



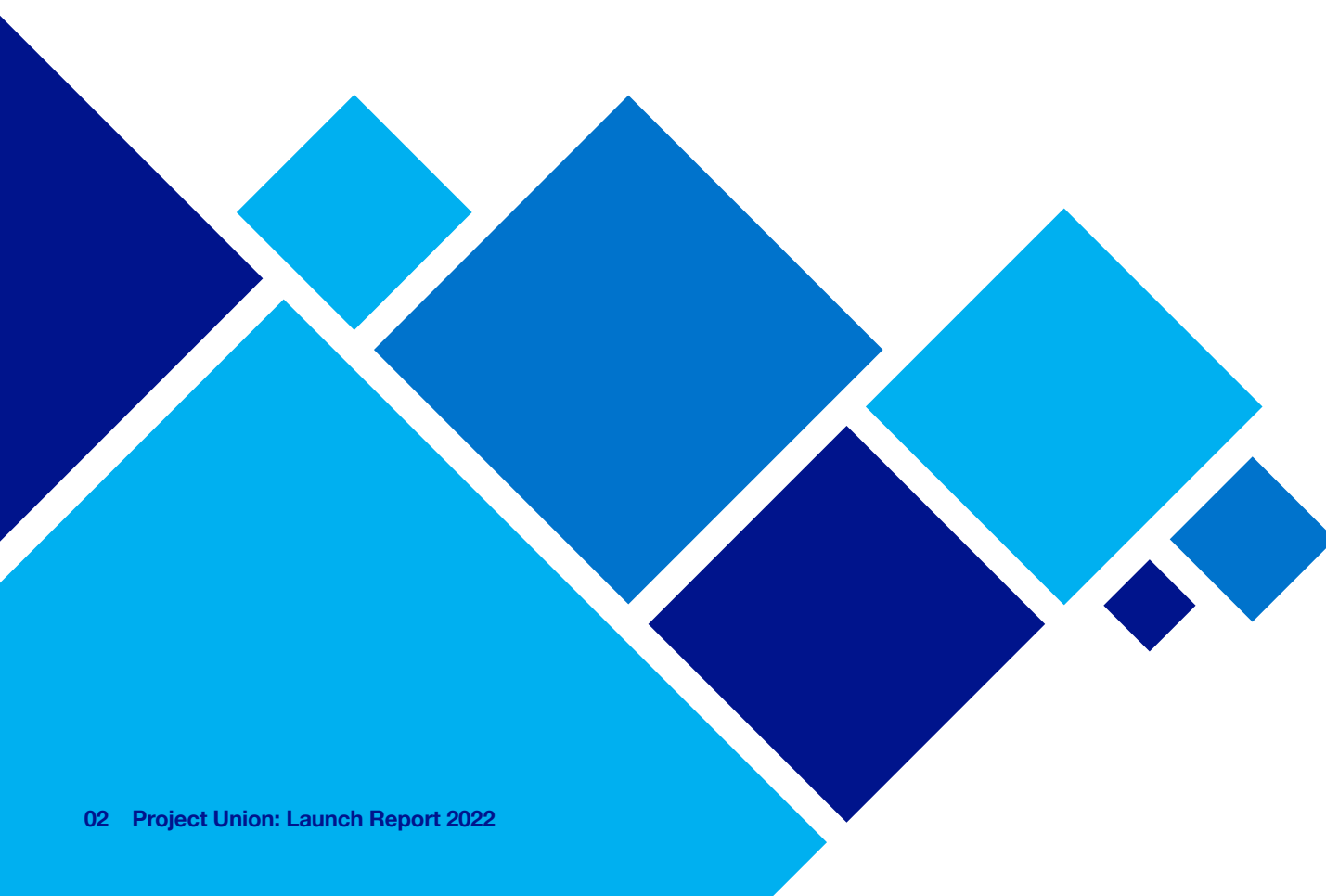
ProjectUnion

Launch Report

May 2022

Contents

Executive summary	04
Unlocking a hydrogen economy	06
What is Project Union?	08
What are the benefits of Project Union?	10
Gas Transmission: Facilitating the transition to hydrogen	12
Market enablers	14
Project Union: a lookahead	16
Opportunities for expansion and integration	18
Summary	20



Foreword



Project Union will connect hydrogen production centres to industrial, heat, transport and power consumers. It will create a resilient network and open a hydrogen market that will ensure fair access and lower costs for all UK consumers.

Antony Green,
Hydrogen Director,
Gas Transmission.

Gas Transmission has an exciting and important role in net zero and in leading a fair energy transition for the UK. We will do this by developing the green gas system of tomorrow, while delivering the natural gas needs of today.

As a nation, we're currently heavily reliant on natural gas for industry and power generation, as well as for heat in our homes and businesses. While the UK builds renewable wind generation to lower our emissions and reach the national target of net zero by 2050, gas will continue to play an ongoing role, particularly to balance the intermittency of wind and to 'keep the lights on'.

Hydrogen is a low carbon, clean gas, whether produced from natural gas with carbon capture or through electrolysis using renewable energy. When combined with renewable electricity generation and hydrogen storage, hydrogen will significantly contribute to the UK becoming more energy independent.

Through Project Union, we will facilitate a low-cost route

to net zero and empower a UK hydrogen economy by repurposing existing pipelines to create a hydrogen 'backbone' for the UK by the early 2030s. Project Union will connect hydrogen production centres to industrial, heat, transport, and power consumers. It will create a resilient network and open a hydrogen market that will ensure fair access and lower costs for all UK consumers. The UK hydrogen backbone will unlock energy security and export opportunities by connecting to storage and a wider European Hydrogen Backbone.

The feasibility phase of Project Union will identify a programme of 'no-regrets' investments with supporting evidence to inform energy policy that will enable the Government to make progress in realising its hydrogen ambitions.

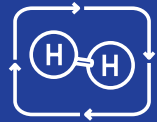
Executive summary

Project Union will connect hydrogen production, storage and demand to enable net zero and empower a UK hydrogen economy. Repurposing existing transmission pipelines will create a low-cost hydrogen ‘backbone’ for the UK by the early 2030s and connect to the proposed European Hydrogen Backbone. It will deliver a programme of ‘no-regrets’ investments with supporting evidence to inform energy policy that will enable the Government to make progress in realising its hydrogen ambitions.

