



Hydrogen Valley - Bringing hydrogen to the West Midlands and East of England

MARCH 2023

The Hydrogen Valley is being delivered in collaboration by Cadent Gas and National Gas Transmission.

Cadent Gas and National Gas Transmission are working together to **demonstrate how their networks can be repurposed** to deliver hydrogen throughout the UK by gathering insight on hydrogen demand in the region to optimise infrastructure planning. In addition to the Hydrogen Valley, Cadent Gas and National Gas Transmission are also **collaborating on other hydrogen initiatives** (East Coast Hydrogen and Capital Hydrogen), which ensures consistency in assumptions about supply and demand across all programmes.



Cadent Gas operates and maintains the largest gas distribution network in the UK, serving the North West, West Midlands, East Midlands, South Yorkshire, East of England, and North London. Cadent seeks to connect hydrogen producers and industrial off-takers across the Hydrogen Valley programme region.



National Gas Transmission, formerly known as National Grid Gas Transmission, owns and operates the high-pressure gas transmission network in Great Britain and is responsible for safely and efficiently transporting gas throughout the country. National Gas Transmission aims to develop a hydrogen backbone by connecting industrial clusters across the UK through Project Union.





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Guidehouse's global Energy, Sustainability, and Infrastructure segment is a trusted advisor to utilities and energy companies, large corporations, investors, NGOs, and the public sector. Our team supported Cadent Gas and National Gas Transmission in the development of the Hydrogen Valley.



Premtech are current Design Framework Consultants for UK gas transmission and distribution networks, including Cadent Gas and National Gas Transmission. Premzero is a specialist team within Premtech developed with the objective of moving the UK onshore oil and gas transportation industry towards net zero by 2050, with a particular focus on hydrogen, biofuels, and carbon capture.

Premzero assessed infrastructure feasibility for the Hydrogen Valley, which included identifying infrastructure requirements, transition pathways, and whole system impacts.



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A map of the United Kingdom showing the gas network. Numerous yellow and pink circles of varying sizes are overlaid on the map, representing hydrogen production and distribution points. The circles are concentrated in the south of England, particularly in the London area, and in the north of England. The title '1. Hydrogen in the UK and the Hydrogen Valley' is centered over the map.

1. Hydrogen in the UK and the Hydrogen Valley

The Hydrogen Valley will play an important role in industrial decarbonisation and delivering the hydrogen economy



The UK is well-placed to **demonstrate global leadership in low carbon hydrogen** due to its geology, infrastructure, and technical know-how. Hydrogen has a critical role to play in the UK's transition to net zero, as it has deep decarbonisation potential for the economy and provides a low carbon solution for hard to decarbonise industrial sectors.

As set out in the British Energy Security Strategy, the UK government is working with industry to develop 10GW of low carbon hydrogen production capacity by 2030. Building on this ambition, the Hydrogen Strategy lays out the **UK's intention to rapidly and significantly scale up hydrogen production to lay the foundations for a low carbon hydrogen economy by 2030**. This is anticipated to attract over £9 billion in private investment by 2030 and unlock up to 100,000 jobs by 2050.

The government is currently providing support for the scale-up of hydrogen to decarbonise the UK's six largest industrial clusters. However, industrials located outside of these identified clusters should not be left behind without an opportunity to decarbonise, as this could cause a loss of historical jobs in the region as a result of delocalisation to another area where the pathway to decarbonisation is clearer and more attainable.

The Hydrogen Valley presents an opportunity for industrials located outside of these identified clusters to unlock socio-economic benefits associated with the energy transition. The Hydrogen Valley establishes a vision of what the transition to hydrogen in the programme region will look like and how best to achieve it over the coming years.

What is the Hydrogen Valley and why is it needed?

Hydrogen Valley is uniquely positioned in the central belt of England, with large potential for a hydrogen economy



The Hydrogen Valley is an east-west corridor that encompasses Norfolk in the east to Shropshire in the west, comprised of the administrative counties of Bedfordshire, Cambridgeshire, Lincolnshire, Milton Keynes, Norfolk, Northamptonshire, Peterborough, Staffordshire, Stoke-on-Trent, Telford and Wrekin, and West Midlands. The Hydrogen Valley is home to major operations in power generation, automotive manufacturing, metal processing, and building materials, and is located at the heart of the UK's strategic road network, at the intersection of the M6, M1, and M40 amongst others.

The Hydrogen Valley is unique as the region is largely landlocked, with limited access to renewable energy for green hydrogen production. Despite this challenge, there are multiple regional initiatives in development, which highlights an opportunity for collaboration and further growth to facilitate the transition to hydrogen and unlock socio-economic benefits for local people and businesses. The region's location in the middle of England makes the Hydrogen Valley a key piece of the puzzle to develop a mature hydrogen economy in the UK by 2050, as the infrastructure demand for this region will inform the phasing and timing for the repurposing of the national network. Identifying key locations where rapid decarbonisation is needed is key to anchor and underpin the necessary infrastructure.

The Hydrogen Valley programme has three objectives



Establish the hydrogen economy in the region to accelerate industrial decarbonisation



Attract hydrogen investments in the region to **enhance socio-economic benefits** associated with the energy transition



Explore infrastructure opportunities to secure **long-term, low cost hydrogen** in the region

Local government is leading on and supporting work to decarbonise the region



Andy Street,
Mayor of the West Midlands

“As we work together to meet our #WM2041 net zero commitment and tackle the climate emergency and drive down energy costs, hydrogen has the potential to play a very important role. It also has the potential to create investment and job opportunities, supercharging our region’s economic growth prospects.

I’m pleased to be able to support this study to better understand what a hydrogen future could mean for the West Midlands. Right across our region, we have the talent, prospective producers and likely users to make such a future viable so my thanks to Cadent for bringing stakeholders together in this way to help to move these efforts forward.”



Dr. Nik Johnson,
Mayor of Cambridgeshire and
Peterborough

“The Cambridgeshire and Peterborough independent commission on climate identified hydrogen as long-term opportunity for delivering a reduction in emissions to help achieve net zero carbon. I welcome seeing how these proposals develop in areas of co-location of production and use.

There are demonstrable benefits in exploring how we sustainably produce and consume hydrogen for the region in terms of skill opportunities, which have the opportunity of being explored at the recently opened ARU Peterborough but also to support industry in our region move to a net zero carbon future.”

Local industries have advocated for hydrogen as a pathway to decarbonising their operations



Rob Wallace,
Hydrogen Development
Manager at ESB

“At ESB, we recognise that hydrogen will play a significant role in the decarbonisation of many sectors and that is why we are actively working with our partners exploring its many opportunities. The Hydrogen Valley project is critical to enabling and supporting the decarbonisation of industry across the central belt of England, and helping the country achieve its climate targets.

It will connect industry and power generation looking to decarbonise through green hydrogen production and storage projects, with the added benefit of connecting to the UK’s other hydrogen clusters.”



Rugby Cement Plant,
CEMEX

“There has been a cement plant in operation at our site in Rugby since 1865, which has grown to become one of the largest energy consumers in the Midlands. It is therefore very important for CEMEX to support innovative initiatives in the local area, such as the Hydrogen Valley project, which will help us reach our ambitious target of being a net-zero company globally by 2050, whilst also contributing towards the modernisation of cement production on a much wider basis.

We believe this initiative can establish hydrogen production and supply throughout a new Midlands hydrogen cluster, which as a whole will also benefit significantly from the added economic and social impacts as well as taking a big step closer to being able to compete on a like for like basis with other areas of the UK already identified within the Industrial Clusters mission.”

Over 60 regional stakeholders were consulted, with many expressing advocacy and support for the Hydrogen Valley



Addressing barriers through collaboration

Cross-sector support and collaboration is necessary to deliver decarbonisation and socio-economic benefits for the region, which is why robust stakeholder engagement was key to the development of a shared, evidence-based vision for the Hydrogen Valley.

The development of a hydrogen economy requires breaking the stalemate between scaling up hydrogen demand and production. Hydrogen production will not be scaled up unless there is sufficient demand, but it is difficult to increase production unless the cost lowers. However, the cost of hydrogen is unlikely to lower without sufficient demand, which leaves all players within the hydrogen value chain waiting for another party to make the first move.

The Hydrogen Valley consortium has provided a forum for key stakeholders in the region to communicate and begin to scale up hydrogen demand and production locally. The consortium has fostered strong collaboration between organisations across the hydrogen value chain, paving the way for infrastructure development in a timely and cost-effective manner.

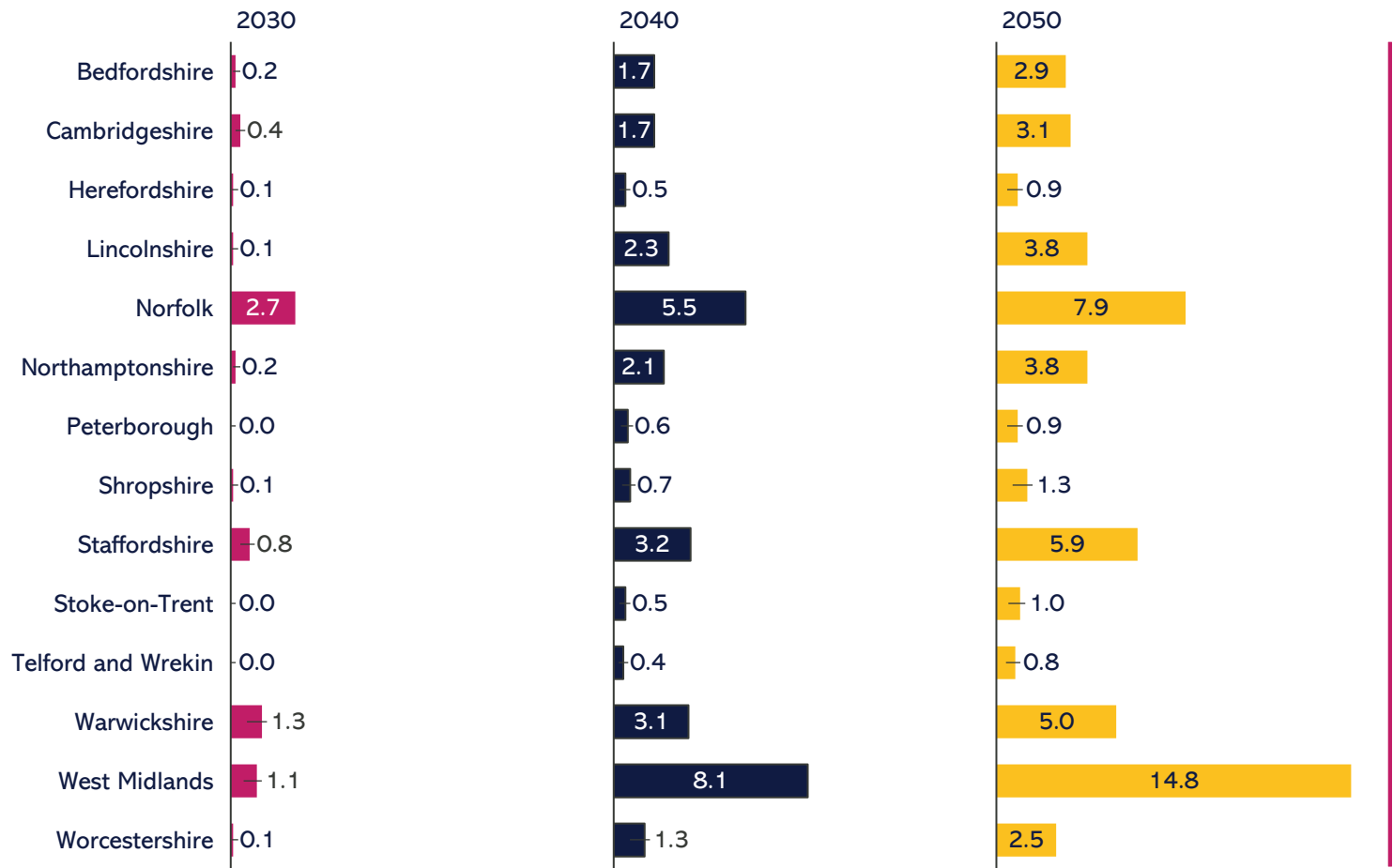


2. Demand and supply in the Hydrogen Valley

Hydrogen demand in the region could reach up to 61 TWh by 2050 with sharp rises from 2040



