HyLine Cymru

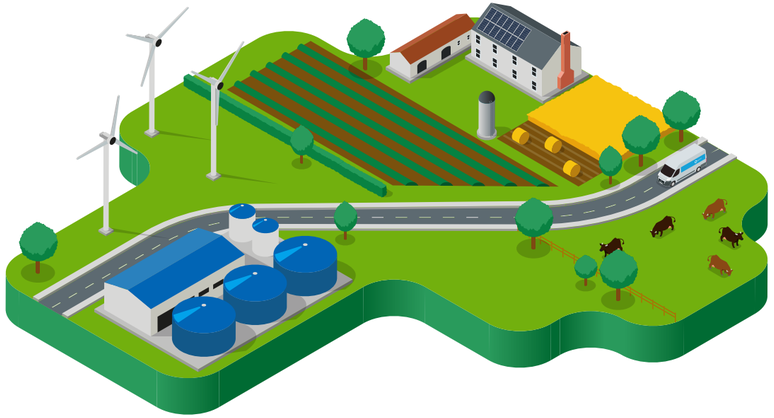
Building the pipeline to net zero in South Wales

WALES&WEST UTILITIES

Contents

HyLine Cymru

This ground breaking project will transport a homegrown, low-carbon energy solution by doing what Wales & West Utilities (WWU) do best – expertly connecting our customers with energy whilst investing wisely to create a sustainable, greener future.



We support the commitment to delivering a cleaner, greener, and fairer Wales. This means changing the way we produce and use energy at home, in industry and for travel. One of the largest and most challenging sectors to decarbonise is heavy industry.

South Wales has a rich industrial heritage; it is home to industries like cement, paper, steel, mineral wool, chemicals and food. It also has a diverse energy supply sector including power stations, onshore wind sites and two LNG terminals supplying over 20% of the UK's natural gas demand.

We recognise the need to invest for the future to decarbonise industry whilst protecting communities, jobs and the economy in Wales and beyond. As such, we're looking at what infrastructure we need to maintain existing supplies of energy whilst transitioning towards the ability to deliver low-carbon hydrogen at scale.

HyLine Cymru is a proposal to build a new 130km hydrogen pipeline across South Wales from Pembroke to Port Talbot. This pipeline will help unlock at least 4.5GW of offshore wind in the Celtic Sea by providing a route to market for clean energy producers, whilst transporting a homegrown low-carbon energy source to our hard-to-decarbonise customers. As well as offering collaborative value in industry, HyLine Cymru will also help local authorities deliver their Local Area Energy Plan, helping Wales achieve its vision for the future.

WALES&WEST UTILITIES

Delivery lead

apollo

Delivery partners

Mabbett® See a Difference.

FGP

ERM

HyLine Cymru

This report summarises the pre-FEED (Front End Engineering Design) for the HyLine pipeline. By building the pipeline and replacing natural gas (methane) with low-carbon hydrogen, the project could enable a reduction of up to 3.2million tonnes of CO_2e per annum, whilst retaining / creating 100's of jobs during the construction and operational phases.

Further to this, HyLine Cymru will be an enabler for 1000's of jobs indirectly through new energy production facilities and new industrial plants. With a positive decision by the UK government in 2026 with regards to hydrogen for heat, this pipeline could further enable the roll out of hydrogen for domestic use in Wales and beyond.

HyLine serves as the driving force behind UK and Welsh decarbonisation goals. Being aligned with the UK Government's strategic directives, including the 10GWs of hydrogen production target by 2030, HyLine stands at the forefront of infrastructure innovation. By enabling seamless, large-scale, and low carbon hydrogen transportation, it propels Wales toward a greener, net zero future.

Supporting organisations:

Public

SWIC
SOUTH WALES INDUSTRIAL CLUSTER

supported by

Sero Net Diwydiant Cymru
Net Zero Industry Wales

Cyngor Sir Penfro - Pembrokeshire County Council

Cyngor Castell-Nedd Port Talbot
Neath Port Talbot Council

Cyngor Sir Gâr
Carmarthenshire County Council

Cyngor Abertawe
Swansea Council

Private

RWE

Heidelberg Materials

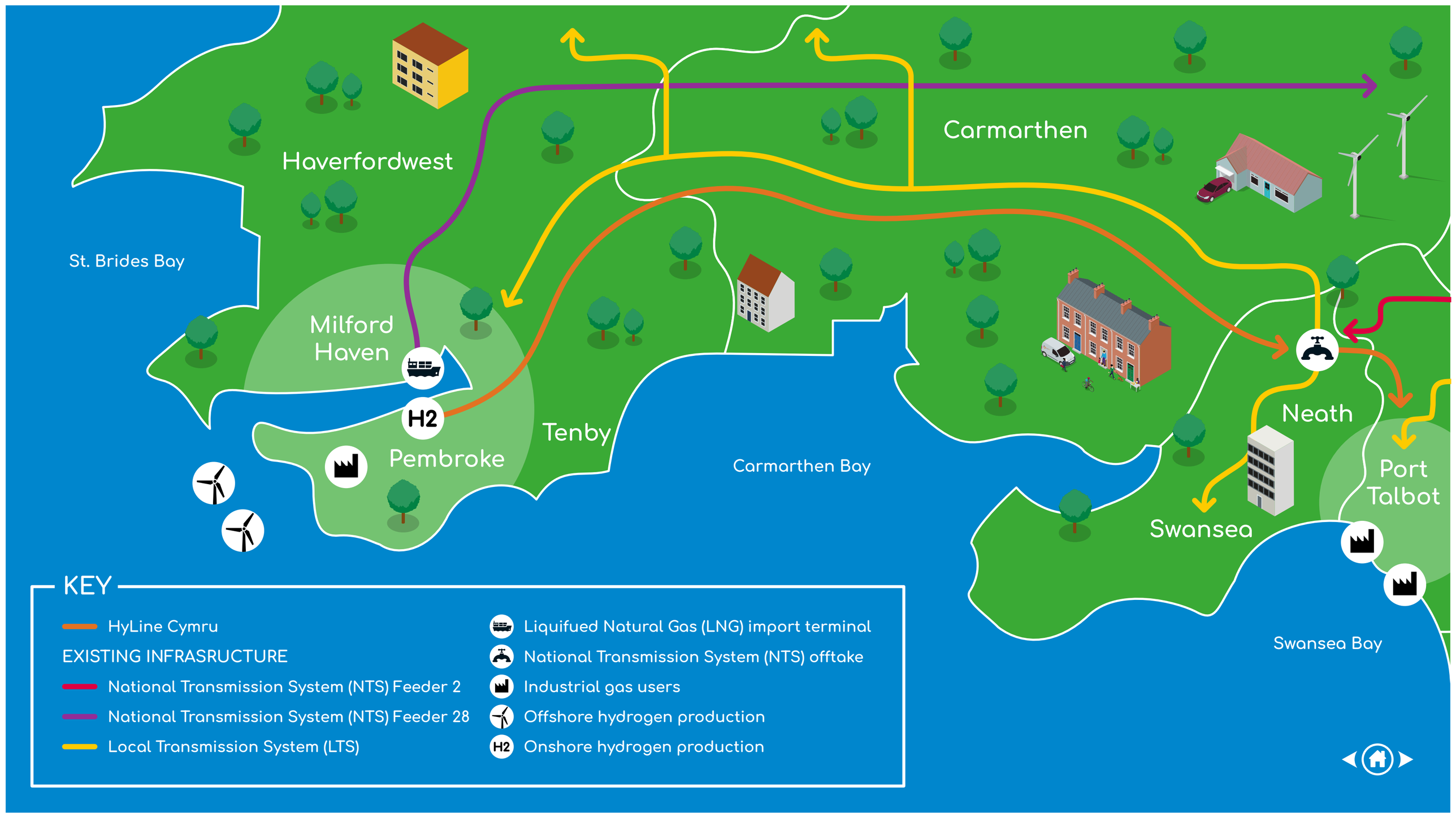
TATA STEEL

LanzaTech

dolphyn hydrogen

Note: CO_2e stands for carbon dioxide equivalent and is a measure used to compare the emissions from different greenhouse gases on the basis of their global-warming potential (GWP), by converting amounts of these gases to the equivalent amount of carbon dioxide with the same GWP.