Why Project Union is vital:



Urgency, pace and scale is required to ensure energy security and independence, benefitting all UK consumers to realise the UK’s decarbonisation challenge and deliver **legally binding** net zero 2050 commitments



Low carbon hydrogen is required for all net zero scenarios



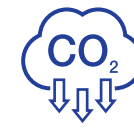
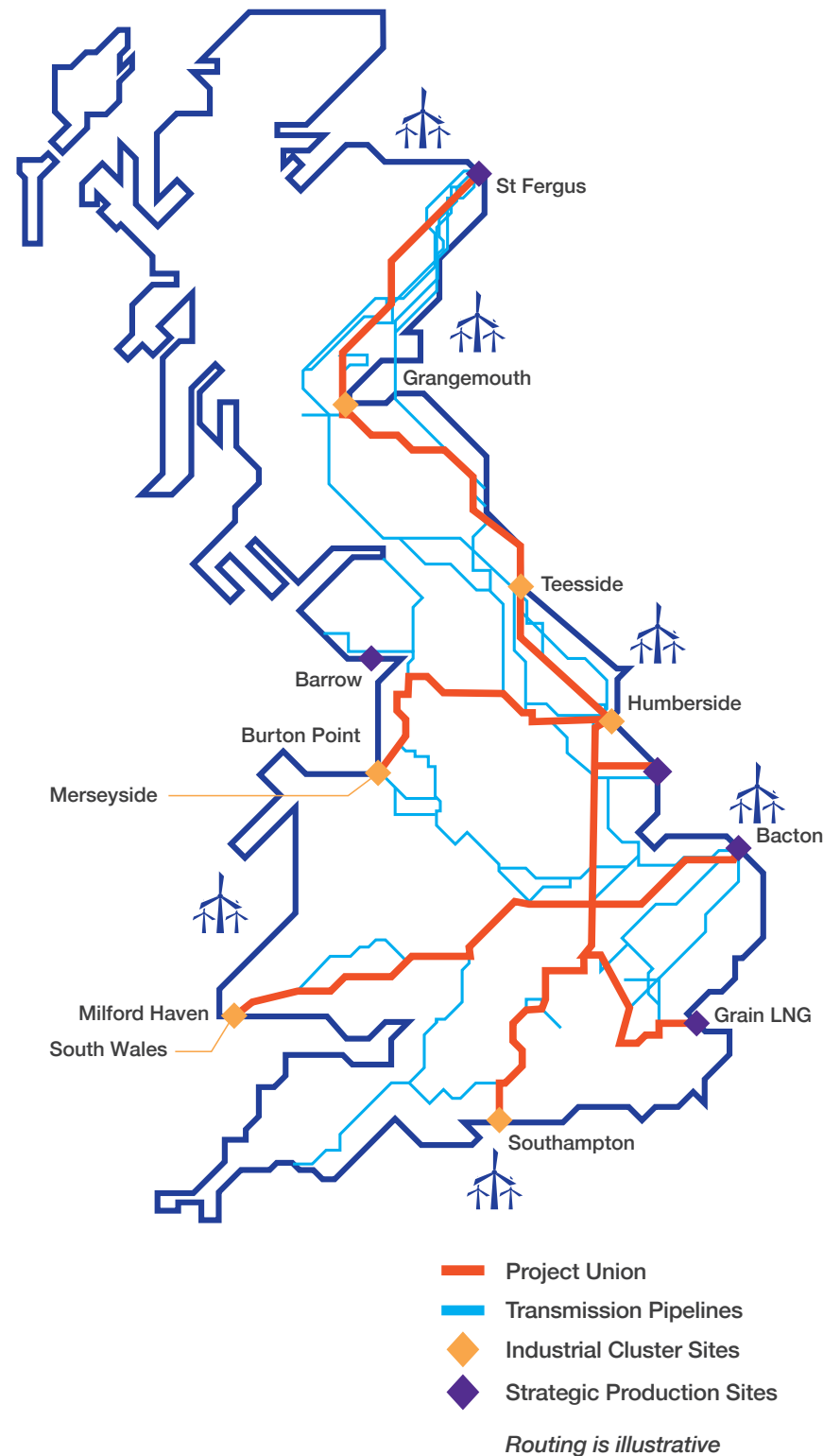
UK Hydrogen Strategy sets a target of **10GW** of hydrogen production – equivalent to six million homes



Low carbon hydrogen can **enable decarbonisation of industry and provide optionality** for transport and domestic heating



Investment in **hydrogen transmission** infrastructure is required to **link supply and demand, de-risk investment decisions, and secure inward investment** to realise a hydrogen economy and reduce the impact on the consumer



Decarbonisation of industry and power

Fair access to low carbon hydrogen enabling businesses to decarbonise. Access to transmission enables hydrogen production at scale.



Energy storage and resilience

System resilience to move and store sufficient volumes across the country.



Connectivity and efficiency

Connect production and storage with demand, enabling system efficiency through shared infrastructure.



Market coupling

Connect isolated production sites enabling competition, reducing costs and improving security of supply.



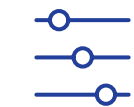
Levelling up and jobs

Project Union will directly support approx. £300m annual GVA (2021 prices) and 3,100 jobs at peak construction.



Global leader in green innovation

Attract global investors by getting best value from national infrastructure and enabling rapid scale up.



Flexibility and optionality

Flexibility in power generation, storage and consumption. Optionality in future hydrogen decisions while maintaining gas networks’ delivery.



Consumer-centric

Innovative, cost-effective consumer focused energy solutions – for example, the pilot hydrogen town brings scalability and expansion.



Promote energy independence

Enable transport of fair access to indigenous supplies around the UK and opens up the potential for export opportunities by connecting to the European Hydrogen Backbone.

The recently announced **Energy Security Strategy has doubled the UK’s 2030 target for low carbon hydrogen production capacity to 10GW**, which will need to be transported to consumers across the UK. This reflects the increasing importance of hydrogen in Government’s energy strategy.

To grow a vibrant hydrogen economy, investors in production and demand need **confidence in resilience of physical supply and connectivity to developing markets**. Project Union can fulfil this role by **delivering a hydrogen backbone of transmission infrastructure**, which is cost-effective and reliable.

Collaboration and coordination are essential to realise the net zero energy system of the future. We will continue to work with Government, regulators, gas network operators and the wider energy sector.

Unlocking a hydrogen economy

To achieve net zero by 2050, we must move away from our reliance on fossil fuels to cleaner alternatives that meet our environmental, social and economic needs.

Low carbon hydrogen can replace natural gas, delivering the flexibility the energy system needs at the lowest cost to the consumer. A UK hydrogen economy could also support over 9,000 jobs by 2030 – and up to 100,000 jobs by 2050¹.

Key hydrogen facts

- In all credible pathways to net zero hydrogen is needed^{2,3}
- Hydrogen will play a key role in decarbonising industry, power, transport and domestic heat
- Hydrogen is the most abundant chemical element on the planet but needs to be separated from existing sources

- Low carbon hydrogen can be produced through a range of technologies for example steam methane reforming with carbon capture and storage or electrolysis
- Hydrogen is a light, storable, energy-dense molecule that can be transported through pipeline infrastructure

Since the UK set a legally binding target of net zero by 2050, the policy landscape has evolved significantly with hydrogen playing a critical role. The UK's Hydrogen Strategy estimates that 250-460TWh of hydrogen could be needed in 2050 to meet net zero, which would make up 20-35% of final energy demand⁴.