Total annual hydrogen demand (TWh)



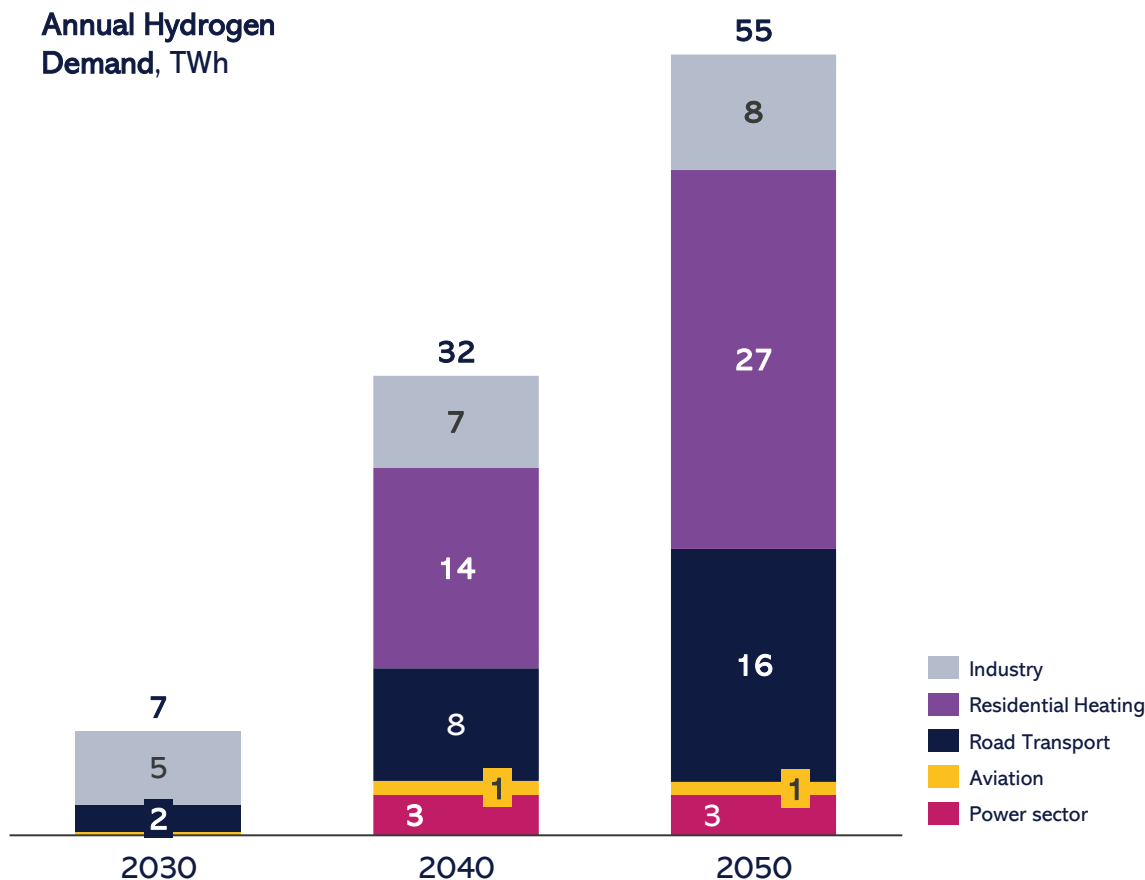
Total consumption of hydrogen could be 7TWh by the end of this decade, rising significantly to 55TWh by 2050.

Hydrogen demand is due to increase across all regions of the Hydrogen Valley, driven primarily by the spread of crucial industrial decarbonisation in the West of the region and large industrial and power generation loads in the East of the region.

Up to 2030, most demand for hydrogen will come from the imperative for industry to decarbonise in the context of a European and global demand for low carbon products and supply chains.

On the other hand, early demand is observed in the central/East of the region. Between 2035 and 2050, further acceleration of industrial decarbonisation along with the potential for hydrogen to heat homes results in a sharp increase in demand across the region.

Industrial hydrogen demand dominates the mix, with sizeable potential for heating and heavy goods transport



Industrial demand continues to rise as more industries with medium to high temperature heat needs switch to hydrogen as a low carbon fuel.

The Hydrogen Valley is characterised* by a **significant proportion of housing stock that may not be well suited to electrification for space heating**. This study has identified up to 27TWh of residential heating demand which could be met by hydrogen technologies by 2050. This accounts for 56% of total heating demand in the region, representing a realistic share alongside other low carbon heating technologies.

The potential for major Heavy Goods Vehicles (HGV) refuelling hubs to be situated in the Hydrogen Valley region results in significant anticipated demand from the road transport sector. **The strategic road network has a number of key intersects in the region** including the intersect between the M6, M1, A1(M), and the M42 amongst others.

Birmingham Airport has expressed an interest to potentially switch their operations to hydrogen by the late 2030s. With Luton Airport also in the region, the demand from **aviation plays a small but notable role in the mix**.

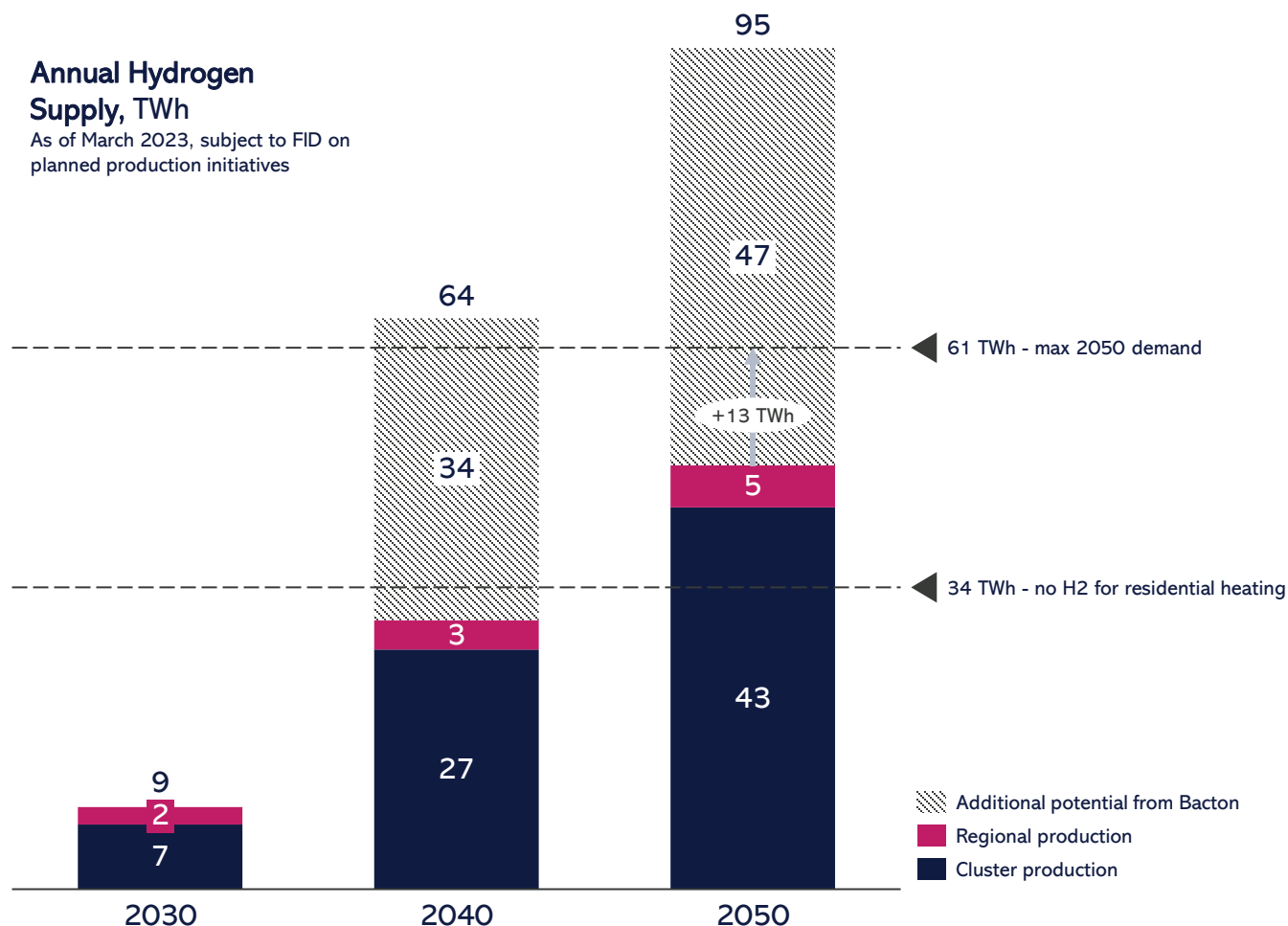
Several key strategic gas-fired power stations including Great Yarmouth, King’s Lynn, Corby and others are located in the region; **switching operations to hydrogen fuelled thermal generation is considered a credible option** for decarbonisation.