View HyLine Cymru map


Haverfordwest
Carmarthen
St. Brides Bay
Milford Haven
H2
Pembroke
Tenby
Carmarthen Bay
Neath
Port Talbot
Swansea
Swansea Bay
KEY
HyLine Cymru
EXISTING INFRASRUCTURE
National Transmission System (NTS) Feeder 2
National Transmission System (NTS) Feeder 28
Local Transmission System (LTS)
Liquifued Natural Gas (LNG) import terminal
National Transmission System (NTS) offtake
Industrial gas users
Offshore hydrogen production
H2
Onshore hydrogen production

HyLine will help to unlock a number of cross-sectorial benefits across Wales by connecting low-carbon hydrogen with industrial demand. These benefits are detailed below and serve to demonstrate the scale of the opportunity presented by hydrogen pipeline infrastructure.

People

Support the development of a green industry and energy hub within Wales.

Fast & Secure

Providing decarbonisation at pace whilst ensuring a resilient gas network which recognises the importance of the British Energy Security Strategy.

Support **1000s** jobs.

Planet

HyLine Cymru has the opportunity to save up to

3.2 million

tonnes of CO_2e per year at the point of use by replacing natural gas with low-carbon hydrogen.

It has the potential to help

Unlock

offshore wind developments in the Celtic Sea by providing a route to market for hydrogen produced onshore and offshore. This will ensure that electrons aren't constrained and that the full **4.5GW** of offshore wind generation can be realised.

Pounds

HyLine Cymru has the potential to add

billions

of GVA by acting as an enabler to both the development of

H2 production and decarbonisation of industry over the operational lifetime.

Project background

WWU is part of South Wales Industrial Cluster (SWIC). SWIC was formed in 2019 to help plan and shape a route to net zero for industry in South Wales. It represents the second largest industrial cluster in the UK, emitting 16 million tonnes of CO_2e per annum. The Cluster Plan project which, concluded in March 2023, demonstrated the opportunity of decarbonisation across multiple geographies and sectors.

The SWIC Vision showcases ambitious plans to achieve:

- **Net zero industries in South Wales by 2040, equating to 40% reduction of current Welsh CO2 emissions**
- **Retention of 113,000 jobs and a net positive increase in jobs overall**
- **Unlocking £30bn investment opportunities in the region**
- **Growing the £6bn Gross Value Added from South Wales industry**

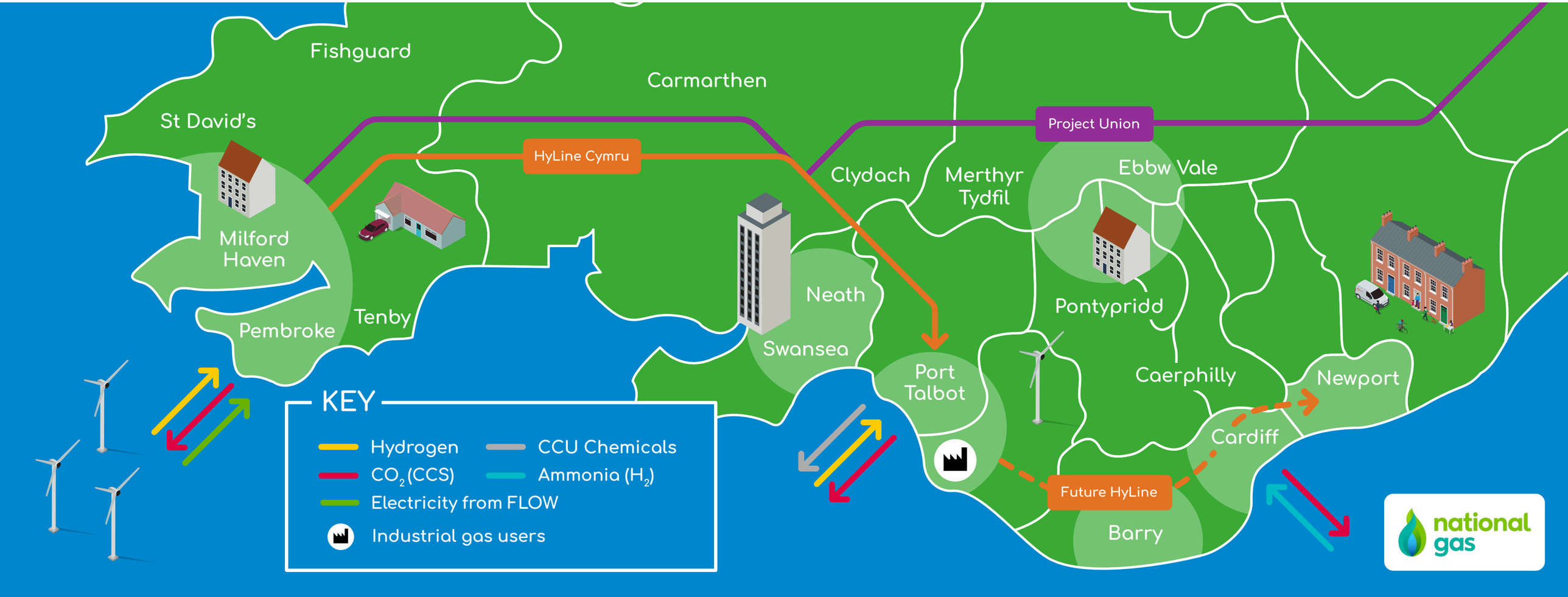
The SWIC Deployment project started in March 2021 linking supply and demand centres in the South Wales region to drive the development of hydrogen infrastructure and technology, and to enable industrial decarbonisation in line with the DESNZ (previously known as BEIS) Industrial Cluster Challenge.

As a core SWIC partner, WWU want to use their Regional Decarbonisation Pathways project plan as an evidence base for their next phase of work in the cluster stories explore how hydrogen can be deployed. HyLine Cymru is that critical link to understand regional hydrogen distribution and deployment.

National & regional context

HyLine Cymru would connect low carbon hydrogen production to energy intensive industrial customers beginning to switch their processes to hydrogen in the 2030s. It could also facilitate the conversion of domestic and commercial heating to hydrogen; enabling South Wales towns to go green while keeping disruption to homes and communities to a minimum.

The below graphic demonstrates the integration of HyLine into the SWIC cluster plans and potential integration into the national Project Union proposal.



What have we done to date?

Our pre-FEED work set out to determine a deliverable, and cost effective pipeline project and potential route to demonstrate the opportunity presented by hydrogen infrastructure. Some of the key elements of the study were:

Clear scenario base to understand the complex supply/demand relationship and use case of the pipeline

Clear and appropriate stakeholder engagement for the current phase of the project

Holistic picture of the project ensuring key barriers, risks and showstoppers are understood/mitigated

A path of least resistance adopted as one of the preferred options for the pipeline route

A pipeline that follows an unconstrained or minimum constraint philosophy

A pipeline that makes use of existing easements where possible and appropriate

To highlight and limit potential difficulties in pipeline routing

To highlight and avoid environmental and ecological areas of concern

To highlight and avoid existing major utilities and infrastructure

Current gas network

The current South Wales gas network consists of two major National Transmission System (NTS) pipelines, Feeder 2 and Feeder 28 which are owned and operated by National Gas transmission.