Hydrogen policy targets

- 2GW of hydrogen production capacity by 2025 and 10GW of hydrogen production capacity by 2030 with over 50% of this coming from electrolytic hydrogen. Total UK project pipeline estimated up to 20GW as of April 2022⁵

- Decision on blending up to 20% hydrogen into natural gas grid by 2023
- The first 100% hydrogen village by 2025 and the first hydrogen town by 2030
- Hydrogen heating decision by 2026

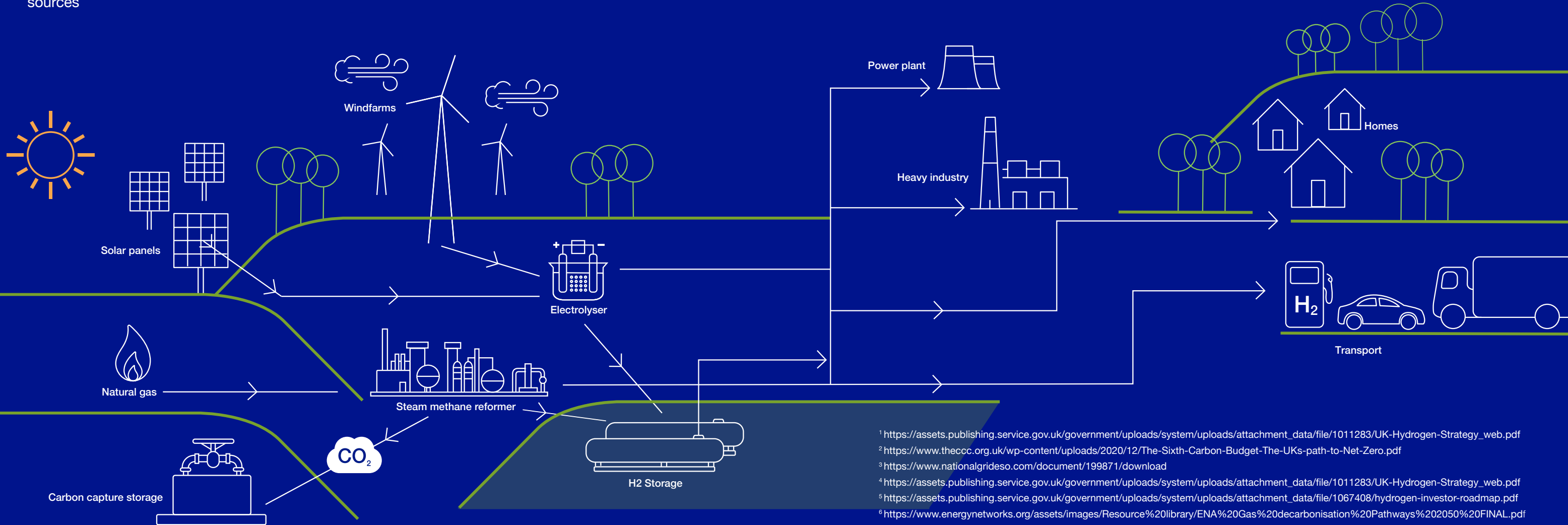
- New business models for hydrogen transport and storage infrastructure designed by 2025
- Launch of a £240m Net Zero Hydrogen Fund in April 2022.

Whole system

Hydrogen can be used in a range of applications including industry, power, transport and domestic heat, with demand often located remotely from production. Hydrogen supply can be connected with demand via the gas grid. Transporting hydrogen through pipeline infrastructure can provide a low-cost route to market essential for growing the hydrogen economy.

Hydrogen will have a crucial role to play in achieving Net Zero and a smart combination of gas and electricity in an integrated energy system will minimise consumer disruption and help to achieve an affordable path to get there. Low carbon gases in combination with low carbon electricity will result in lower total system costs in 2050, compared to an electrified scenario, saving £13bn per year until 2050⁶.

The UK Government has committed to a decarbonised power system by 2035, subject to security of supply. As more renewable electricity generation comes online, surplus electricity can be stored as hydrogen for long periods of time. This stored hydrogen can act as a fuel source to provide flexible low-carbon generation for peak demand or when there is low wind and solar generation, helping to balance the electricity grid.



¹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1011283/UK-Hydrogen-Strategy_web.pdf

² <https://www.theccc.org.uk/wp-content/uploads/2020/12/The-Sixth-Carbon-Budget-The-UKs-path-to-Net-Zero.pdf>

³ <https://www.nationalgrideso.com/document/199871/download>

⁴ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1011283/UK-Hydrogen-Strategy_web.pdf

⁵ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1067408/hydrogen-investor-roadmap.pdf

⁶ <https://www.energynetworks.org/assets/images/Resource%20library/ENA%20Gas%20decarbonisation%20Pathways%202050%20FINAL.pdf>

What is ProjectUnion?

Urgency, pace and scale are all required to realise the UK's decarbonisation challenge and achieve legally binding net zero commitments by 2050. A strong commitment and rapid acceleration of a hydrogen economy is key to enabling the transition to net zero, with Project Union sitting at the forefront of this.

Project Union will deliver a "first of a kind" hydrogen transmission backbone for the UK. Through the phased repurposing of existing assets alongside new ones, a hydrogen backbone of around 2,000km will be created, representing around 25% of the UK's current natural gas transmission pipelines. This approach of primarily repurposing assets is up to five times more cost effective compared to new build. It also minimises the additional environmental impact of new build.

The backbone will initially link strategic hydrogen production sites, including the industrial clusters, across the UK by the early 2030s and provide the option to expand beyond this initial hydrogen transmission network to connect additional consumers. The project will act as a key enabler for developing a hydrogen economy to

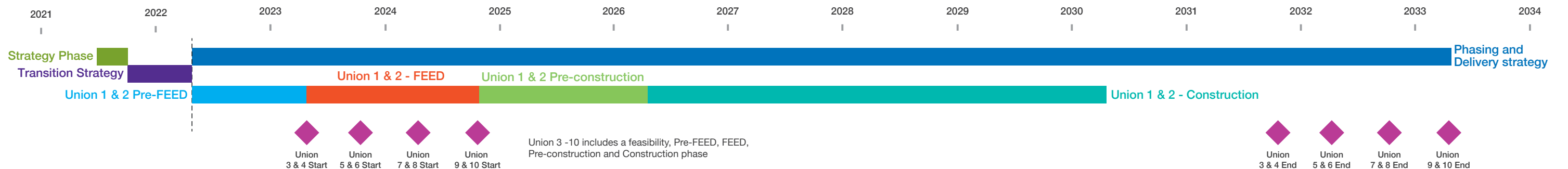
realise 10GW of low carbon hydrogen by 2030. It will do so by connecting and integrating hydrogen supply, demand and storage, enabling effective market growth and efficient scaling up. These infrastructure investments will support a green future while delivering UK-wide economic benefits. A shared hydrogen network will enable decarbonisation, while providing energy resilience. A hydrogen backbone will be at the heart of the future net zero economy.