Regional supply can meet demand, while acting as a key supply hub for supporting the rest of the UK's hydrogen ecosystem



Annual Hydrogen Supply, TWh

As of March 2023, subject to FID on planned production initiatives



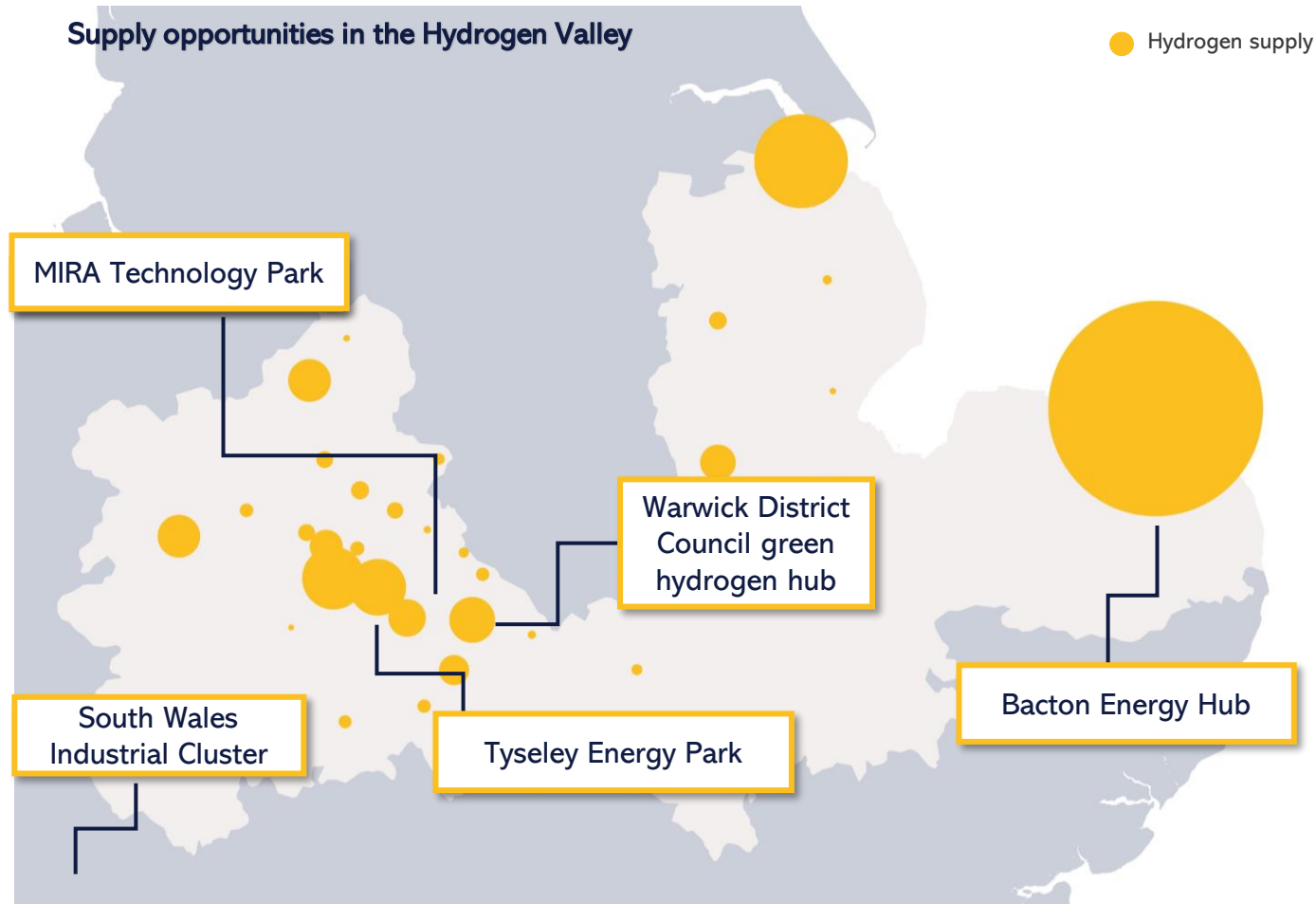
Through extensive engagement with East Coast Hydrogen, which will connect hydrogen from Humber into the Hydrogen Valley, and national production hubs including the Bacton Energy Hub and South Wales Industrial Cluster (SWIC), this study identified significant planned initiatives of 48TWh by 2050 that can confidently be attributed to the demand presented by the Hydrogen Valley. These supplies could service regional demand with a secure, long-term source of low carbon hydrogen*.

The Hydrogen Valley has some potential for solar and wind resources, which create the opportunity to produce green hydrogen through electrolysis. The region is also rich in biomass, which enables the production of hydrogen through biomass gasification. **Regional production** will be an important basis for establishing the hydrogen economy in the 2020s, continuing to contribute to the mix through to 2050.

Whilst this study has identified the need for hydrogen for heating in the region, we recognise there is a level of uncertainty over national government strategy on how heating should be delivered. Cognisant of this, **2050 could see a ~13TWh shortfall in hydrogen supply**. However, this could be delivered through the additional potential capacity from Bacton Energy Hub.

The regional imbalances identified as well as the need for large scale long-term hydrogen transit across this region **reinforce the need for imports from a stable national backbone** of hydrogen infrastructure.

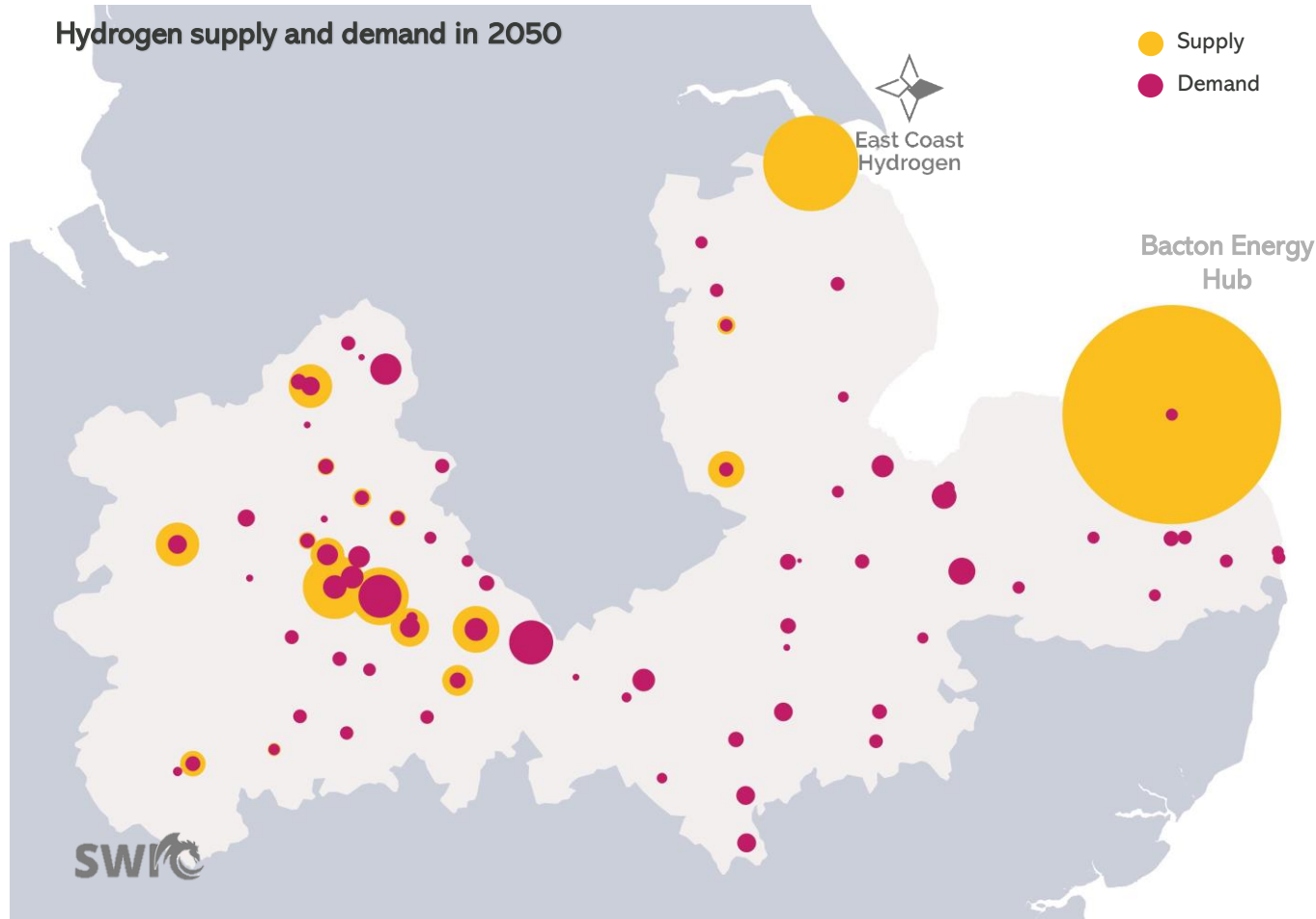
Production in the short term will be spatially distributed across the region, establishing the hydrogen economy



To get the hydrogen economy moving in the 2020s, a number of regional production initiatives are needed. Some have already started with Final Investment Decision (FID) taken on a number of projects, and others are in early stages of development.

- **Octopus** is planning to supply **MIRA Technology Park's** businesses with sufficient green hydrogen to support the equivalent of 60 cars' worth of fuel per day as well as high-power EV chargers
- **Warwick District Council** intends to play a leading role in bringing green hydrogen production into the region by developing a **1 MW electrolyser with plans for further expansion**. The hydrogen produced will help decarbonise the council's vehicle fleet
- **Tyseley Energy Park** produces over a tonne of hydrogen per day to fuel up to 40 buses, with ambitions to **fuel 30 regional trains in subsequent years**
- Further national government support, direction, and clear funding mechanisms could **unlock an additional 2TWh of local production this decade**

Pipelines will be needed to transport the large volumes of hydrogen produced in Bacton to demand across the region



2050 demand could consist of anchors in industry and power generation, with regional transport hubs and potentially domestic heating contributing to a significant 55TWh of annual consumption of hydrogen in this region alone.

- The West Midlands, Warwickshire and Staffordshire in the **West** could **dominate** hydrogen demand by 2050, with around 50% of total hydrogen consumption in the Hydrogen Valley
- Supply from **Bacton, East Coast Hydrogen, and South Wales Industrial Cluster** will underpin a secure, lower levelized cost of hydrogen for consumers
- Whilst localised supply will be prevalent, larger scale secure sources of production will need to be transported to demand centres to meet emerging demand in the mid 2030s and beyond

3. Hydrogen economy development in the 2020s

The development of the hydrogen economy in the region is supported by ongoing and planned initiatives



Tyseley Energy Park as a pioneer of hydrogen for transport hubs

Tyseley Energy Park is the UK's first multi-fuel, open access, low and zero carbon refuelling station. The site is pioneering clean hydrogen for transport in the UK and is powering public and commercial fleets, with plans to expand to rail.

Tyseley Energy Park showcases successful collaboration between stakeholders and can serve as a blueprint for other initiatives across the Hydrogen Valley.



Warwick District Council hydrogen hub for transport

Warwick District Council aims to play a leading role in bringing hydrogen production to the district and promoting hydrogen use within the district.

Warwick District Council is building a 1-3MW electrolyser to power its public service and heavy goods vehicles by the mid 2020s, with plans to scale up production as demand in the district increases over the next few years.