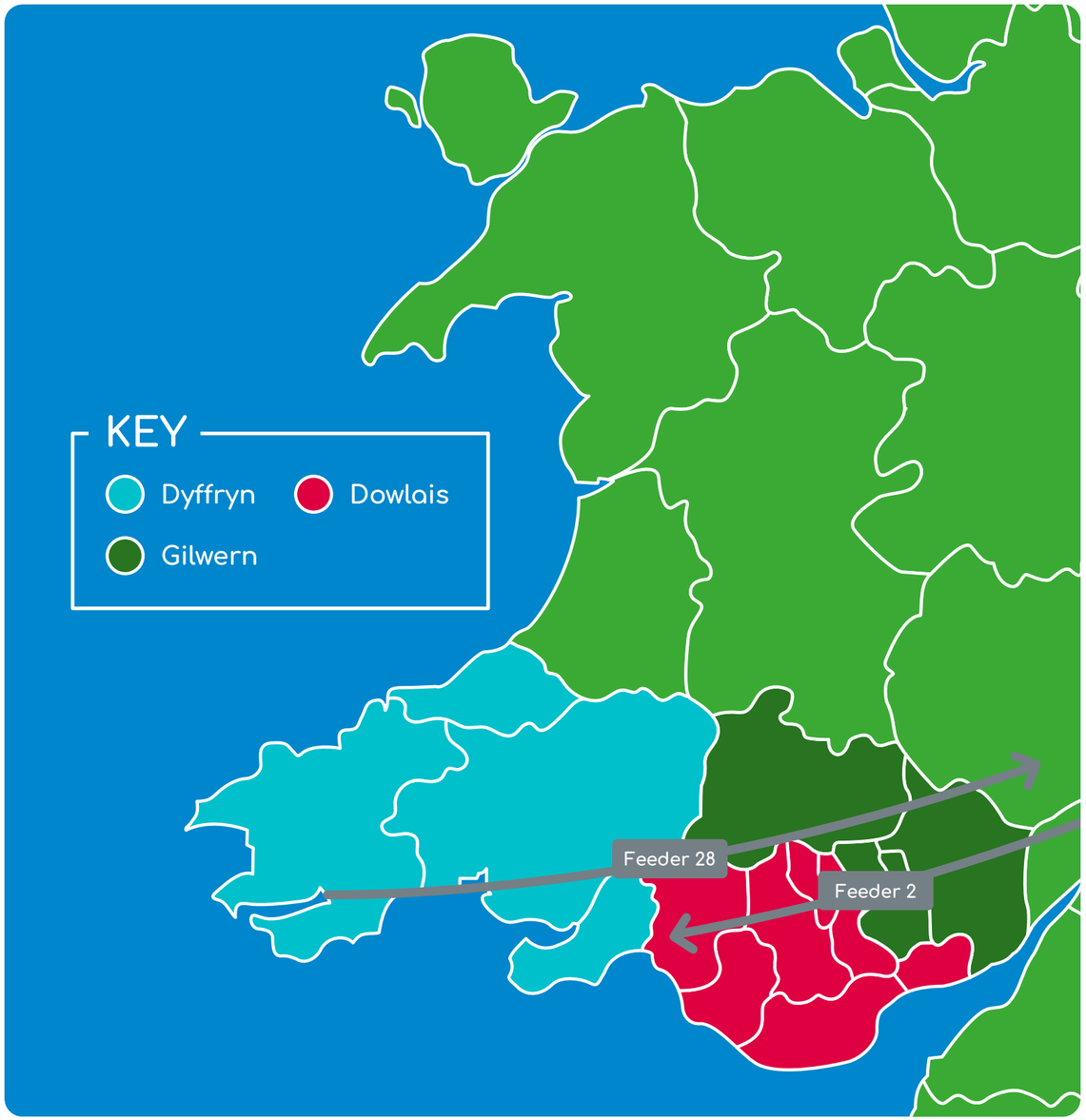
Feeder 28 transports gas from import terminals in Milford Haven where the gas travels west to east towards the core of the NTS, where it meets other major NTS pipelines in central England before gas continues onward to Bacton on the east coast.

Feeder 2 runs from east to west and primarily serves WWU's Local Transmission System (LTS) pipelines from three offtake sites:

- **Dyffryn Clydach**
- **Dowlais**
- **Gilwern**

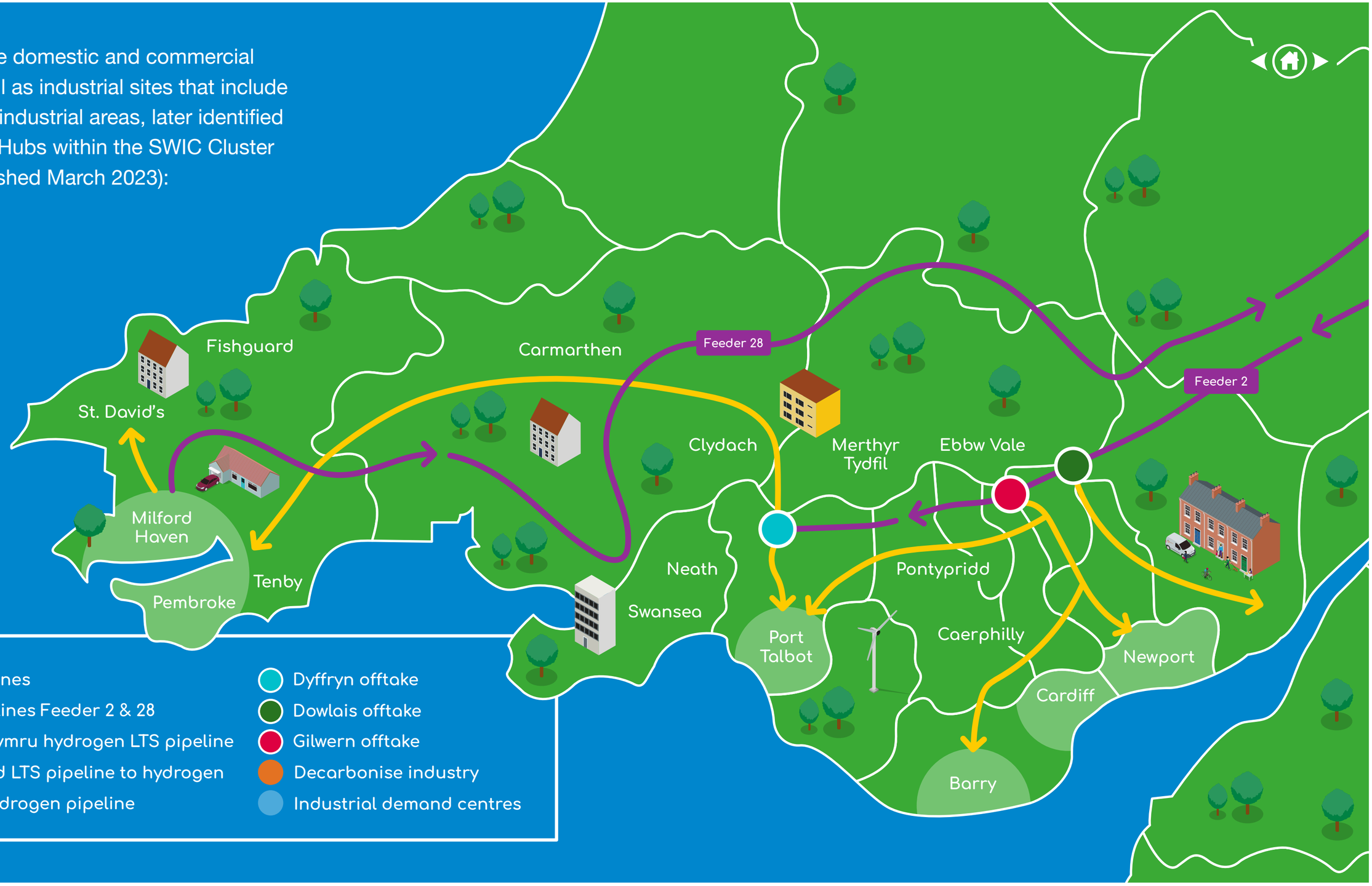
These offtake sites and the downstream LTS network serve all domestic, commercial, and industrial gas customers in South Wales which aren't connected directly to the NTS.

These are major assets, with Feeder 28 capable of transporting 25% of the UK's gas demand, and our Dowlais offtake capable of transmitting more energy than will be produced by the new Hinkley Point C nuclear power plant.



The offtakes serve domestic and commercial properties, as well as industrial sites that include the following five industrial areas, later identified as Clean Growth Hubs within the SWIC Cluster Plan report (published March 2023):

- **Milford Haven**
- **Port Talbot**
- **Barry**
- **Cardiff**
- **Newport**



Regional Decarbonisation

Our Regional Decarbonisation Pathways work, published alongside analysis from Energy Systems Catapult and Costain, demonstrates the role of the gas network across a number of future scenarios.