The project will explore how and when to convert existing pipeline infrastructure for a hydrogen backbone by connecting Teesside, Humberside and Grangemouth as well as linking up Southampton, the North West and South Wales. The backbone will also connect to strategic hydrogen production sites including St Fergus and Bacton.

~2,000km
hydrogen backbone

25%
of the UK's current
natural gas
transmission pipelines

**Early
2030s**
initial backbone
complete



What are the benefits of Project Union?

£300m*
annual GVA (2021 prices)

3,100*
jobs at peak construction

Throughout the early phases of Project Union, we have engaged with a wide range of stakeholders, including potential hydrogen producers, users, storage operators, other network operators, Government and Ofgem.

Through this engagement, some key benefits of Project Union have been identified that matter most to our stakeholders. For example, producers and users of hydrogen tell us they will benefit from the connectivity, flexibility and resilience that the hydrogen backbone offers. These benefits are crucial to supporting the industrial clusters, as well as giving options to those outside of the clusters that want to produce or use hydrogen.

Project Union is also critical to levelling up, attracting investment in the UK and providing options in the future net zero energy system. These benefits facilitate the realisation of the UK Government's Hydrogen Strategy and support the most efficient and cost-effective transition to net zero.

	Consumer-centric	Project Union facilitates decarbonisation for all consumers. It will enable access to cost-effective low carbon hydrogen across the UK, enabling widespread decarbonisation of industry, power, transport, and heat. Project Union will provide key evidence for future policy decisions by providing a blueprint for a minimally disruptive, cost-effective rollout of hydrogen. It can also support a hydrogen town trial, demonstrating a scalable end-to-end process for decarbonising homes and business.
	Levelling up and jobs	A national transmission system will provide fair access to hydrogen infrastructure across the UK and enable existing industries to decarbonise, while continuing to attract capital as global investors target net zero. Project Union will directly support* approximately £300m annual GVA (2021 prices) and 3100 jobs at peak construction.
	Connectivity and efficiency	A hydrogen transmission system connects hydrogen production and strategic storage locations with demand inside and outside of industrial clusters. This enables greater system efficiency and flexibility through coordinated and shared infrastructure, lowering the cost to the consumer. Without a hydrogen transmission system, each industrial cluster and project will require independent capacity to provide flexibility, resilience and to handle peak demand, resulting in over-built, duplicate transmission and storage systems.
	Providing flexibility and optionality	A repurposed national transmission system will provide the fastest and cheapest transport option for hydrogen. This will deliver flexibility in power generation, storage, and consumption, at the scale required to meet net zero across the whole energy system. Creating an initial hydrogen backbone now will also provide decarbonisation opportunities sooner with the option for future expansion of the network at a lower overall cost, pending hydrogen and heat related decisions to be made by the UK Government.
	Market coupling	A hydrogen transmission system connects otherwise isolated production sites to enable competition, driving costs down for consumers, and improving security and certainty of supply. It also provides access for producers to larger markets, enabling faster scale-up of low carbon hydrogen in line with Government targets and ensuring an efficient transition to net zero. In support of the Government's hydrogen strategy, it will additionally enable access to import and export opportunities to Europe by the mid-2030s.
	Decarbonisation of industry and power	Around 50% of industrial emissions are outside of the industrial clusters. Project Union will reach consumers inside and outside of industrial clusters, connecting a wide range of sectors to a resilient, low-cost hydrogen supply. An integrated, large scale network of hydrogen, natural gas and CCUS, will support the UK's net zero targets by providing fair access to a range of decarbonisation solutions
	Energy storage and resilience	National Grid Electricity System Operator's Future Energy Scenarios found that the UK would require at least 15TWh of inter-seasonal hydrogen storage capacity by 2050. Further industry engagement has indicated that 100TWh storage capacity may be required by 2050. A hydrogen transmission system is needed to connect hydrogen production hubs with hydrogen storage and hydrogen users which are geographically dispersed across the country. This will provide a flexible energy system to meet peak energy demand which can't be delivered by intermittent renewables alone
	Global leader in green innovation	The UK has an opportunity to position itself as a global leader in green innovation in a rapidly growing hydrogen economy, attracting talented people and global investment. A national hydrogen transmission system will support the market's emergence and growth by providing a route to market for hydrogen suppliers and access to hydrogen for a range of sectors in geographically disperse locations. Market growth will drive innovation and attract technology developers to secure the best value from the UK's national infrastructure – all of which will enable a rapid scale-up of a UK hydrogen industry, with the opportunity to export hydrogen capability globally
	Energy independence	Project Union will enable transport of and access to indigenous hydrogen supplies and storage around the UK. With energy independence the UK will have increased flexibility reducing the impact the global gas market has on the UK consumer

* The estimates do not represent an estimate of the net (economy-wide) impact of Project Union. They do not for example include adjustments for employment/GVA displacement ('crowding out' of employment/GVA in other sectors of the economy). They also consider only the direct employment/GVA of Project Union, and do not consider possible effects in the Project Union supply chain. The indicators above measure the contribution to the economy of building and operating Project Union assets. GVA is an estimate of the value generated by the assets, less the cost of building and operating them.

Gas Transmission: Facilitating the transition to hydrogen

A critical step towards the transition to hydrogen and delivering the strategic rollout of a 100% hydrogen transmission network will be to demonstrate that the National Transmission System (NTS) and existing gas assets can operate safely with hydrogen.