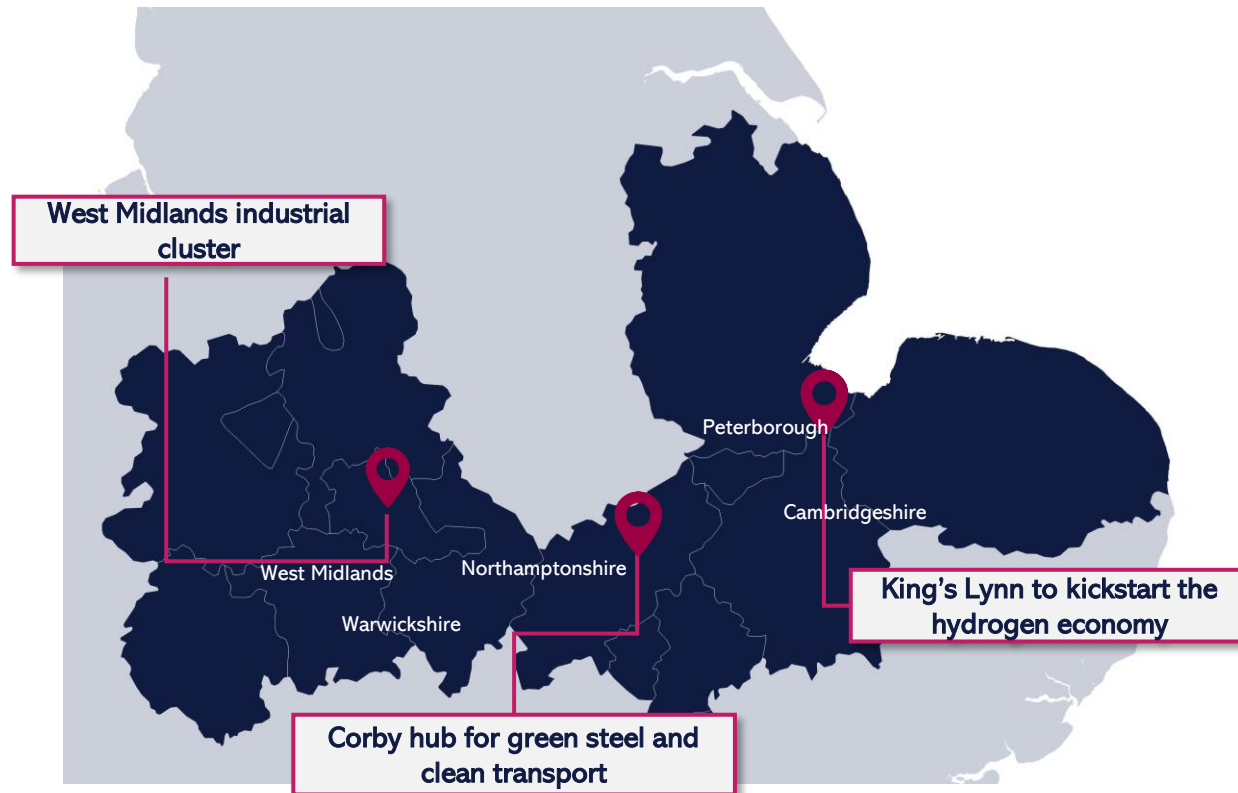


Hydrogen production by JEPCO for local off-take

JEPCO is a hydroponic salad leaf producer based on the East Coast, with hydrogen production on-site expected to begin by 2025.

JEPCO is planning a 20MW electrolyser, which will be powered by onshore wind and solar. The development of this hydrogen project could help establish a replicable business model for similar projects across the region.

The Hydrogen Valley is characterised by several hotspots that will help to establish the hydrogen economy in the 2020s



Although hydrogen from regional and national production is expected to be available across the programme region by 2032, there needs to be first steps in the 2020s to establish the economy and anchor the case for larger scale infrastructure. Knowing where **potential supply and demand in the region are located and overlap** will help to concentrate investment, accelerate the growth of the economy, and ultimately help to identify logical corridors for hydrogen transport and begin laying the foundations of a hydrogen backbone.

The Hydrogen Valley can be characterised by but not limited to the following hotspots:

- King's Lynn to kickstart the hydrogen economy
- Corby hub for green steel and clean transport
- West Midlands industrial cluster

The hotspots give rise to opportunities to attract private investment in the region in the 2020s



King's Lynn to kickstart the hydrogen economy

King's Lynn has the opportunity to kickstart the hydrogen economy in the region, as industrials are ready to off-take hydrogen but waiting for its cost to become competitive with alternatives. Hydrogen is essential for these industrials to remain competitive while decarbonising.

Industrials in and around King's Lynn will anchor demand for hydrogen, creating an opportunity for investment in hydrogen production.



Corby hub for green steel and clean transport

Corby is home to some of the largest steel producers in the UK and hosts a multitude of logistics hubs. These two key sectors have the option to fuel switch to low carbon hydrogen.

Fuel switching in these two key industries could attract investments in hydrogen, and these investments could make low carbon hydrogen an affordable alternative.



West Midlands industrial cluster

The Black Country is unique as there is no major plant that dominates the emissions generated in the region, and 50% of its energy demand comes from businesses that are spread across the region.

Despite these challenges, the region has the ambition to decarbonise by relocating smaller businesses around anchor industries to develop zero carbon hubs. It is essential to attract investment in hydrogen production to this region and to prevent the delocalisation of long-standing businesses.



4. Securing a low cost, long-term hydrogen supply post 2030

Existing asset conversion complemented with new build assets, presents a credible pathway for regional transition to hydrogen



In the Hydrogen Valley region, National Gas Transmission and Cadent own and operate **over 2,000 km of National Transmission System pipelines** and **over 33,000 km of distribution pipelines**, respectively. To determine the feasibility of hydrogen being introduced into these pipelines, the network readiness study analysed:

- 1** **Material grades** - Assessment of the different material grades of carbon steel and polyethylene (PE) pipes in the transmission and distribution networks, and their compatibility with hydrogen
- 2** **Commissioning dates** - Mapped out the age of network assets
- 3** **Known metallurgy issues** - Highlighted unsuitability of feeders and pipeline sections for hydrogen based on known metallurgy issues

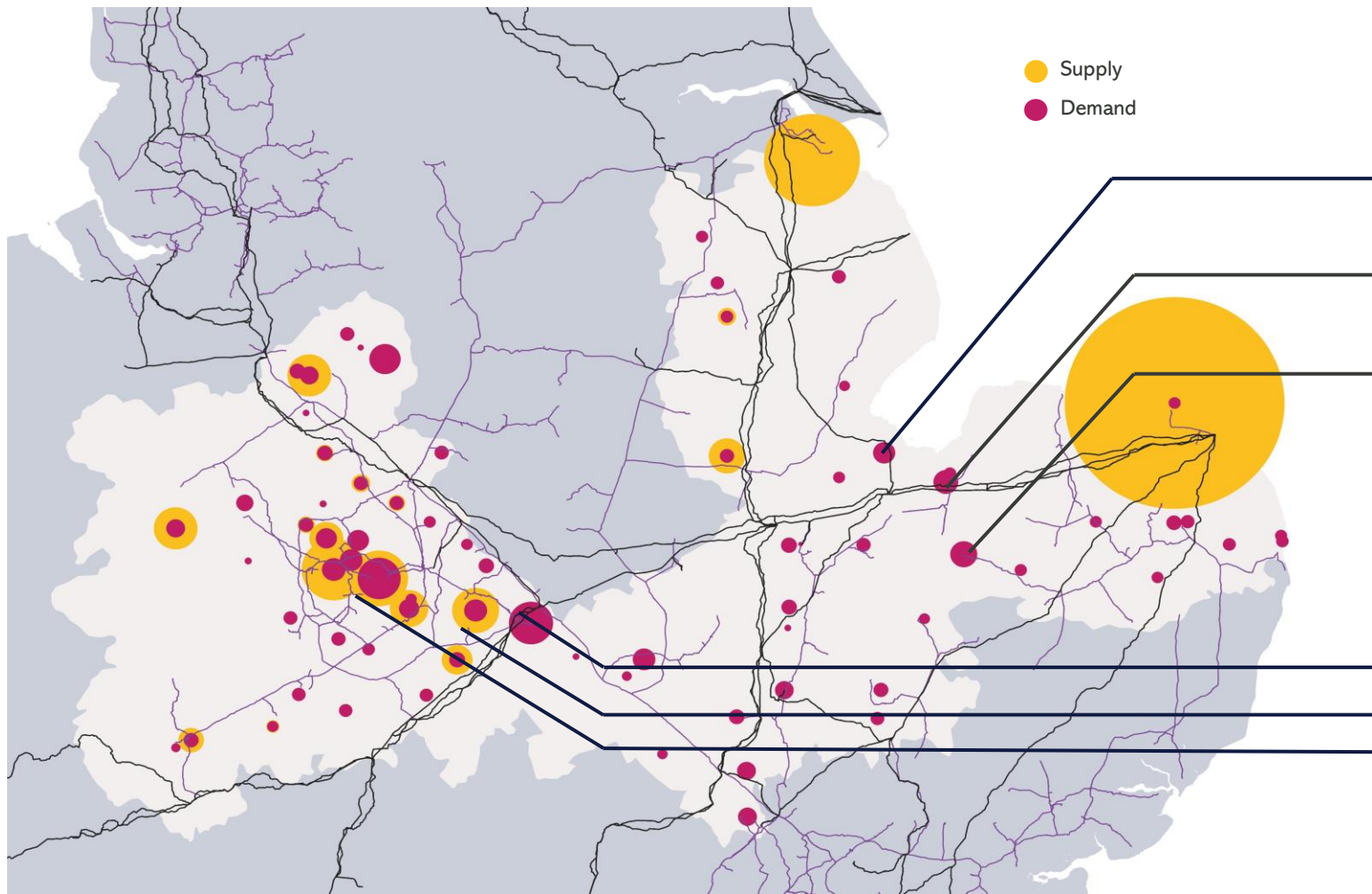
Some of risks assessed as part of the above, include hydrogen embrittlement occurring in high carbon content steel grades, the risk of increased rate of fatigue crack growth, hydrogen induced and stress corrosion cracking, impact on 'soft parts' including valve seals, diaphragms, etc. Hydrogen also has a lower calorific value by volume, so consideration has been given to required flow rates and gas velocities needed.

At a transmission level, there are a mix of older and newer assets, assets with metallurgy considerations and those which could be re-purposed to hydrogen with a less intensive course of modifications. However, the existing assets present a number of credible options to re-purpose. Where assets are not suitable for hydrogen conversion, consideration of new build pipelines and installations will be required, and so during any future pre-FEED phase of this programme, further optioneering is needed to determine the optimal asset solution to transport hydrogen at high pressures across the region.

Cadent's transmission and distribution assets are largely over 50 years old, however the MRP (Mains Replacement Programme), replacing older cast iron pipes with new polyethylene pipe, is due to be completed by 2032, readying the majority of the distribution network to transport hydrogen to the vicinity of domestic consumers' homes. Pending government direction on home heating policy in 2026, a sequenced rollout and conversion of home heating in the Hydrogen Valley region is feasible.