Throughout these scenarios, a clear opportunity was presented whereby new strategic hydrogen pipeline infrastructure could help to unlock existing parts of our network for repurposing – presenting a possible future regional rollout methodology.

QR CODE TO RDP

By building the 130km HyLine Cymru pipeline.

We could unlock a further 2700km of existing network for hydrogen

Routes for HyLine Cymru

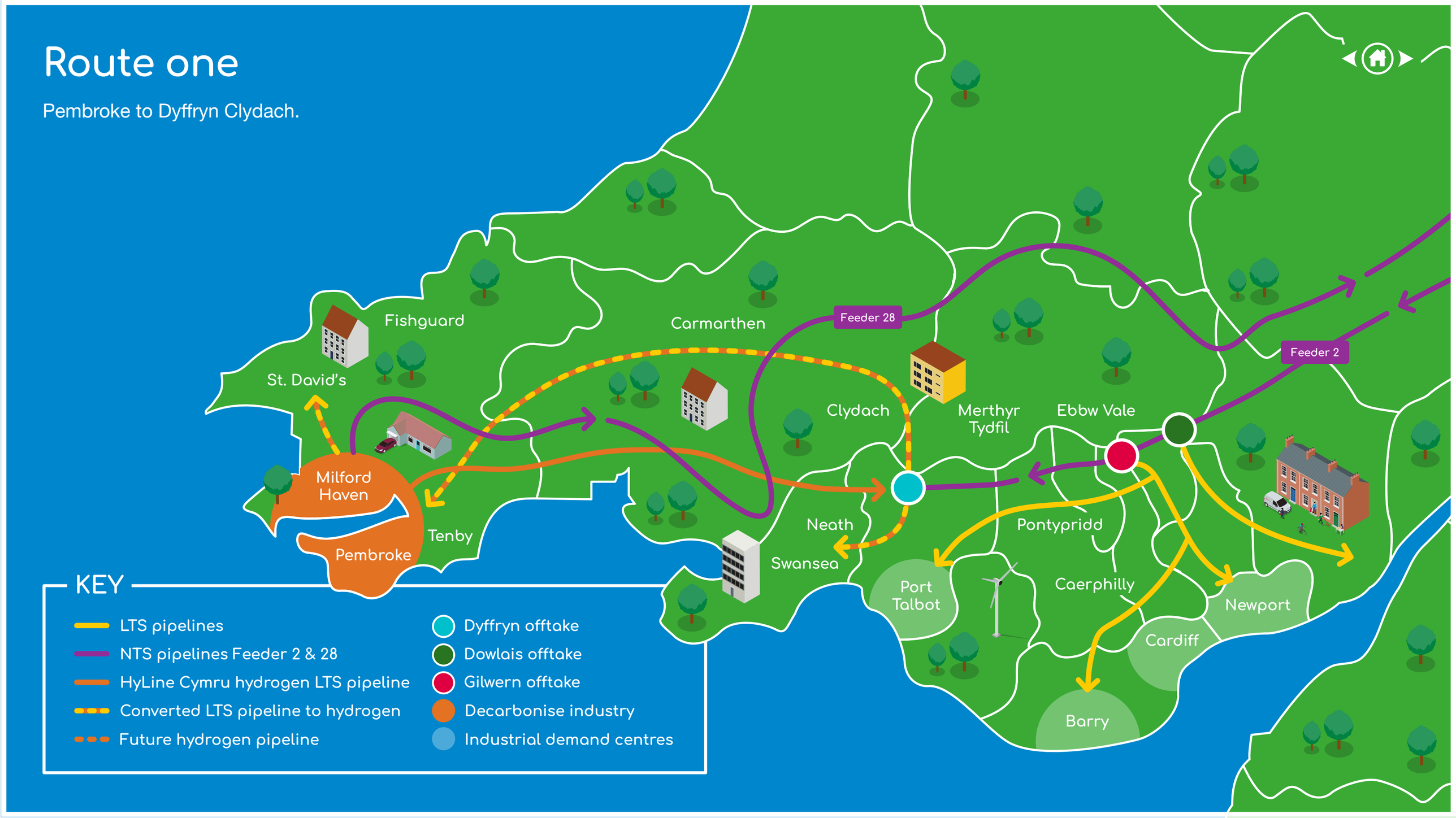
WWU identified four potential routes (R1 to R4) for the HyLine pipeline. These routes have been based on available hydrogen generation at Pembroke and demand profiles for domestic, commercial and industrial use. This takes into account the outputs of direct engagement with industrial partners, whilst also considering forecasted hydrogen demand from industrial gas consumers who are unable to consider alternative means of decarbonisation.

Route ID	Pipeline route	Description
R1	Pembroke - Dyffryn	New hydrogen pipeline from Pembroke to the Dyffryn offtake that serves domestic and commercial properties (including small industry only).
R2	Pembroke - Port Talbot	New hydrogen pipeline from Pembroke to Port Talbot to serve all industry within the cluster.
R3	Pembroke - Port Talbot - South Coast Industrial Demand Centres	Extension of the proposed hydrogen pipeline to serve Port Talbot with the additional industry demand from Barry, Cardiff, and Newport clusters.
R4	Pembroke - Dyffryn - Port Talbot & expansion	New hydrogen pipeline from Pembroke that has the capacity to serve domestic, commercial, and industry demand across all three offtakes in South Wales.