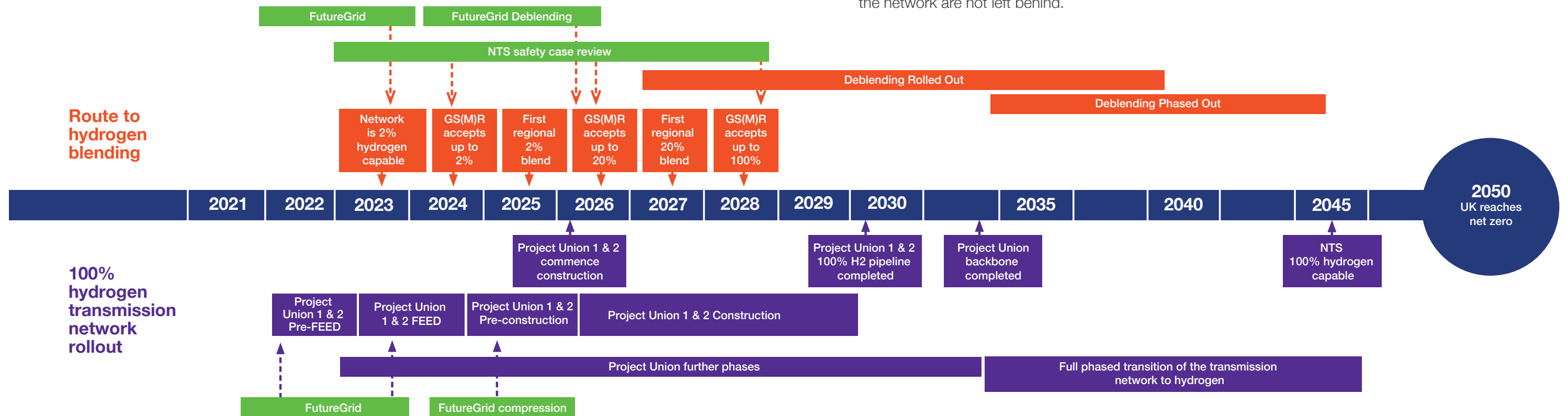
Alongside Project Union, several other projects, studies and research are underway to grow the evidence base for both a blended and 100% hydrogen transmission network.

Facilitating hydrogen blending across the NTS in parallel to the rollout of Project Union's 100% hydrogen transmission network will help to ensure the most efficient and timely transition to hydrogen. It will provide UK Government with a range of options for future decarbonisation, while ensuring those connected to the network are not left behind.

Deblending technology will further ensure all network connected customers' needs are met. Deblending is the separation of hydrogen from natural gas enabling a range of decarbonisation solutions throughout the transition to net zero.

The roadmap below sets out an outline roadmap for delivering a blend of hydrogen across the NTS in parallel to a strategic rollout of 100% hydrogen transmission pipeline sections to realise a UK hydrogen backbone.

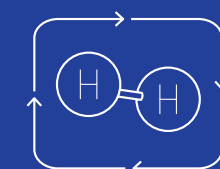
The FutureGrid programme will demonstrate the NTS can transport hydrogen via an offline purpose-built facility and develop the appropriate safety standards required to operate a future hydrogen transmission network. As part of this programme, NTS assets will be tested at different blends of hydrogen up to 100%, representative of potential future operation of the NTS. The outcomes of FutureGrid will inform the development and design of Project Union.



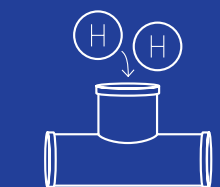
FutureGrid

FutureGrid is now underway – it is our ambitious programme to build a hydrogen test facility from decommissioned transmission assets, to demonstrate the National Transmission System (NTS) can transport hydrogen.

Testing will be conducted in two parts:



Offline Hydrogen Test Facility
NTS assets of different types, sizes and material grades will be tested with 2, 20 & 100% hydrogen.



Standalone Hydrogen Test Modules
Standalone hydrogen test modules will test individual equipment to provide key data required to feed into the main facility.

FutureGrid will help us understand how hydrogen interacts with our assets, so that we can develop appropriate safety standards required to operate our network.

[Nationalgrid.com/FutureGrid](https://nationalgrid.com/FutureGrid)

FutureGrid@nationalgrid.com

Market enablers

To realise the UK Hydrogen Strategy and to facilitate a well-functioning hydrogen economy, the Government and industry will need to work together. There are a range of market enablers that need to be addressed to avoid the risk of a fragmented hydrogen economy evolving, international inward investment opportunities being lost, market confidence deteriorating and a missed opportunity for international hydrogen import/exports. We've provided a summary of market enablers below:

Infrastructure linking supply and demand

For hydrogen to realise its potential and contribute towards net zero, appropriate infrastructure and technologies will need to start being delivered by the mid to late 2020s. Research and testing will need to be in place by the early to mid-2020s.

The UK already has large amounts of gas infrastructure that can be repurposed to transport hydrogen in a cost-effective way. We are carrying out testing of our existing assets through the FutureGrid programme and Project Union will assess how we safely transition them to carry hydrogen, identifying where any new assets will be required.

Business models

The business model design set out by the Department for Business, Energy and Industrial Strategy (BEIS)⁷ for low carbon hydrogen is intended to provide long-term revenue support to hydrogen producers. The aim is to overcome the cost challenge of producing low carbon hydrogen compared to cheaper high-carbon alternatives. Providing this support now will make it easier for hydrogen producers to enter

the market, bringing the cost of production down more quickly. In addition, new business models for hydrogen transport and storage, due in 2025, will be essential for growing the hydrogen economy.

Policies and regulatory framework

Certainty in policy will be essential to secure the investment needed in hydrogen technologies to achieve net zero. UK Government has already set ambitious targets that demonstrate the UK's aspiration for hydrogen and has signposted future policy decisions and relevant work needed across the industry.

Regulatory and commercial frameworks will need to evolve to support investment stimulus for a hydrogen future. We are working closely with BEIS, Ofgem and other stakeholders to develop potential short-, medium- and long-term regulatory framework options.

Market development and growth

Experience in the UK, Europe and beyond demonstrates that an effective energy network that connects diverse points of production to demand, and storage is essential for a market to emerge and successfully drive down costs while maintaining security of supply for consumers⁸.

Project Union will enable low carbon hydrogen to grow from fragmented initial stages to a highly integrated, competitive, transparent and liquid end state with the scope to optimise export and import opportunities to Europe.

Mechanisms to unlock capital investment

Targeted investment will be required to link future hydrogen supply and demand. Mechanisms to unlock capital will be needed to ensure projects can deliver the necessary production, transmission and storage infrastructure with confidence for the future of the industry.

The UK has an opportunity to play a key role in the development of a hydrogen market and the NTS has a vital role to play in enabling this. Investment mechanisms made readily available will act as a catalyst for the UK's driving role, where a delay would affect the ability to gain first mover advantage. Starting the feasibility phase of Project Union now can provide the evidence and certainty needed to de-risk wider investments and policy decisions.

Supply chain and technology

Supply chains are critical to the delivery of a successful hydrogen market, as technologies are new and rapidly evolving. It will be essential to ensure supply chains are ready to support delivery and can be scaled to meet demand.



Further assessment is required to determine the most appropriate design for revised supply chains.

In the feasibility phase of Project Union, the current supply chain will be reviewed. Further assessment will also be conducted to understand the processes and technologies needed for a mature supply chain that will deliver a hydrogen transmission backbone.

Skills and future capabilities

The UK will need to invest in and recruit for over 400,000 green jobs in the energy sector alone to meet net zero by 2050⁹. There is a need to increase the number of people studying science, technology, engineering and maths subjects, with a particular focus on increasing diversity to ensure net zero solutions are innovative and reflect the needs of everyone.

