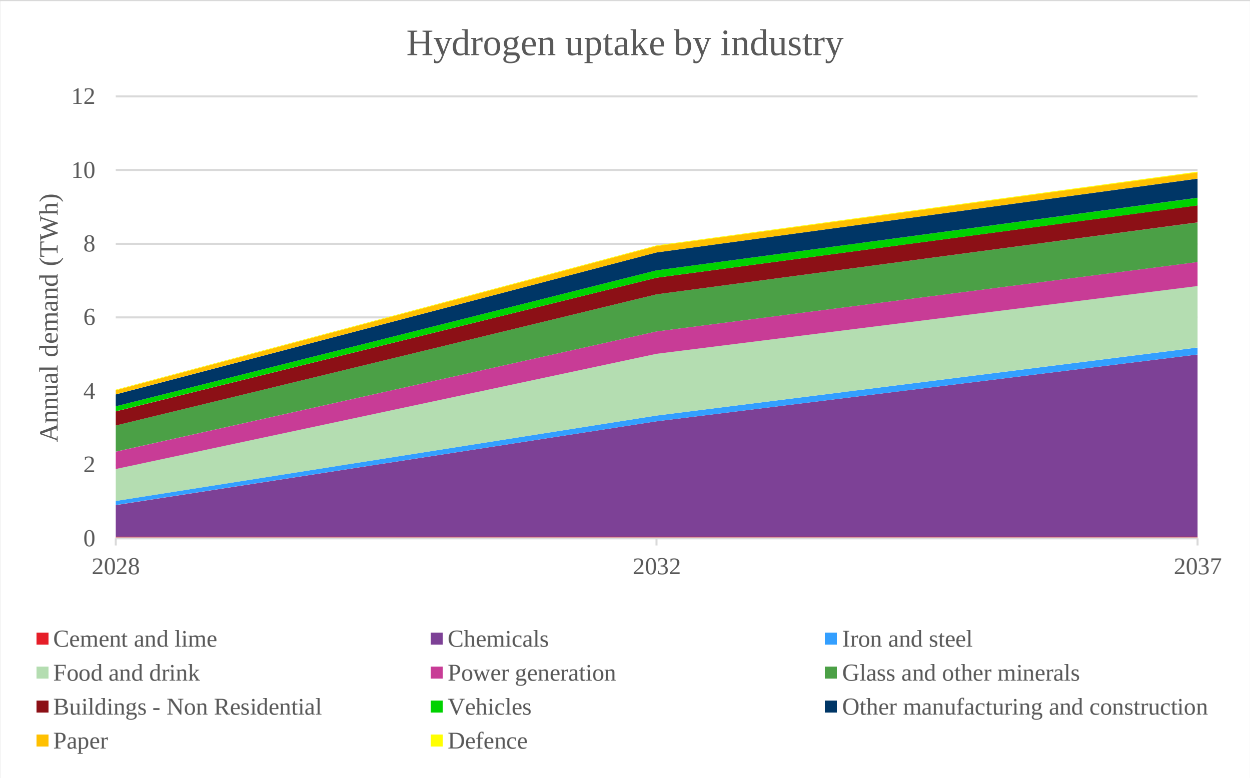


Figure 11: Large user hydrogen uptake by industry

The individual demand profiles determined from this study fed into the network modelling and optioneering phases.

5.2 Combined

The demand has been assessed as different use cases. The below chart shows the combination of the calculated demand at the defined project stages.