View HyLine routes

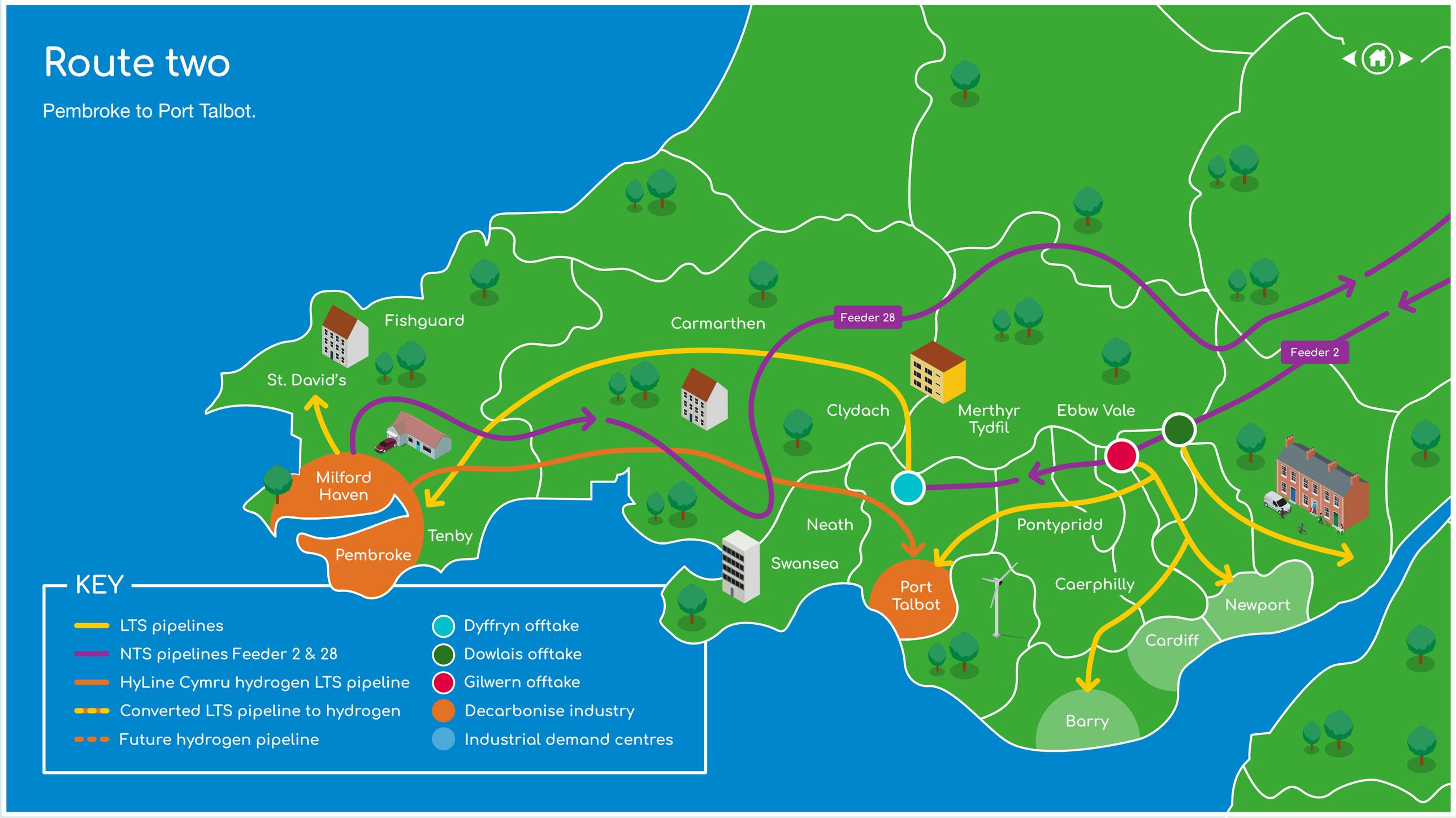
Route one

Pembroke to Dyffryn Clydach.



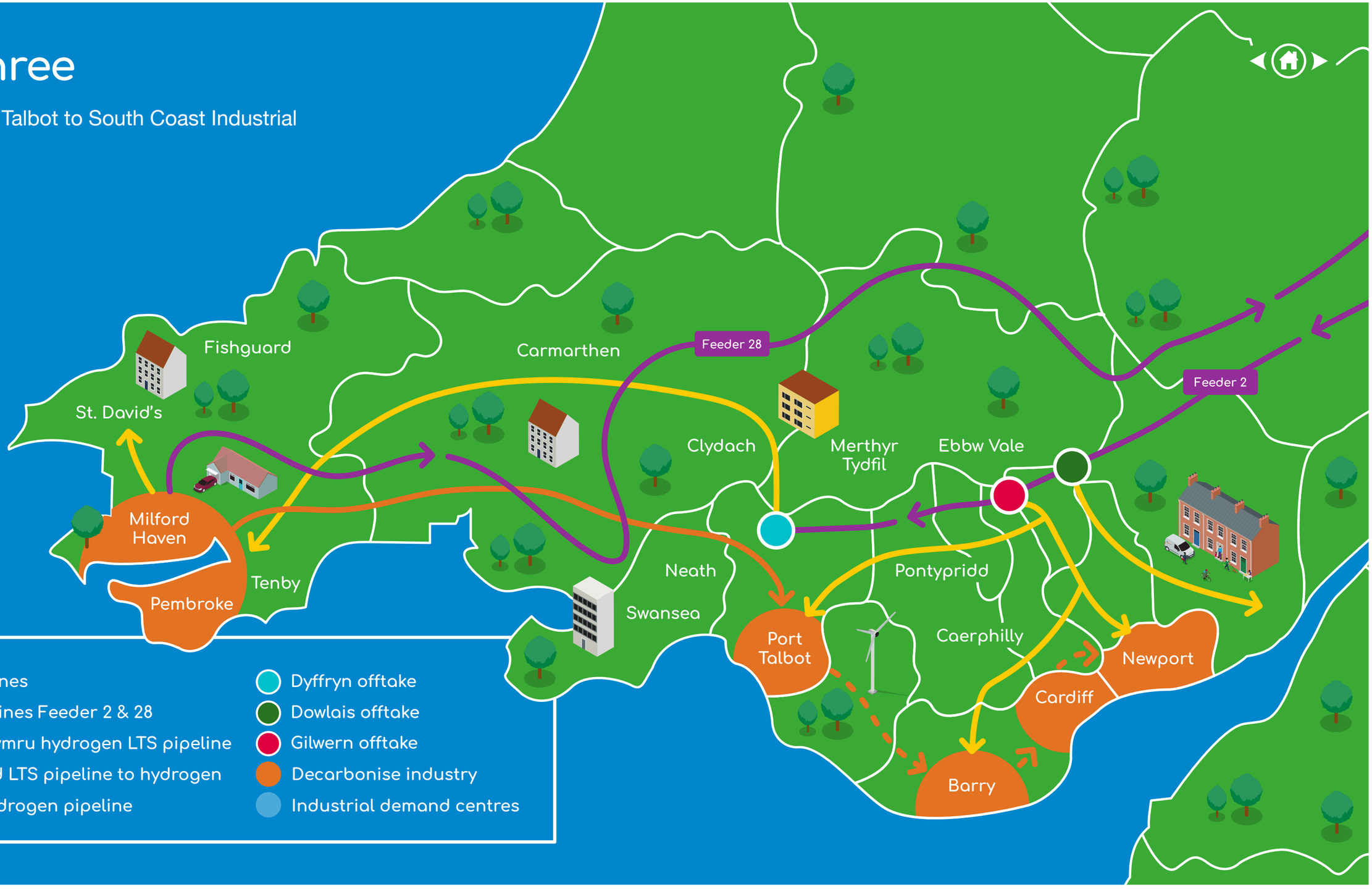
Route two

Pembroke to Port Talbot.



Route three

Pembroke to Port Talbot to South Coast Industrial Demand Centres.



Route four

Pembroke to Dyffryn Clydach to Port Talbot.

Demand development

To develop independent future hydrogen demand scenarios, external literature sources with future hydrogen forecasts were reviewed and compared. This review identified the following relevant sources:

- **Climate Change Committee – Sixth Carbon Budget (CCC – 6CB)**
- **National Grid Future Energy Scenarios (FES – 2021/2022)**
- **Common Future End States (CFES) – South Wales LDZ**

Route ID	Route description	Scenario ID	Scenario description	Low	Central	High
R1	Pembroke - Dyffryn Clydach	S1	Dyffryn Clydach 100% H2		X	
R2	Pembroke - Port Talbot	S2	Port Talbot Industry (Central)		X	
		S3	Port Talbot Industry (High)			X
R3	Pembroke - Port Talbot - South Coast Industrial Demand Centres	S4	Expansion (South Coast)			X
R4	Pembroke - Dyffryn Clydach - Port Talbot	S5	South Wales LDZ			X

10% of home with H2 boilers 10% of homes with hybrid systems	10% of homes with H2 boilers 10% of homes with hybrid systems	60% of homes with H2 boilers 19% of homes with hybrid systems	Domestic
0% gas demand converts	15% gas demand converts	30% gas demand converts	Commercial
20% gas demand converts	30% gas demand converts	50% gas demand converts	Industry
0.49 GWh per day	6.15 GWh per day	21.53 GWh per day	Port Talbort

These sources have distinct decarbonisation pathways that achieve net zero by 2050, with each pathway based on varying levels of consumer engagement, energy efficiency, fuel switching, and prevalence of carbon removal technologies.

Overall, the following scenarios, below, were chosen for the comparison analysis. These were broken down into low, central and high demands and formed the basis of a large matrix of scenarios. This matrix was down selected into five demand scenarios (S1-S5 in the table) to form the most credible scenarios per route. With Route two having two different credible demand scenarios. HyLine has been sized against these demand scenarios.