We are working collaboratively to understand the skills, capabilities and training programmes needed to deliver a hydrogen economy.

Safety case and technical standards

The safety case governs how gas is transported safely through gas networks and needs to be updated for hydrogen. Gas Transmission's FutureGrid project is assessing what updates are needed to ensure hydrogen is transported safely.

Clearly defined technical standards increase the transferability of skills and manufactured parts from one project to the next. Interoperability will unlock increased efficiencies and further development potential for people.

Consumer and public perception

Hydrogen has been used within industry for years, for example in the chemicals and refining sectors. But the potential of hydrogen as a low carbon energy source is relatively unknown among customers and the public. It will be essential to raise consumer and public awareness to the benefits of low carbon hydrogen as well as testing acceptability of hydrogen's role in the future. Understanding consumer needs and ensuring the market meets these needs are critical steps in the successful adoption of hydrogen.

⁷BEIS Business Model Consultations, Nov 2021 <<https://publishing.service.gov.uk>>

⁸"ACER Market Monitoring Report 2020 – Gas Wholesale Market Volume": market price of gas in functioning markets is lower than poorly functioning markets; with price convergence between member states being dependent on available non-congested infrastructure.

⁹<https://www.nationalgrid.com/document/126256/download>

ProjectUnion: A look ahead

Project Union will take a staged approach to delivery, with an initial feasibility stage for each section of pipeline, followed by FEED and construction stages. This approach introduces key decision points that account for the evolution of policy while protecting consumers from undue cost risk.

Over the next 12 months, we will carry out the feasibility stage for two sections of Project Union (Union 1 & 2). Within this stage, we will complete two pre-FEED studies. These pre-FEEDs will focus in on specific sections of the hydrogen backbone and consider which pipelines can be repurposed and if any new assets are needed. This will ready us to move to more detailed FEEDs for those two sections.

During the feasibility stage, we will carry out an ongoing assessment of Project Union's phasing strategy to determine the ordering of pipelines to be transitioned. We will also complete work in various areas that will enable us to deliver Project Union as a whole.

These areas are:

Procurement

Our procurement strategy will be assessed ahead of procuring and deploying hydrogen-ready assets to support the delivery of the hydrogen backbone.

Impact assessment

We will consider whether improvements or updates are needed to our current policies, procedures, skills, capabilities and data.

Technical design and delivery

To deliver Project Union, network modelling will be undertaken to determine the phasing strategy and routing options, which will maintain security of supply throughout the transition. We will also develop our asset management strategy and system operation requirements.

Regulation and commercial

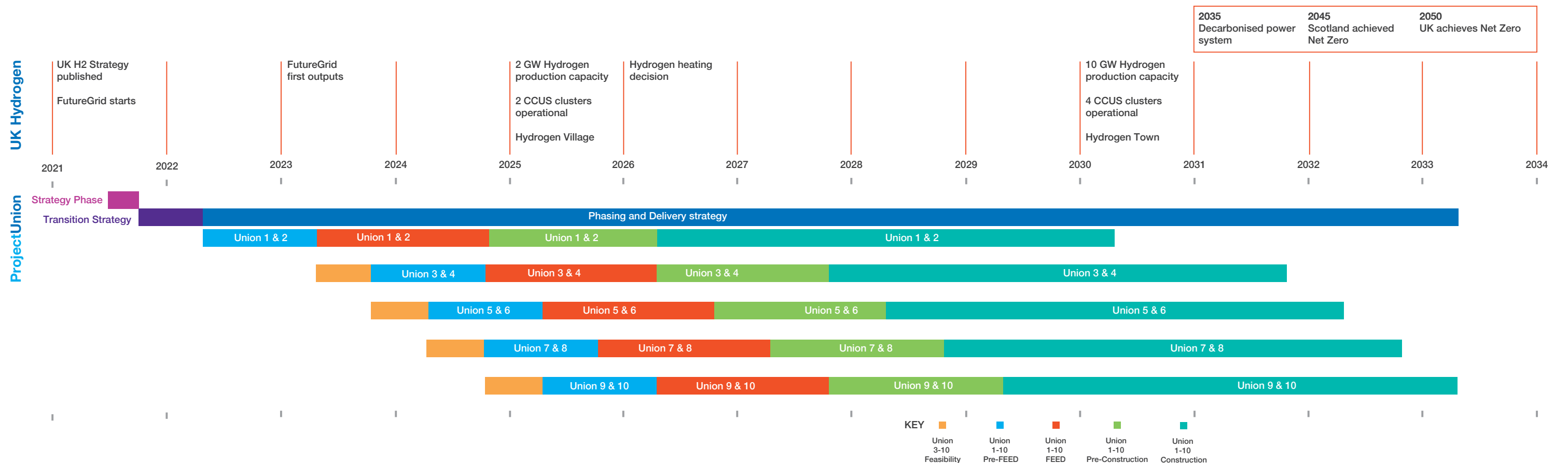
We will investigate how the current regulatory and commercial frameworks may need to change in a hydrogen world.

Customer

There are a range of customers connected to and receiving natural gas from the NTS today. We will work with our customers to understand their needs now and in the future so that we can support and facilitate a managed transition to net zero.

Stakeholder engagement

It is essential to understand how Project Union will interact with all our stakeholders across the value chain – such as producers, users, local authorities and Government. We will work collaboratively to ensure an aligned decarbonisation pathway.



Opportunities for expansion and integration

Project Union spans the UK, connecting all major industrial clusters and hydrogen production centres, linking hydrogen supply, storage and demand. The widespread connectivity and access to mass hydrogen production allows for optionality on the expansion of the backbone in the future. This can facilitate further widespread decarbonisation.