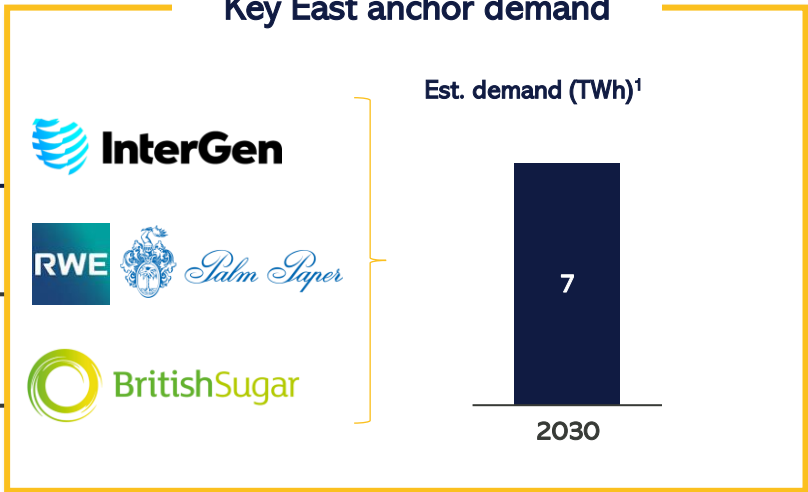
Optioneering studies to be completed during potential pre-FEED will include assessment in line with latest hydrogen standards and best practices, as well as any learnings from ongoing hydrogen projects such as FutureGrid and HyNet. Where specific assets are identified for repurposing, a number of studies will be required to assess compatibility of assets with proposed new operating parameters, including (but not limited to) review of records and record availability, metallurgy/material compatibility, equipment compatibility (e.g., valve seals), preliminary design factor calculations, and hazardous area classifications.

Large clustered industrial anchor demands will underpin infrastructure development primarily from East to West

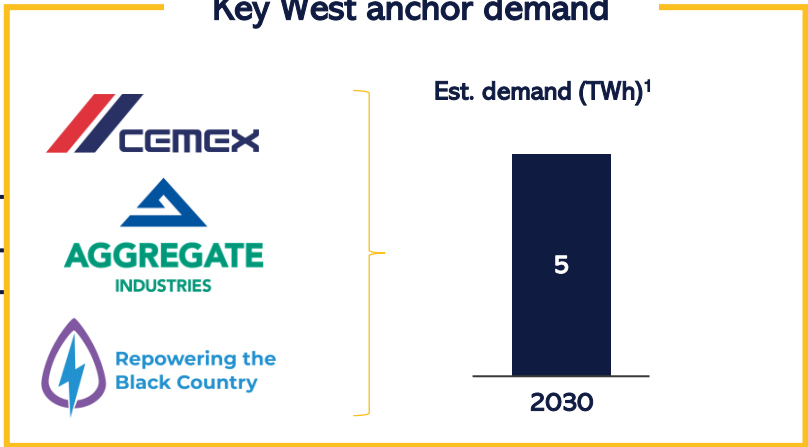


● Supply
● Demand

Key East anchor demand

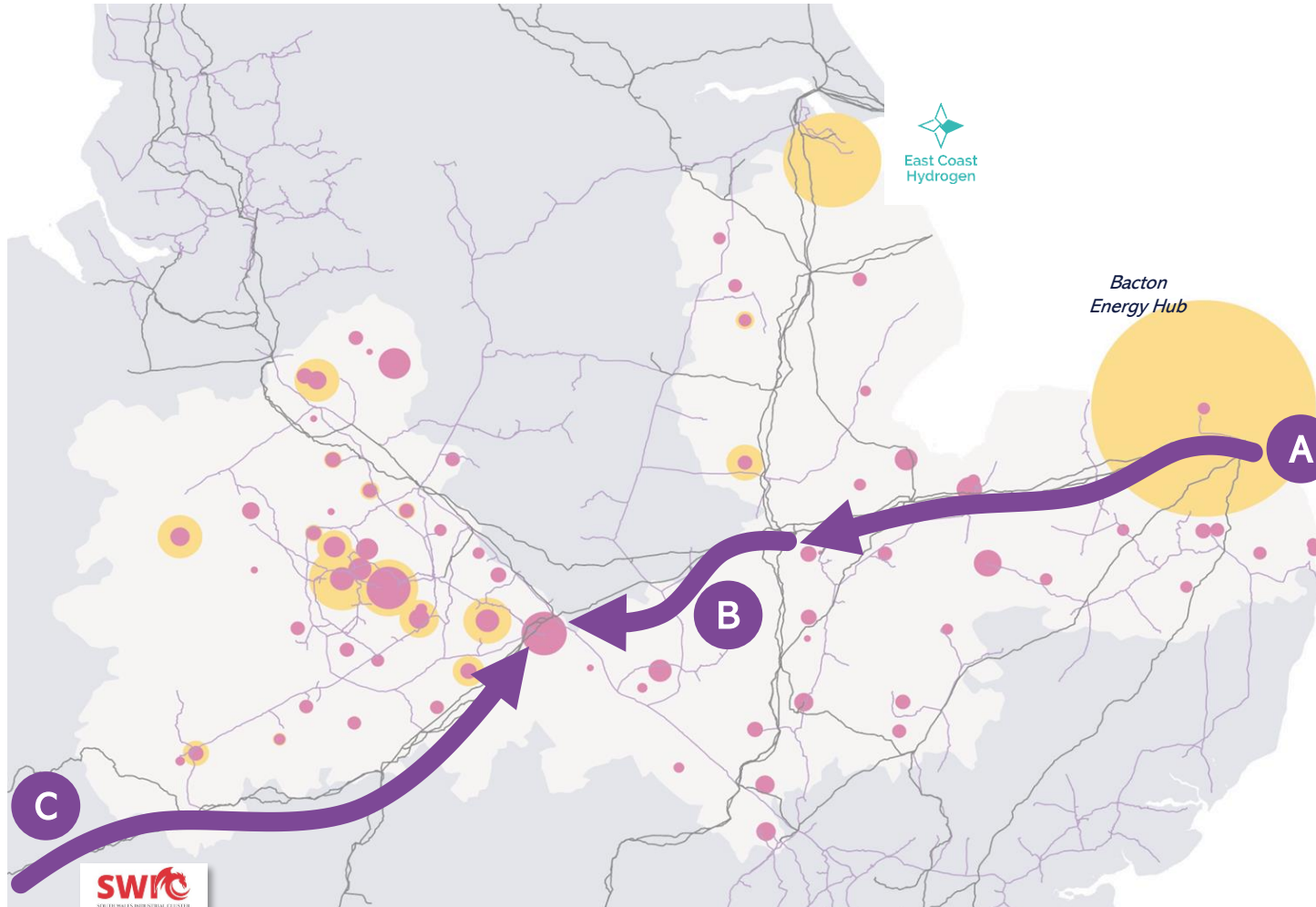


Key West anchor demand



¹The anchor demand figures on this page are estimated and not yet firm. They anticipate the potential for future hydrogen demand. These are not committed quantities. 24

Three supply corridors are key to the vision and can deliver access to abundant and low-cost hydrogen supply by 2032



To deliver the demand to anchor sites in the East and West of the region, three large-scale pipeline corridors are envisaged.

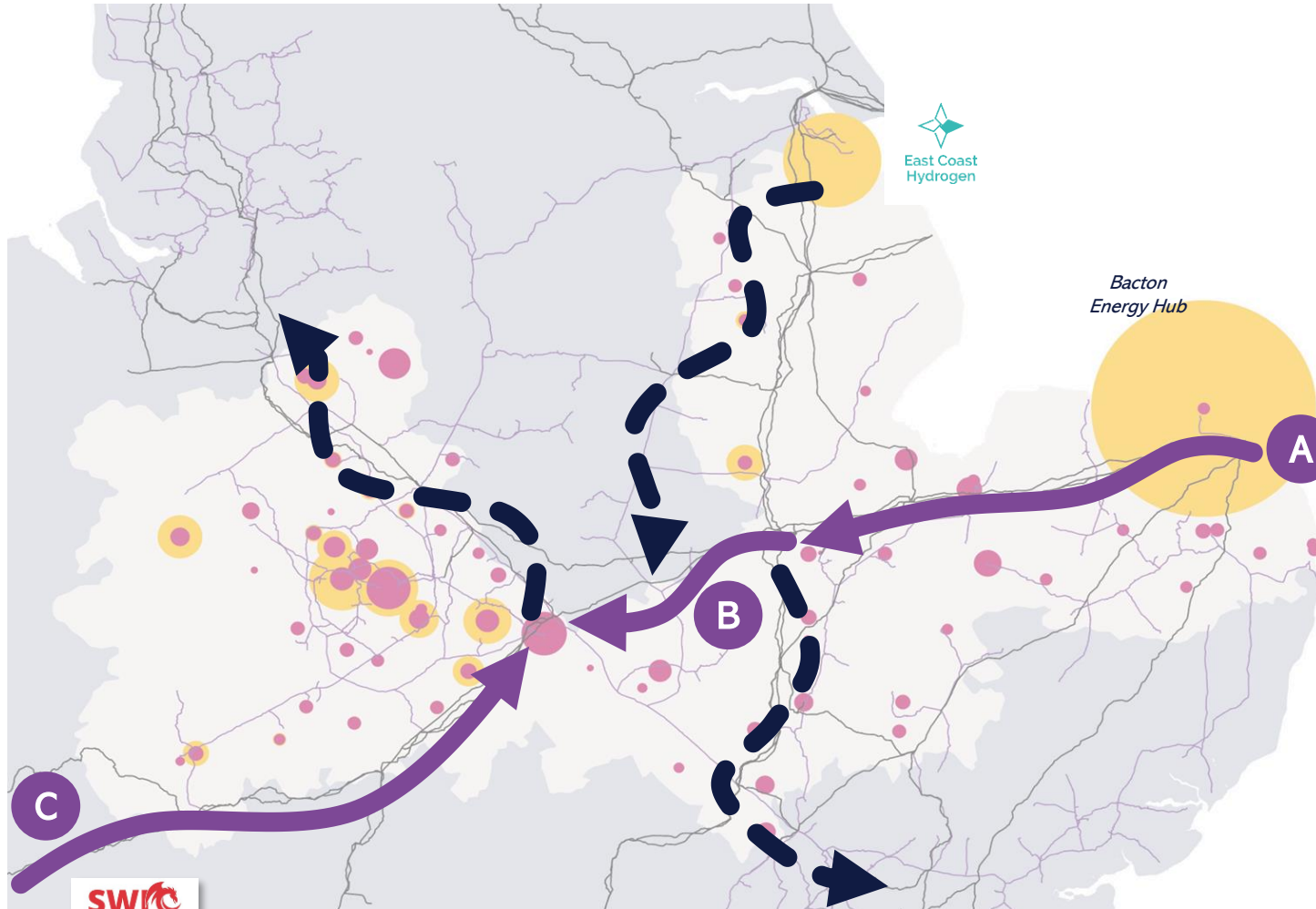
The corridors will initially connect large-scale supply from Bacton and South Wales Industrial Cluster (SWIC) with anchor demands, then connect with other programmes such as East Coast Hydrogen, and potentially expand at the National Transmission System level as part of Project Union.

Certainty about the deployment of this infrastructure will enable market actors to develop supply and demand more rapidly.