Low

- Widespread Engagement (CCC – 6CB)
- Consumer Transformation (FES – 2021/2022)
- Low Scenario (CFES)

Central

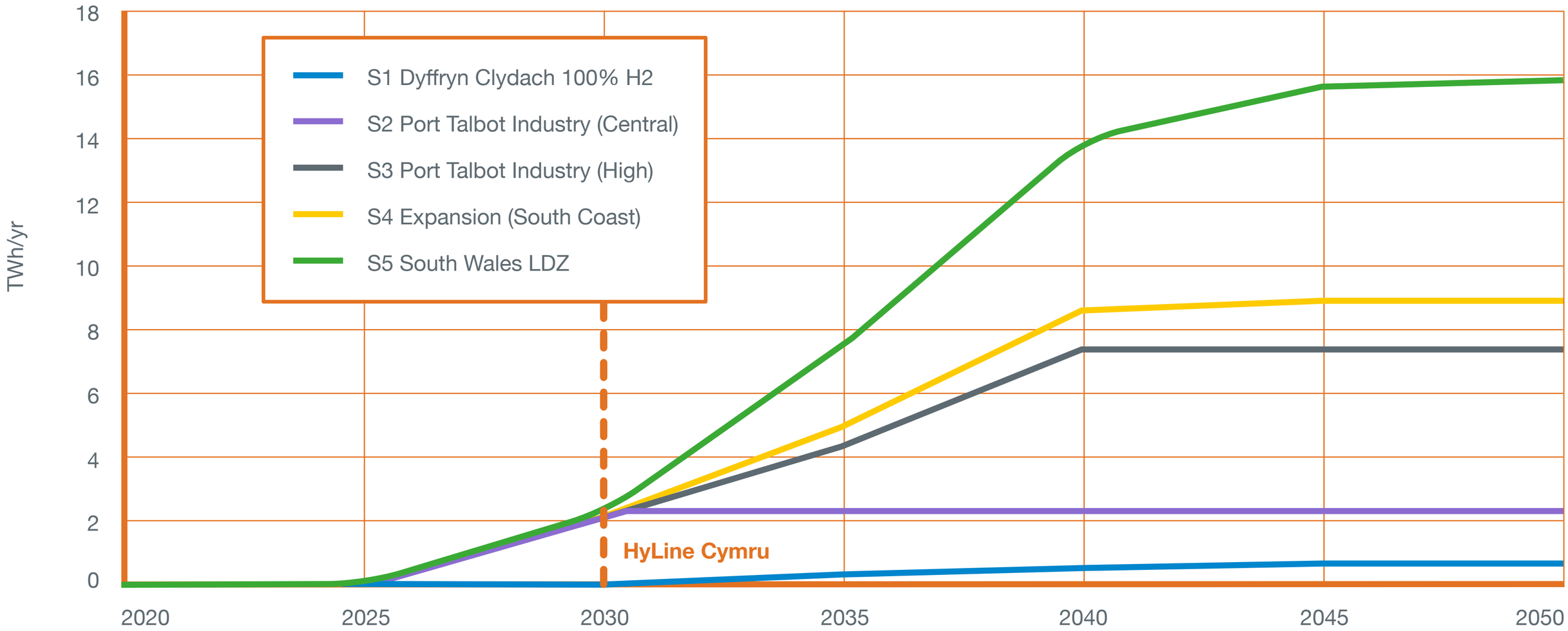
- Balanced Pathway (CCC – 6CB)
- Leading the Way (FES – 2021/2022)
- Central Scenario (CFES)

High

- Headwinds (CCC – 6CB)
- System Transformation (FES – 2021/2022)
- High Scenario (CFES)

Hydrogen demand pathways

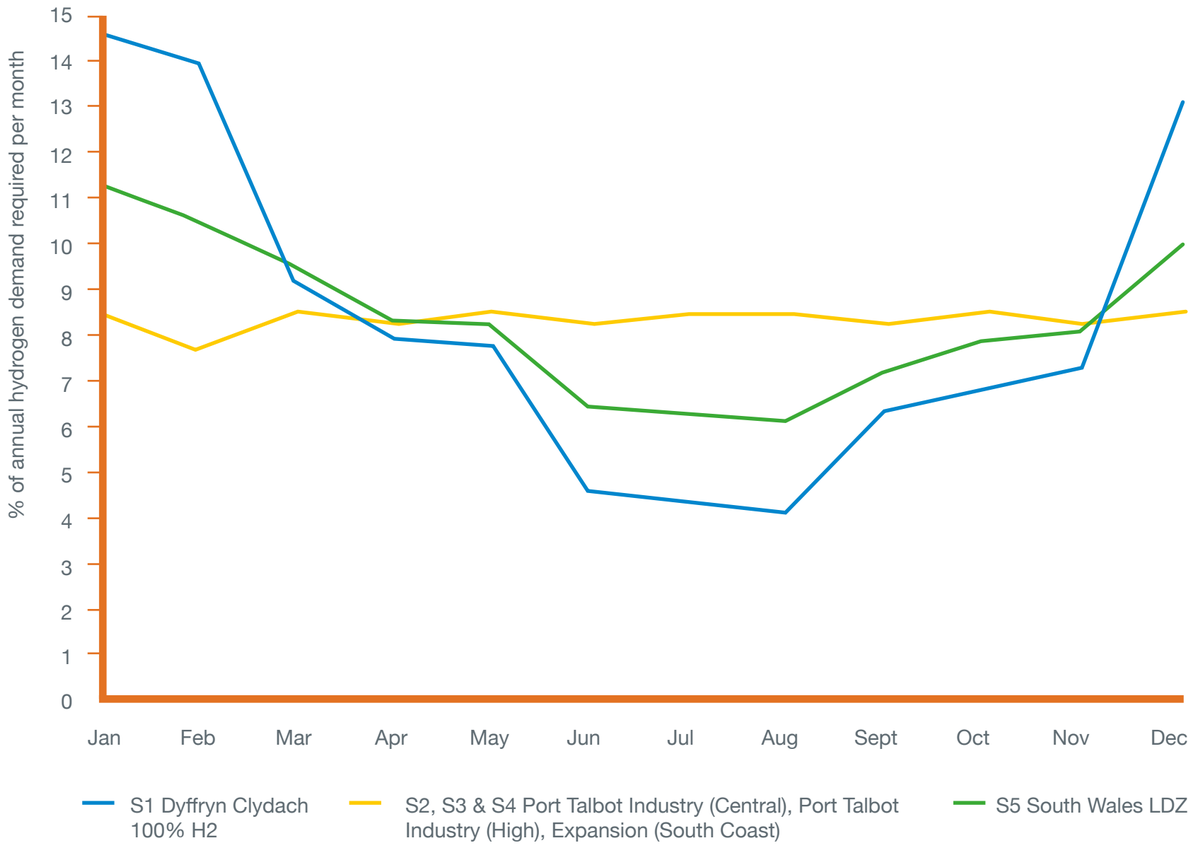
Whilst the 2050 hydrogen demand will ultimately determine the final pipeline sizes, the pipeline will operate based on demand. Hence, it is important to understand how the hydrogen demand will develop over time to allow WWU to plan the future. A future pathways analysis was undertaken to supplement the 2050 end state analysis for each of the five future demand scenarios. The pathways were analysed on five-year intervals taking both stakeholder specific data and more generalised pathways as described in the previous slide.



Seasonality and storage

The proportion for domestic demand in each scenario drives an increased need for storage. The monthly hydrogen demand for each pipeline shows that the Dyffryn Clydach and South Wales LDZ routes are highly seasonal.

This graph shows the seasonal impact on annual demand each month for the 5 scenarios.



The volume of storage required will not only depend on the chosen scenario, but will also depend on the way hydrogen is produced and the flexibility of this process through continuous or variable production, including offshore hydrogen production from wind.

Continuous production relies on a constant supply of renewable power from a mix of local, PPAs and grid

Variable production is linked to offshore wind profiles to supply the renewable power for hydrogen production

Storage capacity required in 2023, 2040 and 2050, for continous and variable production

	Storage capacity, continuous production (TWh)			Storage capacity, variable production (TWh)		
	2030	2040	2050	2030	2040	2050
S1 Dyffryn Clydach 100% H2	0.02	0.09	0.12	0.02	0.09	0.12
S2 Port Talbot Industry (Central)	0.00	0.00	0.00	0.07	0.07	0.07
S3 Port Talbot Industry (High)	0.00	0.00	0.00	0.07	0.24	0.24
S4 Expansion (South Coast)	0.00	0.00	0.00	0.07	0.27	0.28
S5 South Wales LDZ	0.22	1.25	1.42	0.23	1.34	1.53

For most scenarios, there is a change in storage requirements from 2040 due to an increase in demand.

Industrial scenarios S2,S3 and S4 could be managed from a supply based on continuous production. Other scenarios are likely to depend on **Project Union** to access large-scale storage.