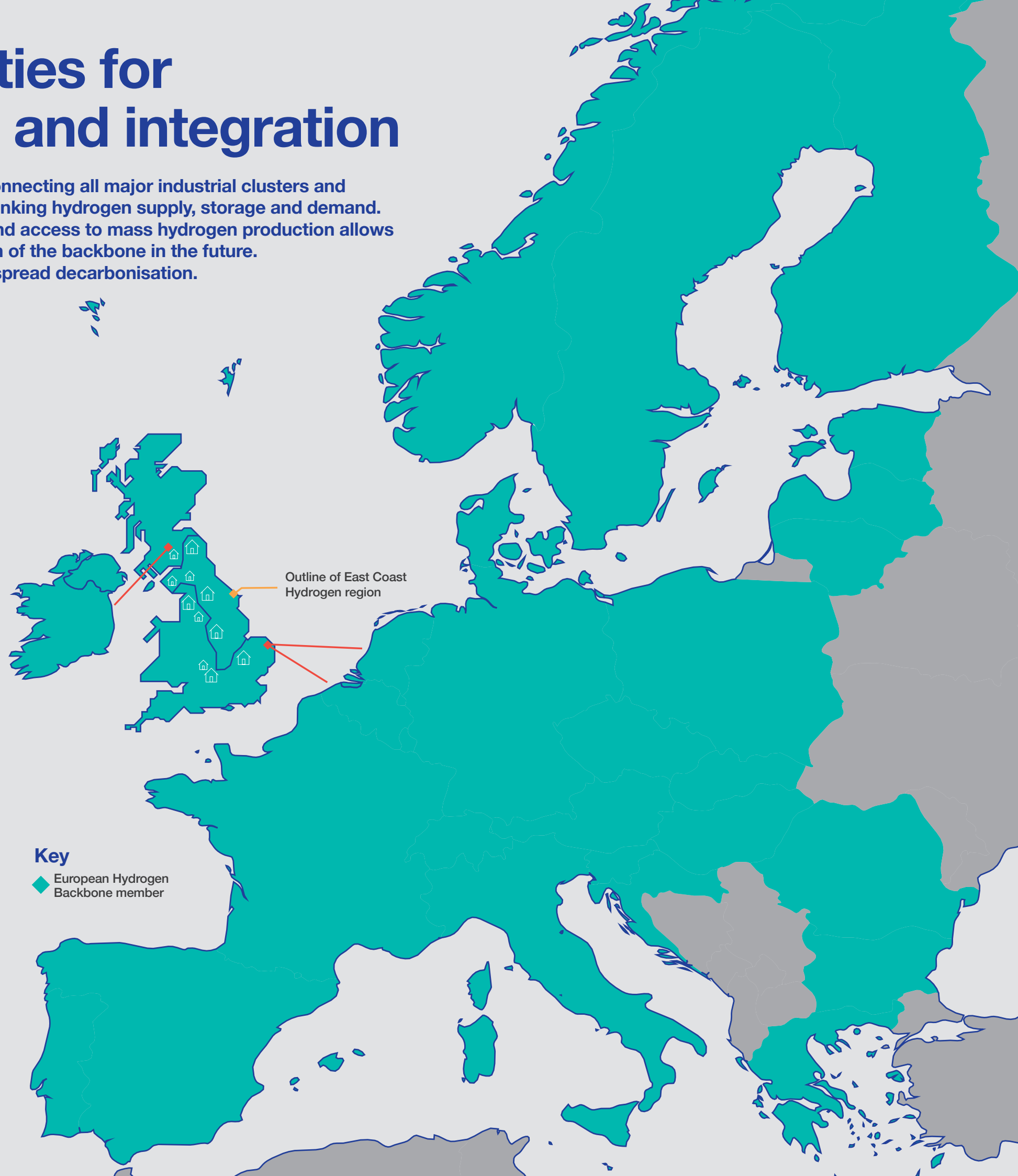
The extent of this expansion depends on the Government and consumer decisions. However, with the delivery of the initial hydrogen backbone, Gas Transmission will be ready to act once decisions are made and further policies are in place. For example, if the Government decides hydrogen should be used to heat homes, the hydrogen backbone will be readily available to be used to feed distribution networks and bring hydrogen into homes.

100% Hydrogen village and town

With the Government's plans for a 100% hydrogen village by 2025 and 100% hydrogen town by 2030, Project Union's hydrogen backbone can feed into gas distribution networks that are connecting into the developing village and town. Not only will this provide additional resilience, but a full end-to-end value chain will also be developed, showcasing how hydrogen in homes can operate as safely and reliably as natural gas today.

East Coast Hydrogen

East Coast Hydrogen is a collaborative project between Gas Transmission, Northern Gas Networks (NGN) and Cadent Gas. It will repurpose pipeline infrastructure and build new hydrogen pipeline infrastructure to enable regional decarbonisation and conversion to hydrogen. The region includes all of NGN's area, the Eastern part of Cadent's network and involves a section of Project Union, which runs through the region.



The 15-year programme will act as a blueprint for regional decarbonisation and will be delivered in phases to take hydrogen from where it is produced, to supply a range of end uses including industry, residential, power and transport. The collaborative programme represents an opportunity for the Government and the private sector to work together in delivering on our ambitious decarbonisation targets.

East Coast Hydrogen will connect over 7GW of hydrogen production by 2030, meeting over 70% of the UK Government's 10GW by 2030 target in a single region.

Integration with the European Hydrogen Backbone

Since the establishment of the European Hydrogen Backbone (EHB) initiative in 2020, membership of the group has significantly grown. Currently, there are **31** energy infrastructure operators covering **25 EU Member States** plus **Norway**, the **United Kingdom**, and **Switzerland**. All members have developed a vision illustrating how dedicated hydrogen pipeline infrastructure is expected to grow over time, forming a truly pan-European hydrogen network – the European Hydrogen Backbone¹⁰.

By 2040, the European Hydrogen Backbone is projected to reach a length of almost **53,000km** consisting of **~60% of repurposed** natural gas pipelines and **~40% new pipelines**.

Integrating Project Union's UK Hydrogen Backbone with the European Hydrogen Backbone is key to enable imports and exports of hydrogen with neighbouring countries.

¹⁰<https://www.ehb.eu>

Summary

Gas Transmission has an exciting and important role in net zero and in leading a fair energy transition for everyone in the UK. We will do this by developing the green gas system of tomorrow, while delivering the natural gas needs of today.

Project Union is the phased repurposing of the UK's natural gas National Transmission System (NTS) to create a UK hydrogen backbone carrying 100% hydrogen by the early 2030s. Taking a consumer-centric approach, the backbone will facilitate cost-effective, fair access to low carbon hydrogen across the UK, enabling widespread decarbonisation of industry, power, transport and heat.

A phased approach to repurposing assets will maintain security of supply on the natural gas network during the transition, sustaining our reliable service to our customers. Repurposing pipelines is up to five times more cost effective than building new. While some new assets may be required this will be minimised to keep costs low and reduce any environmental impact that would emerge.

This is a no regrets option to unlock decarbonisation solutions across the UK by connecting hydrogen production and storage with demand, enabling system efficiency and lower cost to the consumer through shared infrastructure. It will provide a route to market for hydrogen production to scale and through the connection of isolated production sites it will enable competition, reducing costs and improving security of supply.

Project Union will support the levelling up agenda and jobs with initial estimates indicating direct support for approximately £300m annual GVA (2021 prices) and

3,100 jobs at peak construction. It will contribute critical evidence to inform key hydrogen policy decisions by creating a blueprint for a minimally disruptive, cost-effective rollout of a hydrogen network. Aligned with the UK's Hydrogen Strategy, it can also accommodate a hydrogen town trial, demonstrating a scalable end-to-end process for delivering hydrogen to homes and businesses.