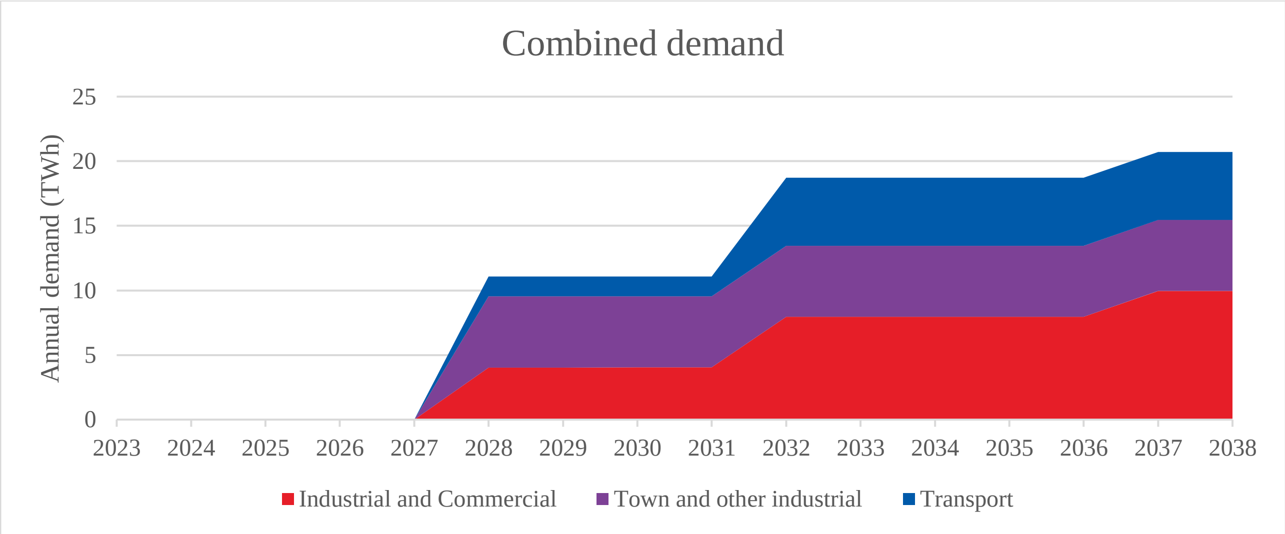


Figure 12: Combined user demand

6. Recommendations

The demand assessment conducted for the Pre-FEED study has been both quantitative and qualitative, which was deemed necessary due to the importance of the demand data to the viability of the selected network.

At the beginning of the FEED study, the users should be further engaged to further understand and confirm their requirements including anticipated hydrogen demand and potential connection dates. This should be done in line with the project programme and the users anticipated connection date. This will reduce the risk of any changes impacting the technical, environmental, and consenting works which are being undertaken as part of the FEED.

The demand for industrial and commercial users has been based on the top 250 current natural gas users. Whilst demand is highly weighted to the largest top 40 sites, there are still opportunities to identify additional users who are within close proximity to the developed network. Once the routes are further developed in the FEED stage, additional users can be identified and engaged with.

There are multiple emerging industries which are anticipated to develop should low carbon hydrogen be available. These are industries such as SAF and lithium hydroxide processing facilities. Continual market engagement will be required throughout the project as it is anticipated that as certainty of supply increases, this will increase investor confidence in these emerging industries. These are large potential demands which have not currently been included in the identified demands of this phase.

The option of using hydrogen to transition to net-zero has been new to many of the stakeholders during the engagement. As the certainty of supply increases, businesses may find additional uses above that of their current natural gas uses. For example, some users have reported that they would investigate transitioning their haulage fleets to hydrogen if this was available. This has the potential to increase the demand at some sites considerably, this hasn't been included in the reported figures.

7. References

[1] E. E. f. t. C. C. Committee, “Analysis to provide costs, efficiencies and roll-out trajectories for zero-emission HGVs, buses and coaches,” 2020.

[2] BEIS, “Hydrogen Transportation and Storage Infrastructure Assessment of Requirements up to 2035,” 2022.

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Committee for climate change: The Sixth Carbon Budget The UKs path to Net Zero *https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf*

HM Government: Industrial Decarbonisation Strategy CP399 March 2021 *https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/970229/Industrial_Decarbonisation_Strategy_March_2021.pdf*

HM Government: UK Hydrogen Strategy CP475 2021 *https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1011283/UK-Hydrogen-Strategy_web.pdf*

UK Hydrogen Champion (2023) Hydrogen Champion Report Recommendations to government and industry to accelerate the development of the UK hydrogen economy

National Grid ESO (2022) Future energy Scenarios

A.1 Data collection questionnaire

East Coast Hydrogen

Northern Gas Networks

Cadent
Your Gas Network

nationalgrid

East Coast Hydrogen Data Collection Form

To support the East Coast Hydrogen pre-FEED study, we need to accurately model future natural gas demand and forecasted hydrogen production, storage and off-take. As you are a key stakeholder within the East Coast region we would invite you to participate in our data collection exercise.

Participation will help to ensure we can effectively take your needs and requirements into account during our evaluation process. It will be essential for selecting the most appropriate pipeline repurposing and routing option, as well as securing funding from BEIS and Ofgem.

Please use the links to navigate

Next

East Coast Hydrogen

Data Agreement

The questions set out in this form make up part of an infrastructure planning project which has been jointly commissioned and conducted by Northern Gas Networks, Cadent Gas and National Grid Gas Transmission ('the Project Partners') who are also supported where necessary by additional advisors who are subject to appropriate confidentiality agreements, with the purpose of gaining a further and better understanding from new and existing business customers of the potential and appetite for commercial use of hydrogen to power businesses in the future ('the Project').

Your participation in this project is voluntary. Any answers you provide will be kept confidential but will be considered and evaluated by us for the Project. By confirming below, you agree that you are happy for us to share the information you have provided with the other Project Partners and any of their additional advisors.