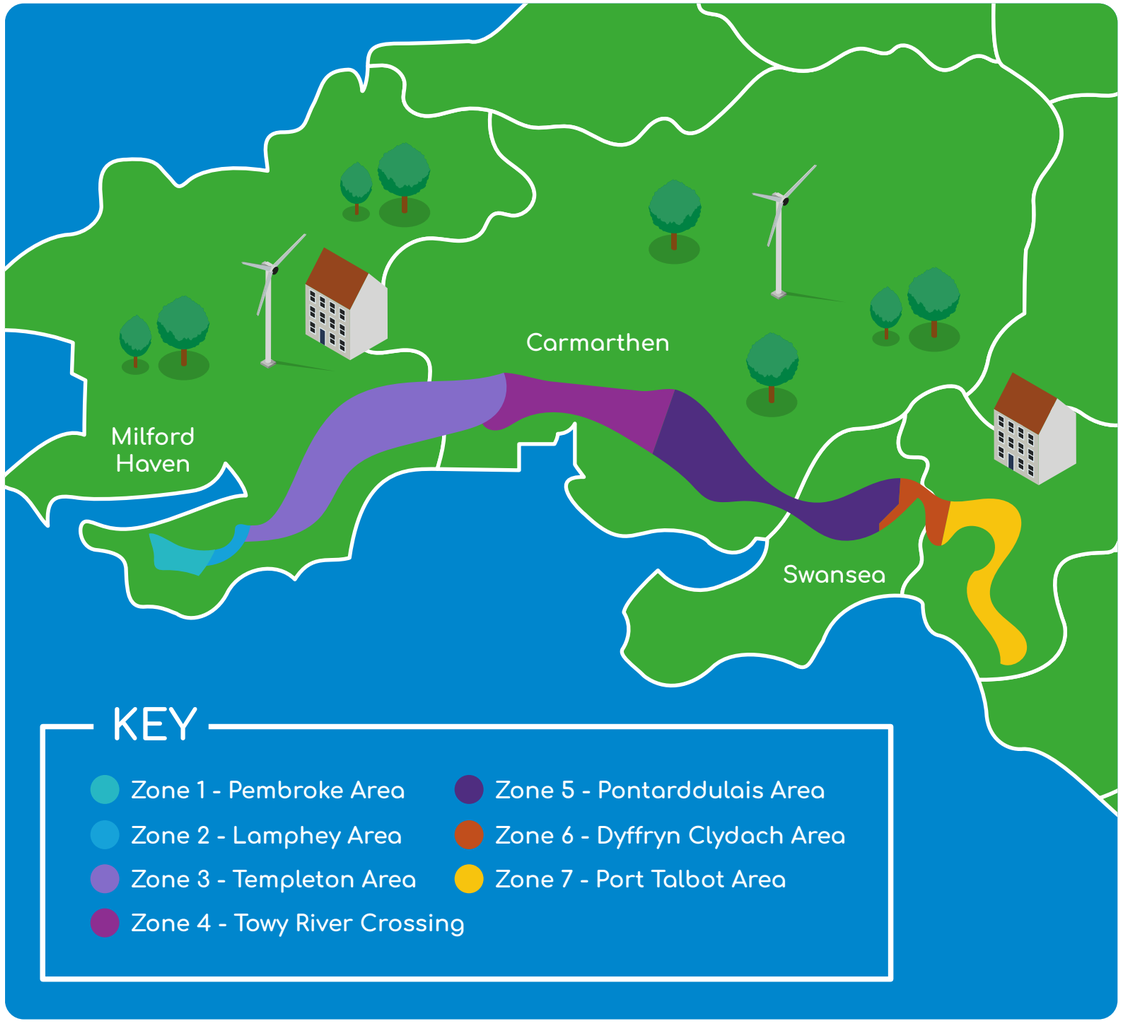
Pipeline corridor selection

A proposed pipeline corridor has been developed based on a set of criteria deisgned to identify a preferred route. This criteria is as follows and based on applicable standards and best practice:

- Route identified on a suitable scale within zones of interest
- Pipeline corridors to avoid running closely to high density traffic, railways, overhead cables, major pipeline and other buried plant
- Route to be kept to a practical minimum
- Route start and finish points
- Consideration of intermediate fixed points along the route
- Route to avoid, as far as practicable, populated areas
- Route to avoid, as far as practicable, any significant environmental, archaeological and future developments and engineering constraints
- Route to take into account minimum proximity distances between the pipeline and normally-occupied dwellings and building

The pipeline would be constructed mainly by underground trench excavation, pipe laying, then reinstatement to the original profile and covering.

Where infrastructure or obstacles are encountered, such as major roads and river estuaries, Horizontal Directional Drilling (HDD) methodology will be considered.



Preliminary design

For the optimisation of capital expenditure (CAPEX), efficient solutions are based on pipelines with minimum wall thickness, optimised design pressures thorough engineering process, best practice and safety.

Appropriate engineering design which follows international codes of practice will ensure that HyLine is constructed and operated to the same safety standards as current natural gas pipelines and following ALARP principles.

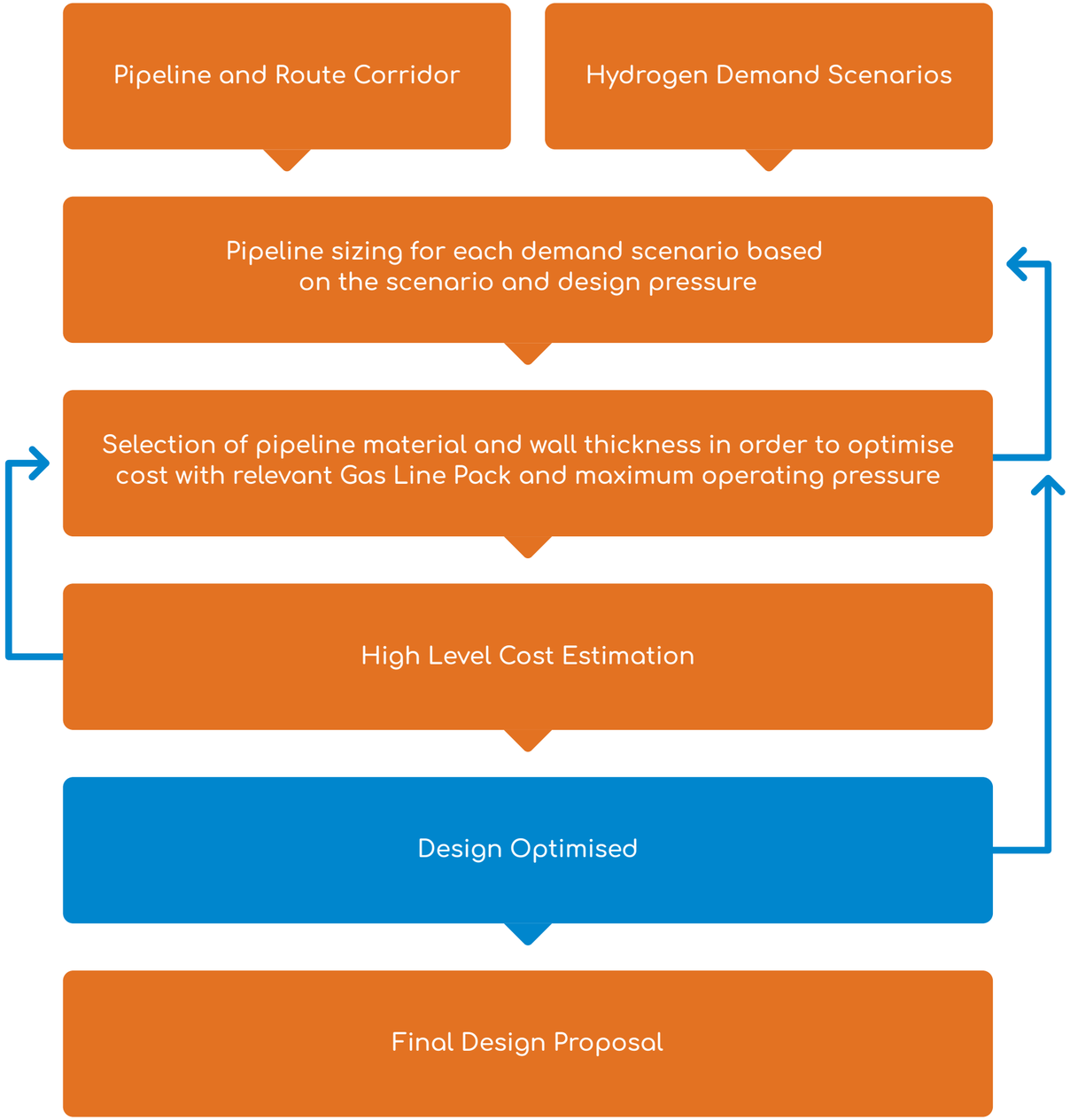
Scenario		Pipeline				
Scenario	Design pressure (barg)	Nominal Diameter (inch)	Steel Grade	Length of pipeline (km)	Capacity flow (scm/h) Note 1	CAPEX comparison %
S1	60	12”	X52	106.5	213,000	100
S2	60	12”	X52	128.1	207,000	127
S3	60	24”	X52	128.1	790,000	239
S4	60	24”	X52	128.1	790,000	239
S5	60	32”	X52	128.1	1,402,000	371