The three hydrogen supply corridors are:

- A** Corridor A: Bacton to Peterborough by 2030
- B** Corridor B: Peterborough to Churchover by 2032
- C** Corridor C: SWIC to West Midlands by 2032

A coordinated transition will see national strategic planning alongside regional corridor development targeted for 2032



For hydrogen to be delivered at scale across the Hydrogen Valley, a hydrogen network infrastructure is required to bridge the gap between hydrogen production hubs and industrial demand centres.

- Hydrogen production in Bacton starting in 2030 can be used to **supply low-carbon fuel to industrials in King's Lynn** through a first hydrogen network pipeline
- An East to West Midlands connection could be completed by 2032, **bridging the gap** between hydrogen production in Bacton and the West Midlands
- National Gas Transmission's Project Union intends to develop early infrastructure from East Coast Hydrogen to the East Midlands by 2030
- The South Wales Industrial Cluster can supply its **excess hydrogen generation** to the Hydrogen Valley and the country by connecting to the national hydrogen backbone in 2032
- Further north-south hydrogen development and integration will provide **resiliency to hydrogen supply** in the Hydrogen Valley

Corridor A delivers the first phase, bringing hydrogen to anchor demands in the east of the region



The Bacton to Peterborough pipeline can provide key anchor demands in the Peterborough/King's Lynn region with a secure supply of hydrogen

- The **supply from Bacton** can be secured with adequate provision of hydrogen production by 2030
- Three existing NTS pipelines, **feeders 2,4, and 27**, **present opportunities for conversion** as part of Project Union. However, a new build option may also offer the right solution. Future optioneering will inform the optimal pipeline route, option, and design
- This corridor would provide a **secure supply of hydrogen to the wider region** should hydrogen for home heating be required across Norfolk, Cambridgeshire, and Peterborough

Corridor B connects the second tranche of anchor demands, with Churchover compressor a logical connection point



The Peterborough to Churchover pipeline will move the hydrogen supplied from Corridor A across to the West Midlands, underpinned by regional industrial demand.

- It is imperative for heavy-industries of small or large size to decarbonise by 2030. Whilst some large regional businesses are already spatially grouped, other **small and medium-sized industries** may need to relocate to **cluster demand**
- The pipeline supply will be fed from the Corridor A supply from Bacton and **supplemented by local green hydrogen production initiatives**, potentially at Corby and elsewhere in Warwickshire
- Construction could take place in parallel with other corridors in the Hydrogen Valley in the 2020s, with a view to **commissioning in 2032**

Storage will play a critical role in ensuring security of supply and minimising variability on the hydrogen system



Intraday, interday and interseasonal storage will play a key role in the Hydrogen Valley region given:

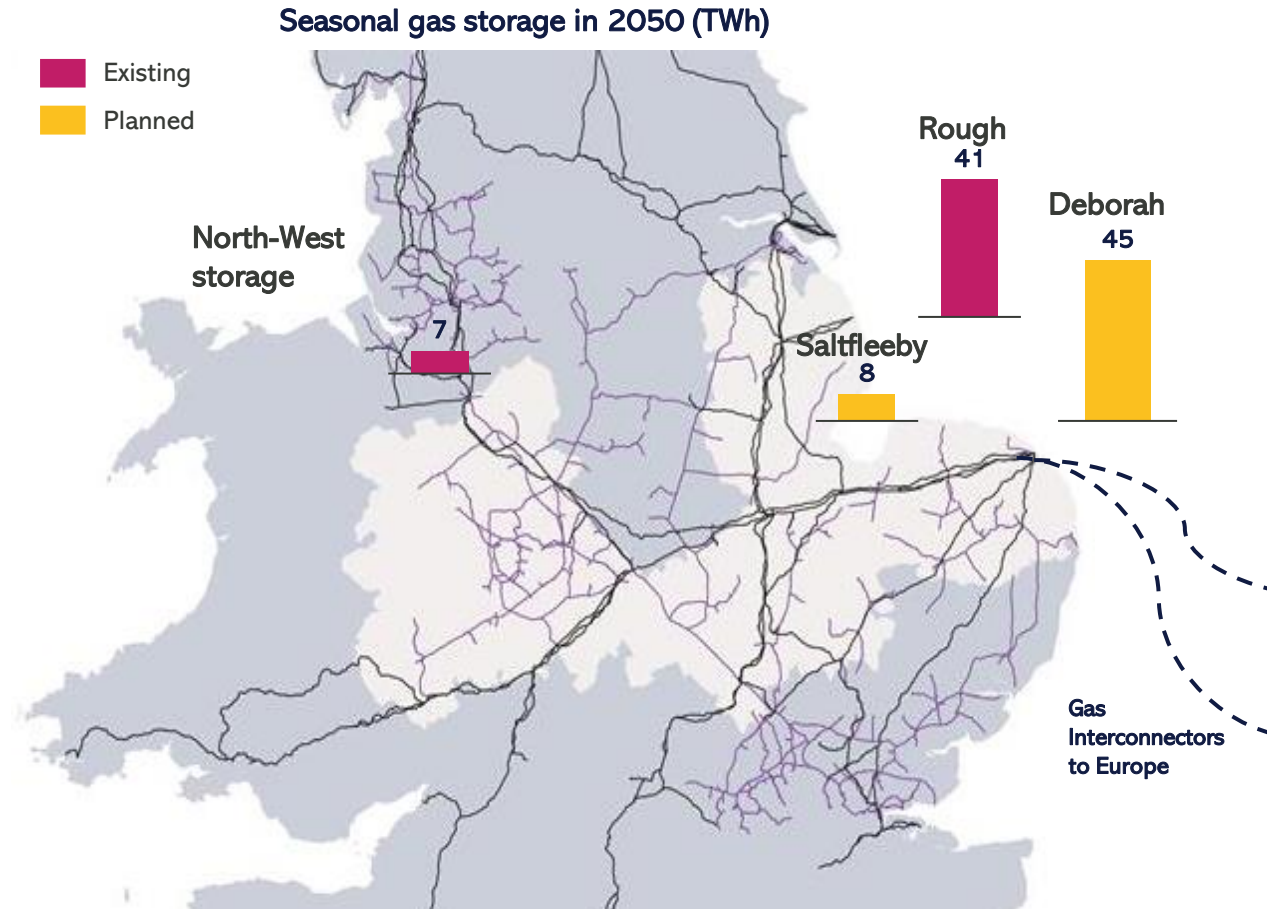
- The variable nature of renewable generated hydrogen (both within-day and seasonal)
- The large distances between hydrogen supply and demand
- Storing excess supply from large entry points at Bacton and East Coast Hydrogen

Effective storage within the Hydrogen Valley will have numerous benefits both for the region and enabling the hydrogen transition in the UK:

- Dampen variability in hydrogen flow received by demand users, allowing users to optimise and plan effectively
- Reduce supply-demand mismatches on the system, reducing the need for balancing actions from network operators
- Reduce seasonal variability in hydrogen price

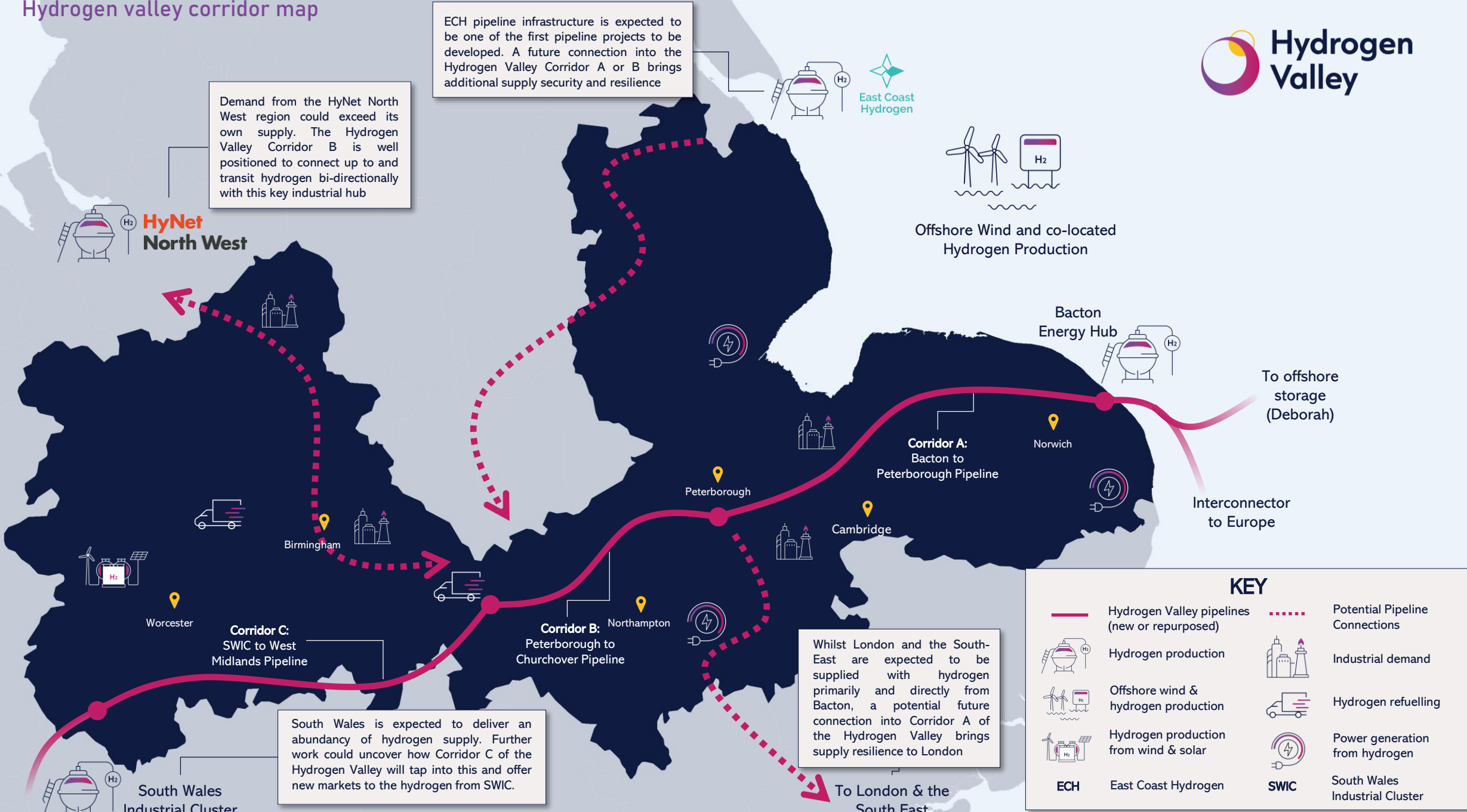
For Hydrogen Valley, a mix of storage options will be key to realising these benefits:

- Line-pack storage inherent within the hydrogen pipeline network will help meet intraday storage needs
- Should they be converted to store hydrogen, Rough as an existing storage facility and the planned Deborah facility can help to meet seasonal storage needs