I confirm I understand and agree to the above statement	-

Next

Site/ Project Details

Please provide the following details for your site or project that will be a network demand

Company	
Site/ Project Name	
Address	
Key Contact Name	
Key Contact Email	
Key Contact Number	

Filling out the form:

•Navigate through the form using the links, or by working through the tabs from left to right.

•Attempt to populate all relevant fields. If information is not currently known, this can be provided at a later date.

•If you provide information in different units from those requested, please make this clear by highlighting the cell and noting the unit.

Next

Future Energy Demand and Net Zero Plans

The following tabs relate to your **future energy use** as a demand on the network. These questions relate to both **natural gas** and **hydrogen**.

Future Use of Hydrogen:

If your net zero plans do/ could involve the use of hydrogen, as a blend or 100%, to replace some/ all of your natural gas demand please click here

If your net zero plans **don't involve hydrogen**, do you expect your natural gas usage to change in the future? This change could be due to:

- A decrease in natural gas usage due to **increased process efficiency**
- An increase in natural gas usage due to **increased production/ Output**
- The same energy usage but a part or full **switch** to **another source of energy**, such as electricity.

if so, click here to provide future demand information

If your future natural gas demand will stay the same in the future then there are no more questions to answer. Thank you for taking the time to respond.

Please save and return to: cverity@northerngas.co.uk and tgreenwood01@northerngas.co.uk

Current Network Demand

The following questions relate to the **current natural gas energy usage** of your site for it's key industrial process or power generation.

This will provide a benchmark against future energy usage.

Q1	**What is the current function/ output of the site?**
	Answer

Q2	**What is the key industrial process the natural gas is used for?**
	Answer

Q3	**Do you have your own pressure reduction station on site?**
	Answer
	If you have your own pressure reduction station, do you want NGN to supply the gas at your desired operating conditions without your pressure reduction station?
	Answer

	Natural Gas Demand	Quantity	Unit
Q4	What is your current **annual** natural gas usage?		MWh
Q5	What is your current **average daily** natural gas usage?		KWh
Q6	What is the **maximum daily** natural gas usage?		KWh
Q7	What is the **peak demand** within a day?		MW
Q8	Maximum Ramp Rate		KW/h

	Demand Profiles	Link
Q9	Please upload provide a link or add it in as an additional tab your **daily natural gas demand profile**. If using a link, **Excel** is the preferred format.	*link or add as new tab*
Q10	Please upload provide a link or add it in as an additional tab your **annual natural gas demand profile**. If using a link, **Excel** is the preferred format.	*link or add as new tab*

	Current Operating Conditions	Quantity	Unit
What **pressure** range at the LTS offtake do you require to operate your asset?			
Q11	Maximum Pressure		barg
Q12	Minimum Pressure		barg
What **temperature** range at the LTS offtake do you require to operate your asset?			
Q13	Maximum Temperature		°C
Q14	Minimum Temperature		°C

Q15	Additional Comments:

Next

East Coast Hydrogen

Future Use of Hydrogen

Please fill out the following questions if your **net zero plans** may involve the use of **Hydrogen**: as a **blend** or **100% Hydrogen**

	If your **Net Zero plans involve hydrogen**, assuming it was available, what is the **earliest year** you could start using:	
		Year
Q1	A Hydrogen Blend	*yyyy*
Q2	100% Hydrogen	*yyyy*

Q3	What is the **maximum hydrogen blend** you could use on your existing assets without requiring significant modification? (%)
	0%

Q4	Would you require a **constant hydrogen blend** percentage or could you receive a **variable blend**?
	Constant/ Variable

Q5	If you require a specific hydrogen purity, such as for a fuel cell, please provide detail below:
	Answer

Q6	Additional Comments:

Next

East Coast Hydrogen

Future Network Demand

These questions relate to your natural gas demand in future years and how it will change from the current usage.

The dates below **align** with **network analysis** work and **key project dates**

For the **process** you currently use **natural gas** for, how do you expect your **annual energy usage (regardless of energy source)** to change as a percentage compared to the information provided for current natural gas demand?

This change could be an decrease in natural gas usage due to increased efficiencies, or an increase in output from the site.

100% being no change. 50% half of current demand. 200% double of current demand.

Year	Change in energy usage for current natural gas process
Current	100%
2025	0%
2028	0%
2030	0%
2037	0%

Of this **future energy demand provided above** for each year, what percentage of this will be made up from the following energy sources?