X52 is a grade of steel with superior mechanical strength which is recommended by design the for hydrogen service.

Potential future requirements for the pipeline and how it might fit into the wider UK energy transition may mean that it would operate at higher pressures. Increasing the pipeline design pressure to 75 barg instead of 60 barg would have the following CAPEX impacts:

S1, S2, S3 and S4 would increase CAPEX by 22% - 28%

S5 would require a non-standard pipe size and would increase the CAPEX by 32% - 35%



Project key considerations

There are a number of key considerations that need to be addressed with regards to progressing the project.

Considerations	Description
Supply of hydrogen to the pipeline	Significant work has been undertaken at pre-FEED to identify supply and demand requirements, but it is clear that there are many variables and further work needed to match supply and demand to finalise the pipeline design
Demand / supply match up	Significant work has been undertaken at pre-FEED for supply and demand requirements but it is clear that there are many variables. The early FEED work will look to address this.
Commercial agreements	Reaching a final investment decision will require commercial agreements to be made between suppliers and consumers, as well as the entire supply chain. These are likely to need significant external funding, with no agreements or funding mechanisms currently in place.
Managing variation in demand and supply	Initial estimates for above ground storage to manage variation in demand are large. The project will investigate if this can be controlled via a large flexible user, at source (electrolyser) or via project union tie in.
Planning approval	Is a complex process with a challenging route through and is currently being investigated. Consent is likely to be needed to authorise the construction of any proposed pipeline route, including rights over land to enable the installation and future retention of the pipeline. The proposals would also need to be assessed to understand their likely significant effects on the environment. In addition, national and local policies would need to be considered and, where relevant, applied in presenting the case for a proposed route. The specific pathway to seeking authorisation for the construction of a hydrogen pipeline in Wales is subject to ongoing consideration.
Regulatory approval	A complex process and could be driven by policy (2026). The project is actively engaged with Ofgem.
Supply chain	With potentially multiple infrustructure projects in the UK the project will need to ensure sufficient skilled labour is avaliable to meet the schedule.
FID approval	Stage gates delayed, financial commitment/funding etc
Legal	The project will investigate arrangements for all stages of the project.

Next steps

The development of a hydrogen pipeline system will need close coordination with producers and offtakers who lie upstream and downstream of each other and the pipeline respectively. The next phase will explore the sufficient support needed and its availability for each of these parties to make a coordinated investment decision.

A clear and coordinated pan-UK strategy for hydrogen and CCS needs to be established, to facilitate large-scale hydrogen transportation and storage for industry. This should build on the Energy Network Association's hydrogen vision for the UK, along with nationally significant projects such as HyLine and Project Union.

Further appraisal of the route options will take place during the next stage in the development process. This will align closely with the strategy and next steps regarding the consenting position for pipelines in Wales. It will include public consultation on potential/preferred routes, engagement with key stakeholders (including industrial offtakers, local and national decision makers) and early environmental/survey work.

Technical areas would be carefully considered, including matters such as economic benefits, sustainability and the strategic communications and consultation processes as part of any consenting route.

Timelines

The key considerations and next steps have fed into a delivery timeline which considers how HyLine Cymru will need to be delivered alongside major production, and customer-led projects in order to maximise the possible benefits.

Offtaker agreements and pre-consentng
2024

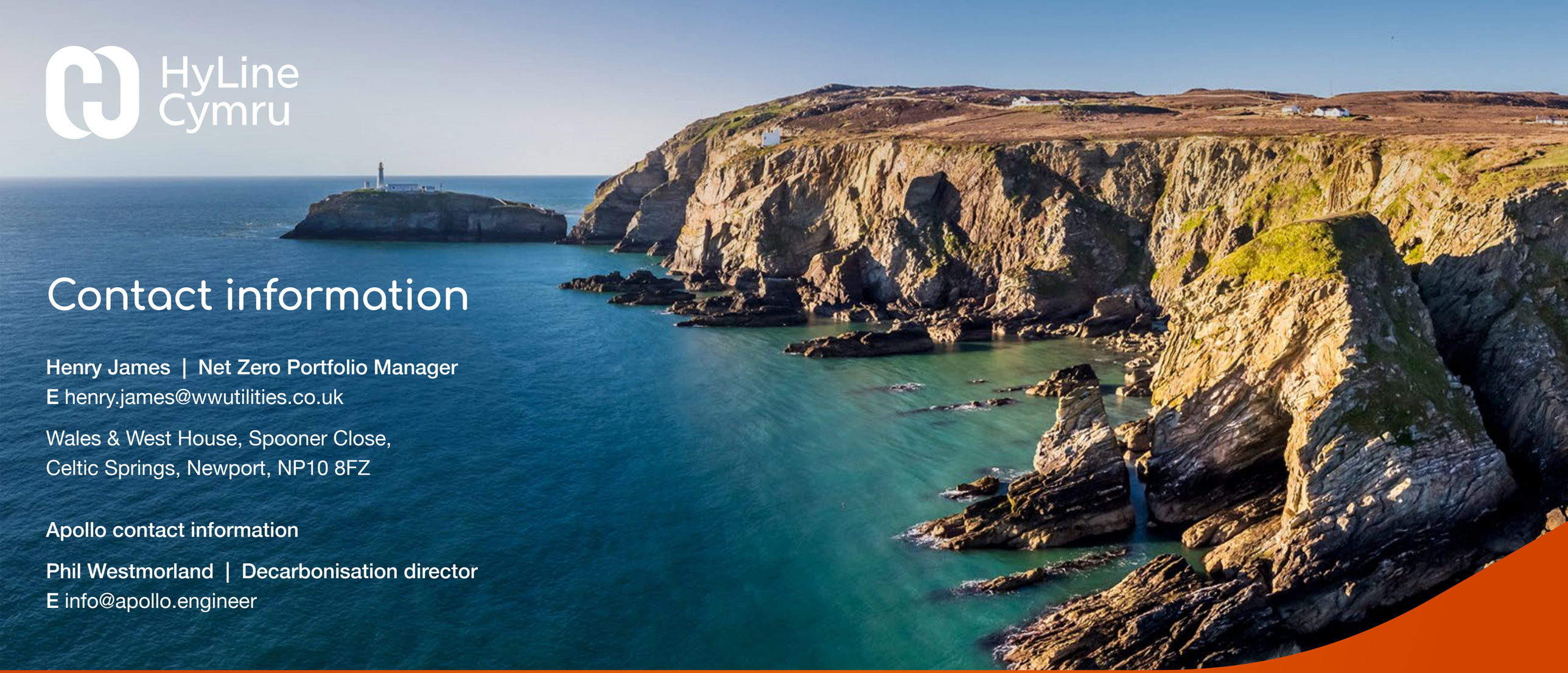
Planning, Public Consultation and Consenting
2025 - 2028

Front End Engineering Design (FEED)
2025

Detailed Design
2027 - 2028

Construction
2028 - 2032

HyLine Cymru



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Delivery lead

apollo

Delivery partners

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