In 2023, total UK gas storage capacity was 50 TWh

Hydrogen valley corridor map



KEY

	Hydrogen Valley pipelines (new or repurposed)		Potential Pipeline Connections
	Hydrogen production		Industrial demand
	Offshore wind & hydrogen production		Hydrogen refuelling
	Hydrogen production from wind & solar		Power generation from hydrogen
	East Coast Hydrogen		South Wales Industrial Cluster

5. Benefits of the Hydrogen Valley

The Hydrogen Valley will unlock socio-economic benefits for the UK energy system, the region, and consumers



National benefits

- Supports the 2035 target to reduce emissions by 78% compared to 1990 levels and is key to achieving the 2050 net-zero target
- Provides energy security and resilience by prioritising UK energy resources over imported

Regional benefits

- Supports existing and new jobs in key sectors, ensuring that the region retains its leadership in legacy industries
- Attracts private capital investments to accelerate the pace of economic and industrial development in the region
- Retains the region's position as the logistics transport hub of the UK

Consumer benefits

- Access to low-carbon, affordable energy
- Pollution reduction through cleaner energy sources for industrial processes
- Consumer choice

In-region benefits for the Hydrogen Valley



25,000 jobs to be supported and a further 9,000 created



Up to £28 billion of private capital investment



25% of the emission reductions needed in the region to reach net-zero



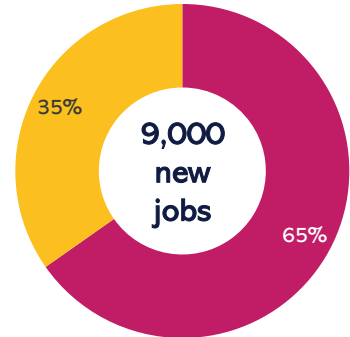
Reduce reliance on fossil fuels - 48TWh of clean hydrogen produced

The Hydrogen Valley could support more than 25,000 jobs in the region and create a further 9,000 new roles



Throughout the net-zero transition journey, **34,000 jobs could be safeguarded or created** in the region, creating real, tangible benefits to people in the Hydrogen Valley.

The Hydrogen Valley creates new job opportunities that will exist in a net zero world, as the programme establishes a vision to accelerate the development of clean energy technology and infrastructure. These job opportunities exist at every level, starting from recent graduates at the entry level to more specialised positions at a more senior level that require more expertise and skills.



Hydrogen Production
Infrastructure Development

Hydrogen production encompasses all jobs related to the production of clean fuel, from design engineers to construction workers.

Creating jobs in infrastructure development is an opportunity to re-train engineers in a sector that has seen minimal development since the 1970s in the UK but is set to regain strategic importance towards 2050.

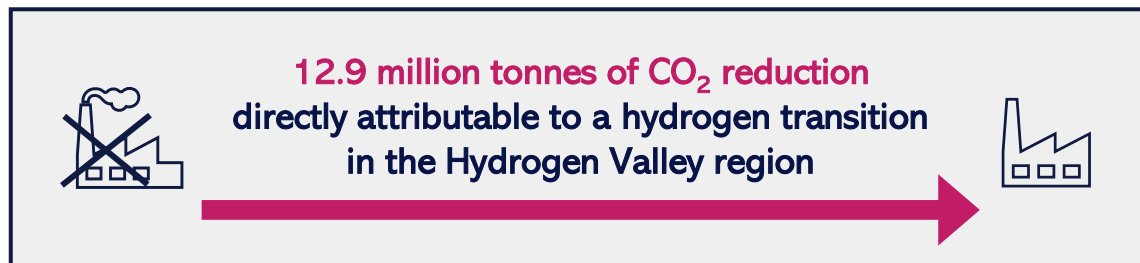
Over the last two centuries, the region has become a leader in several key industries, including ceramics, steel, and cement manufacturing. Its strategic position has also defined the region as a central logistics hub for the transport of goods and merchandise in the UK. These two sectors, industry and transport, will have to undergo a fundamental shift in the way they operate to achieve net zero. This shift will be driven by access to new technologies and low carbon fuels.



The UK industrial decarbonisation strategy has currently focused on designated industrial clusters. This strategy is enabling the acceleration of the development of low carbon energy supply in these clusters by attracting investments. However, industrials within the Hydrogen Valley region should not be left behind without an opportunity to decarbonise. This creates a risk that these industrials may need to relocate to other regions or countries to remain competitive, which could result in the loss of historical skills and jobs in the region.

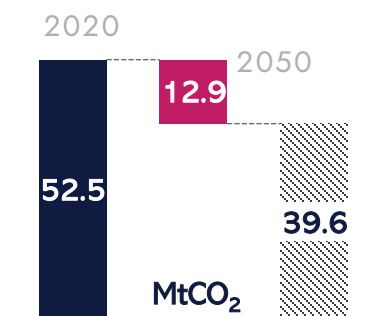
The Hydrogen Valley programme enables the region to retain its leadership in these key sectors by providing opportunities for industrials to decarbonise.

Hydrogen Valley can deliver 25% of emission reductions needed from the region to reach net-zero by 2050



For the UK to achieve its net-zero target, it will need to consider a range of low carbon solutions. Hydrogen will be a key solution to decarbonise heavy industry, peaking power generation plants and long-distance transport.

Emission reductions in the Hydrogen Valley



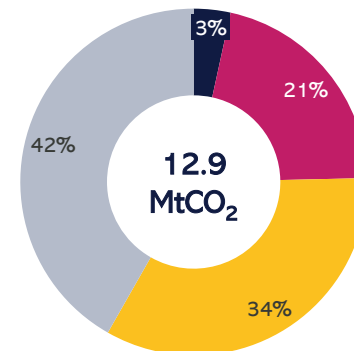
By transitioning to hydrogen, the region can achieve 25% of emission reductions needed to meet its net-zero target. By decarbonising key sectors such as industry, transport, power generation and heat, the Hydrogen Valley demonstrates the role of hydrogen as an indispensable tool in the journey to net-zero.

■ Today's regional emissions

■ Emission reductions attributable to hydrogen use

▨ Other

Sectoral emission reductions linked to hydrogen switch



■ Industry ■ Residential Heating
■ Transport ■ Power sector

The Hydrogen Valley:

- Hosts the largest UK cement production kiln
- Is home to cutting edge ceramics manufacturers
- Has a legacy of steel and metals manufacturing
- Is the largest logistics hub in the UK

Low carbon hydrogen production from renewables and carbon capture offers a clean alternative to fossil fuels, enabling these industries to decarbonise and continue to operate in a net-zero economy.

More broadly within the region, transport, residential heating, heavy industry and power generation rely on fossil fuels. A switch to low carbon hydrogen in these sectors would bring about significant emission reductions, as shown in the chart above.

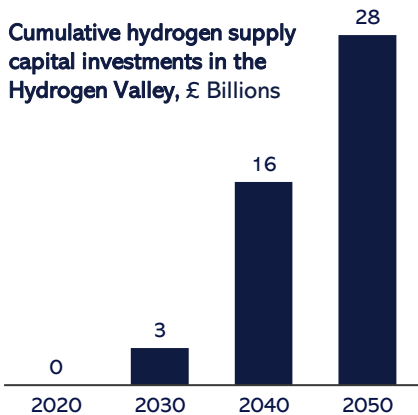
The Hydrogen Valley could attract up to £28 billion in private investments, boosting the regional economy



Developing the Hydrogen Valley **could attract up to £28 billion in private capital investments** in hydrogen production

Developing the infrastructure for the net-zero economy requires significant capital investments. Private companies are looking for opportunities to invest, establish themselves as leaders, and grow the market. The Hydrogen Valley has the potential to attract a large number of these investments due to its favourable natural resources and location.

Up to £28 billion of private capital could be invested across the region by 2050. These investments are likely to be dominated by hydrogen production assets such as electrolyzers and steam methane reforming (SMR). Further private capital is expected to be invested in modernising equipment such as hydrogen-ready turbines or heavy goods vehicles.



The Hydrogen Valley programme provides certainty to the market by bridging the gaps between stakeholders. Hydrogen investors often feel that they lack information and confidence to invest in hydrogen production projects, while industrials and other potential hydrogen off-takers need certainty of supply before upgrading their equipment. Additionally, infrastructure companies such as gas utilities need to understand where and when to invest in new or repurposed network infrastructure to transport hydrogen to ensure the hydrogen is there when required.

By encouraging discussion and collaboration, the Hydrogen Valley contributes to breaking the stalemate that exists within the hydrogen value chain. The programme has and will keep engaging directly with key stakeholders in the region to understand plans and challenges in the adoption of hydrogen. This continuous engagement is key to accelerating private capital investments by uncovering opportunities and providing responses to challenges raised.

The Hydrogen Valley has access to the offshore wind and carbon capture potential of the North Sea. It also has the most developed distributed industrial sector and the largest demand for transport fuels across the UK, making the region a very attractive market for local investments.

Kick-starting the hydrogen economy and unlocking the first investments in the region is challenging, but there is a unique opportunity for investors to pave the way and lead the market. The public sector is equally key to provide market certainty and advertise the strengths of the region.

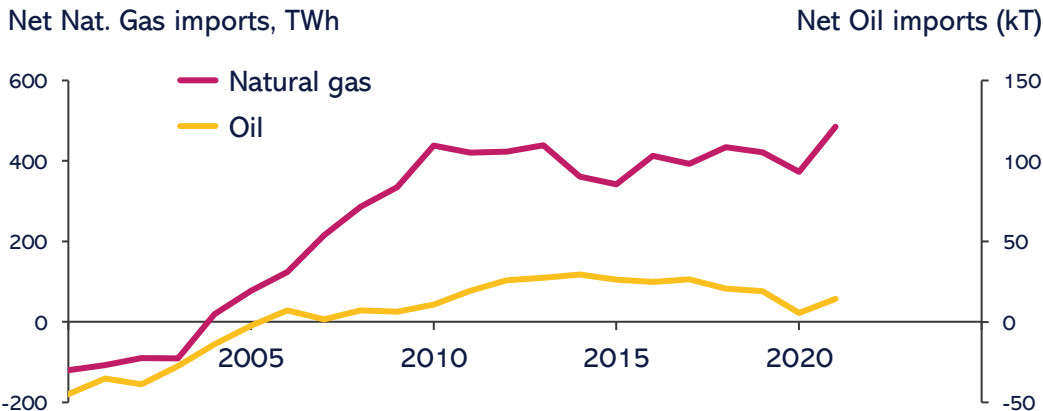
The Hydrogen Valley increases the region's energy security and protects its consumers from volatile prices



Local resources are used for local hydrogen production and consumption, which **protects consumers** from volatile prices and **reinforces UK energy security**

The war in Ukraine and the subsequent European energy crisis has reminded countries around the world of the importance of energy security. Reliance on energy imports can cause increased energy prices and severe disruption to the economy.

Net reliance on energy imports has been increasing in the UK



... but the Hydrogen Valley has the potential to be independent



Access to neighbouring offshore wind potential off the East Coast for **green hydrogen**



Availability of offshore structure for **CO₂ and hydrogen storage**



Access to indigenous and imported natural gas for **blue hydrogen**



Ample land for development of hydrogen production facilities

By accelerating the shift away from fossil fuels, the Hydrogen Valley aims to contribute to the UK's strategic independence by repositioning the country as an energy exporter rather than importer. This will help protect the UK and the region from global energy market price volatility and ensure reliance of supply throughout the year.