	Natural Gas	Hydrogen	Electricity	Other	Total
Current	100%	-	-	-	100%
2025	0%	0%	0%	0%	0%
2028	0%	0%	0%	0%	0%
2030	0%	0%	0%	0%	0%
2037	0%	0%	0%	0%	0%

Must total to 100%

Note please consider potential hydrogen use for fleet transport etc

Future Operating conditions

Please provide the following information if known. We appreciate this may not information currently known

	LTS Offtake Pressure (barg)		LTS Offtake Temperature (°C)	
	Min	Max	Min	Max
2025				
2028				
2030				
2037				

Additional Comments:

End of Survey

This is the end of the questions relating to Network Demand. Thank you for taking the time to respond.

Please save and return to: cverity@northerngas.co.uk and tgreenwood01@northerngas.co.uk

If you have another site to provide information on for, please download the relevant template from the original email.

A.2 Base profile adoption rates

Lookup for base profiles								
	Hydrogen uptake factors				**Alternative Energies (electricity, solar, efficiency) uptake factors**			
Industry adoption	***2028***	***2032***	***2037***	***Basis / Reference***	***2028***	***2032***	***2037***	***Basis / Reference***
Buildings - Non-Residential	0.3	0.4	0.4	Generally, largely distributed infrastructure and large electrification potential. However, assuming a hydrogen supply is available, this will form a replacement for heating load.	0.2	0.3	0.3	Decarbonisation of buildings through solar or heat pumps is anticipated to be a large portion of their strategy, but less so in this case where a hydrogen supply is available. Efficiency improvements in buildings further reduce natural gas consumption.
Iron and steel	0	0	0	Likely to be decarbonised with electric arc furnaces and CCUS, as suggested by CCC, UK Hydrogen Strategy and BEIS Net zero plan.	0	0.15	0.2	Based on installation of Electric Arc furnaces and CCC projected carbon reduction by technology for iron and steel production. Assumed large demand will remain for natural gas due to production coupled with CCUS.
Chemicals	0	0.4	0.75	Assumed high uptake but slower than other industries due to less pressure on net zero. Hydrogen can provide the high temperature requirements of the industry. Much of the combustion technology is distributed across processes and will take time to phase in.	0.1	0.1	0.1	Based on low capex easy to obtain carbon savings from electrification on site but limited due to the assumption of hydrogen availability to site.
Cement and lime	0.4	0.75	0.75	Process heat which is very centralised.	0	0	0	Low ability to use electricity for decarbonisation due to heat requirements.
Other manufacturing and construction	0.2	0.35	0.35	Generally distributed combustion equipment on site which required a phased change.	0.1	0.2	0.2	Based on low capex easy to obtain carbon savings from electrification on site but limited due to the assumption of H2 availability to site.
Food and drink	0.5	0.75	0.75	Large drivers for decarbonisation and centralised process heat. Relatively easy to switch equipment to accept hydrogen.	0.1	0.2	0.2	Generally, a sector where electrification has potential, but with an assumed hydrogen line this is assumed to be preferable.
Glass and other minerals	0.75	1	1	Proven technology for hydrogen powered glass furnaces and good industry push for net zero.	0	0	0	Low ability to use electricity for decarbonisation due to heat requirements.
Paper	0.4	0.6	0.6	Large drivers for decarbonisation and centralised relatively easy to switch equipment to accept hydrogen	0.1	0.1	0.1	Based on low capex easy to obtain carbon savings from electrification on site but limited due to the assumption of H2 availability to site due to the process heat requirements.
Vehicles	0.5	0.75	0.75	Large drivers for decarbonisation and centralised process heat. Relatively easy to switch equipment to accept hydrogen.	0.1	0.1	0.1	Based on low capex easy to obtain carbon savings from electrification on site but limited due to the assumption of H2 availability to site due to the process heat requirements.
Manufacturing Biofuels	0.5	0.75	1	Strong industry focus on carbon reduction. Natural gas use mainly for process heat which would typically be a good candidate for hydrogen.	0	0	0	Low ability to use electricity for decarbonisation due to heat requirements.
Power generation	0.75	1	1	Assumed to be gas peaking plants with engines which can often readily accept H2. These will be a key part of the H2 economy, using H2 as energy storage. Alternatively these are wastewater treatment works with anaerobic digestion producing biogas, with the methane as a back up.	0	0	0	N/a
Quarry	0	0.25	0.5	Processing plant has some capabilities to convert to hydrogen usage. Potential for vehicle plant also.	0	0	0	Low ability to use electricity due to consumption requirements.
Defence	0.25	0.5	0.5	Potential to convert ground fleet and buildings to hydrogen with a strong appetite for hydrogen in the sites which discussions have been held with.	0.1	0.2	0.2	For the buildings portion of the current site use there is anticipated to be high potential for electrification and efficiency improvements. But factors lower due to buildings not making up full site usage.