Recognising the need for a whole system approach to net zero, a UK hydrogen backbone can deliver hydrogen across the country for flexible low-carbon power generation to complement intermittent renewables. The backbone can also be expanded to increase capacity, in line with future hydrogen decisions on heat.

A national hydrogen transmission system will support market growth, which will drive innovation and attract technology developers to secure the best value from the UK's national infrastructure. A rapid scale-up of a UK hydrogen industry can secure the UK's position as a global hydrogen leader, bringing the opportunity to export hydrogen capability globally.

Project Union will take a staged approach to delivery.

This is crucial to protecting the end consumer from undue cost risk.

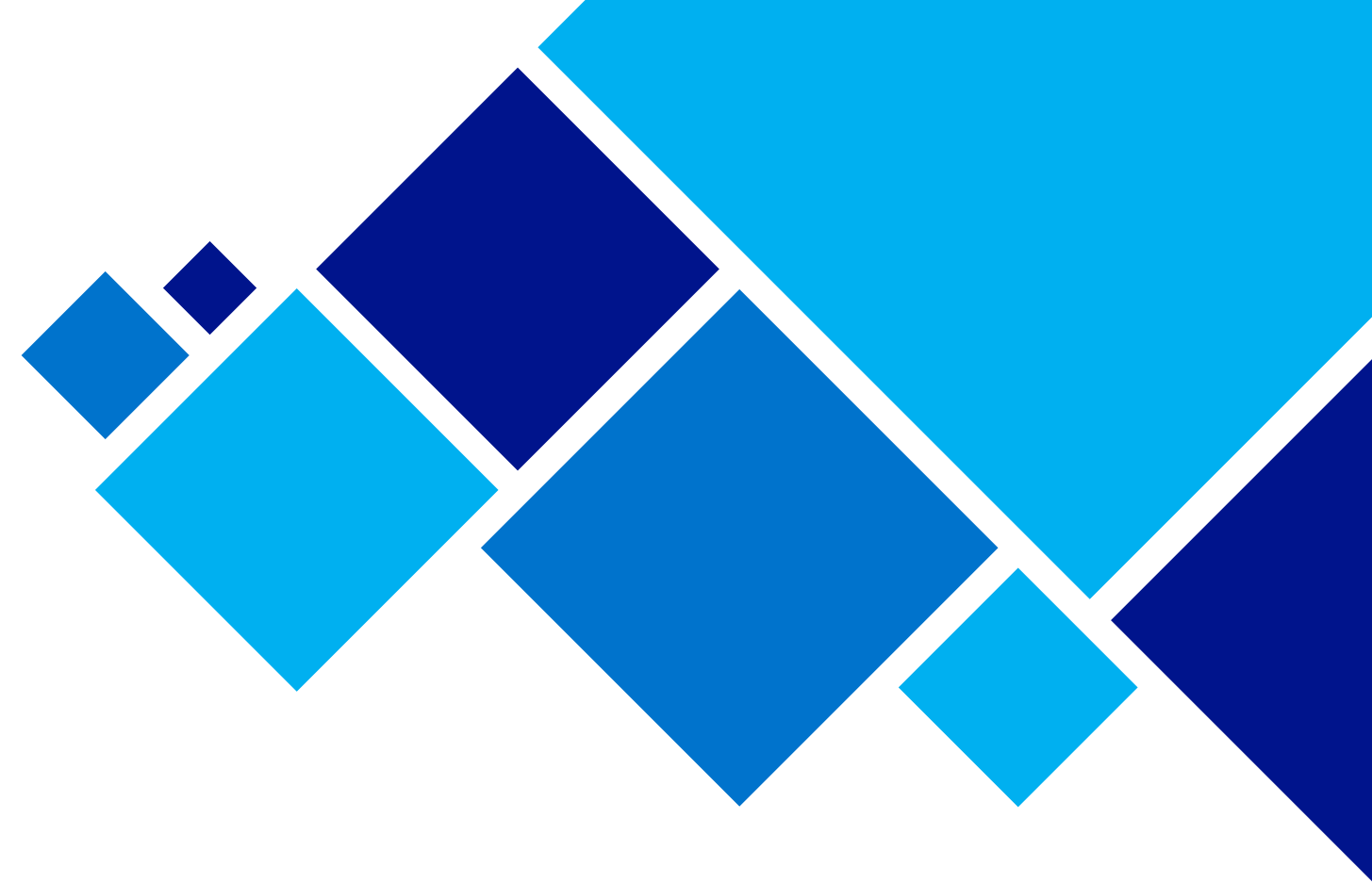
With this approach, we need to start now if we are to deliver a hydrogen backbone by the early 2030s

...and maximise the benefits that Project Union will deliver.

The next step is a feasibility phase starting in June 2022. This will provide a full evidence case for the central role of hydrogen transmission within the UK Hydrogen Strategy

...and the most cost effective and value adding way to develop and deliver this. Early development will take place over the next few years to enable a phased conversion to hydrogen starting from 2026, with the full backbone delivered in the early-2030s.

We will continue to work with our customers and stakeholders to deliver a solution that meets their needs. This engagement will be a fundamental input into the design of the backbone ensuring that no one is left behind in the transition to net zero. Collaboration with other networks, including gas distribution, electricity and water networks to align our infrastructures will further enable our ability to develop the most efficient net zero system which benefits all homes and businesses, across the UK.



Danielle Stewart
Hydrogen Programme Manager

“Project Union is a unique opportunity to maximise the use of our existing UK infrastructure to benefit the consumer through low-cost, widespread access to hydrogen – delivering the net zero energy system of the future.”

Acronyms

BEIS	Department for Business, Energy & Industrial Strategy
CCC	Climate Change Committee
CCUS	Carbon Capture, Utilisation and Storage
EHB	European Hydrogen Backbone
FEED	Front End Engineering Design
GW	Gigawatt
GVA	Gross Value Added
NTS	National Transmission System
Pre-FEED	Preliminary Front End Engineering Design
TWh	Terawatt hour

Phases of Project Union - Definitions

Transition strategy phase	The purpose of the transition strategy phase has been to complete early network modelling, looking at possible backbone solutions, costings and assessment of wider economic and social benefits.
Feasibility phase	The purpose of the feasibility phase will be to identify potential pipeline routes, assess the readiness of existing assets, and determine an overall transition plan for delivery, aligned with industrial cluster developments.
Pre-FEED	This phase will prove technical and economic option feasibility, to develop the project design basis.
FEED	Initial detailed design of options.

ProjectUnion Get involved



Antony Green
Hydrogen
Director



Danielle Stewart
Hydrogen
Programme
Manager

 Hydrogen@nationalgrid.com

 www.nationalgrid.com/hydrogen



National Grid Gas Transmission

National Grid House
Warwick Technology Park
Gallows Hill
Warwick
CV34 6DA

www.nationalgrid.com/hydrogen