To achieve this, the Hydrogen Valley and the UK can leverage the clean energy production potential of the North Sea. The North Sea is Europe's largest reservoir of offshore wind, local natural gas, CO₂, and hydrogen storage.

6. Who is supporting the Hydrogen Valley?

Upstream: Hydrogen production



Summit Energy Evolution is leading the hydrogen supply workstream on the Bacton Energy Hub. Summit Energy Evolution is committed to ensuring supply from Bacton could reach the Hydrogen Valley and meet local demand and where possible, identifying synergies between the two programmes to create low carbon energy infrastructure.



ESB is Ireland's foremost energy company and has operated as a leading independent generator in the UK for almost 30 years. As outlined in its Net Zero to 2040 strategy, ESB is committed to identifying and supporting hydrogen production opportunities, including the ambitious Hydrogen Valley programme.



JEPCO is a salad leaf producer based on the East Coast of England that is developing electrolytic hydrogen production capacity on-site. JEPCO welcomes the opportunity to connect with other key regional stakeholders through the Hydrogen Valley consortium.



Tyseley Energy Park is actively working to kickstart the hydrogen economy in the West Midlands. Tyseley Energy Park would like to play a leading role in bringing hydrogen production to the district and promoting its usage as a low carbon fuel.



Green Switch Capital is a renewable energy business that develops, builds, funds, and operates renewable energy projects. Green Switch Capital is looking for investment opportunities in hydrogen supply within the Hydrogen Valley.



Protium is a green hydrogen energy services company that provides end-to-end sustainable energy solutions for its clients by designing, developing, financing, owning and operating green hydrogen infrastructure. By doing so, Protium can help clients achieve their sustainability targets by transitioning them to a low carbon future. Protium is looking for investment opportunities to develop and supply green hydrogen within the Hydrogen Valley.

Midstream: Transportation



Cadent Gas is the UK's largest gas distribution network. Cadent Gas seeks to connect hydrogen producers and industrial off-takers across the Hydrogen Valley.



Wales & West Utilities is actively working to develop the hydrogen in the West of the UK and would like to maintain a leading role in hydrogen development at the national level by collaborating with other utilities. Wales & West has committed to collaborating with Cadent Gas and National Gas Transmission to build out a vision that will help scale hydrogen in the UK.



National Gas Transmission owns, manages, and operates the national transmission network in Great Britain. National Gas Transmission aims to develop a hydrogen backbone by connecting industrial clusters across the UK through Project Union.



HyCymru, the Wales Hydrogen Trade Association, is the new representative body which aims to advance the hydrogen economy in Wales. HyCymru is supported by a comprehensive range of companies and organisations in utilities, renewable energy, community enterprise, engineering & sustainability consultancy, housing, land, technology, manufacturing, research, industry, legal and recruitment.

Downstream: Hydrogen demand (1/2)



RWE is the UK's largest operator of Combined Cycle Gas Turbine (CCGT) power plants with a fleet of around 7GW installed capacity, providing security for the country's energy supply. RWE is driving an accelerated pace of transition into this new, decarbonised world and in support of this is targeting investments of tens of millions of pounds in the next three years as it assesses Hydrogen and CCS combustion options to decarbonise its sites.



Aggregate Industries is one of the leading building materials suppliers, and is committed to grounding sustainability in the future of the construction industry. Aggregate Industries is looking to decarbonise some of its operations in the region with hydrogen, with the aim of remaining competitive and retaining industrial activity in the region.



Repowering the Black Country is working to develop an innovative net-zero industrial cluster that will drive economic growth and job creation across the region. Repowering the Black Country is identifying whether manufacturing sites within the Black Country are suitable for electrification or hydrogen.



British Ceramic Confederation is the trade association that represents the collective interests of the UK ceramic manufacturing industry. British Ceramic Confederation is exploring the usage of hydrogen as a fuel for the ceramics sector.



CEMEX is a global leader in the building materials industry committed to reaching net-zero emissions across its products and operations by 2050. CEMEX is interesting in supporting innovative, local, sustainable initiatives by exploring the potential opportunities created by the Hydrogen Valley to help achieve its net-zero targets, remain competitive and retain industrial activity in the region.



PepsiCo's business encompasses all aspects of the food and beverage market. It oversees the manufacturing, distribution, and marketing of its products.

Downstream: Hydrogen demand (2/2)



Palm Paper is a paper specialist that produces a wide range of paper grades for the UK and European markets. Palm Paper is considering decarbonising some of its operations in the region with hydrogen, with the aim of remaining competitive and retaining industrial activity in the region.



Hill & Smith PLC is a leader in infrastructure products and galvanizing services. Hill & Smith PLC is looking to decarbonise some of its upstream and midstream operations using hydrogen, with the aim of becoming a leader in decarbonisation of the galvanising process.



Johnson Tiles is the UK's only large-scale manufacturer of ceramic tiles. Johnson Tiles is interested in exploring the usage of hydrogen in its operations.



Birmingham Airport is the UK's seventh largest airport, with a commitment to be net zero by 2033. Birmingham Airport is interested in exploring the role that hydrogen can play in helping the airport, and its partners, reach its net zero and zero carbon targets.



British Sugar is the sole processor of the UK's beet sugar crop and is the lead sugar producer for the British and Irish food and beverage markets. British Sugar is considering the role of hydrogen in decarbonising its operations.

Public and third sector: Local authorities (1/3)



West Midlands Combined Authority represents eighteen local authorities and three Local Enterprise Partnerships. The West Midlands Combined Authority's regional energy strategy is driven by Energy Capital, which works to influence government policy and create partnerships. Energy Capital is interested in how the Hydrogen Valley could help the West Midlands realise its local hydrogen potential.



Warwick District Council is a local authority that is actively working to address the climate emergency. Warwick District Council would like to play a leading role in both bringing hydrogen production to and promoting hydrogen use in the district.



North Northamptonshire Council is aligned with the wider UK ambition to tackle climate change and supports initiatives in this direction. North Northamptonshire Council sees the Hydrogen Valley as an opportunity to accelerate decarbonisation in its district by providing the industrial, power, and transport sectors with an affordable, clean energy supply.



North Sea Transition Authority initiated the Bacton Energy Hub Area Plan and believes that the Hydrogen Valley could identify and realise the potential that hydrogen brings to the development of the low carbon economy region. North Sea Transition Authority is interested in the Hydrogen Valley as a keystone customer for the Bacton Energy Hub.



The Worcestershire LEP (WLEP) works in partnership with private sector, higher and further education institutions, and public sector partners to create and deliver economic growth, improved workforce skills and high value jobs & productivity across the County as set out in the WLEP's Plan for Growth. We are committed to delivering against our Energy Strategy and supporting the County in its journey towards Net Zero.



The Black Country Local Enterprise Partnership (LEP) is the key body which determines strategic economic priorities in the region. It is comprised of Dudley, Sandwell, Walsall and Wolverhampton. We work to create jobs and build a strong economy by tackling barriers to sustainable growth.

Public and third sector: Higher education and research (2/3)



Energy Research Accelerator works with UK government, industry, and higher education to undertake innovative research, develop the next generation of energy leaders, and demonstrate low carbon technologies that help shape the future of the UK energy landscape.



Midlands Engine is a pan-regional partnership that acts as a positive force for economic, social, and environmental change to drive prosperity for communities and businesses. Midlands Engine has committed to collaborating with the Hydrogen Valley to build the hydrogen economy in the region, and commissioned the Midlands Engine Hydrogen Technologies Strategy in February 2022.



Midlands Connect researches, develops, and progresses transport projects which will provide the biggest possible environmental, economic, and social benefits for the Midlands and the rest of the UK. Midlands Engine welcomes the opportunity provided by the Hydrogen Valley to connect with other key regional stakeholders.



Keele University has a strong interest in hydrogen research and innovation and is leading research on the hydrogen supply chain, in addition to considering hydrogen as part of its future campus energy management and decarbonisation plan.



Birmingham Energy Institute at the University of Birmingham researches the challenges of introducing the hydrogen economy to replace the current reliance on carbon-based fuels.



Cranfield University is a British postgraduate public research university specialising in science, engineering, design, technology and management.

Public and third sector: Higher education and research (2/2)



The Cambridgeshire and Peterborough Combined Authority is a combined authority covering the ceremonial county of Cambridgeshire in the East of England. At the Combined Authority, our mission is to make life better, healthier, and fairer for all by driving growth that is evenly spread and sustainable.



North Norfolk District Council, home to the Bacton Energy Hub site, supports the UK's transition to Net Zero. The Council believes it should be possible to achieve a Net Zero target across its operations by 2030. As an organisation we have already started our decarbonisation journey and want to work with partners across North Norfolk in this shared ambition.



HyDEX includes many businesses associated with hydrogen development, and is strengthened by the strong political support of the Midlands Engine and LEPs. HyDEX will support and foster the creation of a new hydrogen industrial economy in the Midlands. This will be achieved by working with SMEs, established Midlands-based and UK commercial partners, and multinationals to accelerate innovation, build markets and support the required skills transition.

7. What is next for the Hydrogen Valley?

From 2023, the Hydrogen Valley initiative will look to extend its regional collaboration and build market confidence



Expand the scope of the Hydrogen Valley Consortium



- Continue regular engagement with existing stakeholders
- Discuss and onboard further stakeholders interested in joining the Hydrogen Valley consortium
- Raise stakeholders' challenges and needs with public authorities

Further improve market certainty to attract investments



- Develop new investible propositions based on stakeholder engagement insights
- Continue to connect investors to potential off-takers
- Support the DEVEX grant application of existing promising investible propositions

Gather public sector support to promote investments



- Keep engaging with local authorities to gather support and momentum behind the Hydrogen Valley
- Engage with Department for Energy Security and Net Zero (DESNZ) and Ofgem to discuss challenges raised by stakeholders regarding hydrogen business models, network reconversion and funding for industry

Pre-FEED planning and project development



- National Gas Transmission are conducting pre-FEED for the full NTS as part of Project Union in 2023. The phasing priority will determine which sections on the NTS will have priority for more detailed optioneering, to determine preferred routes and options

The Hydrogen Valley is a **central part of the national energy transition story**, connecting coastal hydrogen hubs with mainland England.

Key industrials across the region have highlighted the challenges they face when planning their decarbonisation strategies, including the **need for certainty regarding the timings of hydrogen supply**. To ensure that industry have access to affordable low-carbon fuels in time to meet emissions reduction targets, hydrogen network investment need to be planned ahead.

This study has developed a **clear and tangible roadmap to develop a hydrogen network** across the region by 2032, connecting the large hydrogen production hub in Bacton and South Wales to the West Midlands being built by 2032 to deliver hydrogen at scale across the region.

This plan can support UK energy security and net-zero ambitions while securing **business growth and jobs creation** in the region.

For more information on the programme, to become a supporting member of our Consortium Group and to get in contact with our team, please visit:

www.hydrogenvalley.co.uk