Western Gateway
Porth y Gorllewin

Developing the Western Gateway as the UK's Green Energy Powerhouse

Western Gateway Hydrogen Opportunities and Delivery Pathway 2050.

Powering a greener, fairer future

June 2023

Foreword

Communities across South Wales and Western England have a long history of powering innovation and supporting trade for the rest of the UK.

Today, with globally respected research institutions, universities and world leading manufacturing and engineering companies based across the area, our communities are still working at the cutting edge of digital and net zero technology.

Our area is home to 4.4 million people, it supports 2.1 million jobs and contributes £110bn a year to the UK economy.

Through the Western Gateway Partnership, our local authorities, businesses and academia have committed to becoming the UK's Green Energy Powerhouse, powering efforts to reach net zero and creating new opportunities.

Working together, we believe we have the expertise and strategic resolve to achieve this. Not only are we home to world leading companies and innovative business clusters but we are also a hub for some of the sectors which face the biggest challenges to decarbonisation. We have the UK's largest aviation cluster with 14 of the 15 world's largest aerospace manufacturers in the area and the might of South Wales's Industrial Cluster within our geography.

We want to ensure the UK can be a world leader in net zero energy, discovering the future of sustainable flight, decarbonising industry and more. By publishing these headlines, we want to highlight the opportunities to grow the UK economy that can be achieved by supporting Hydrogen and other net zero projects in our area.

Not only are we promoting these opportunities, we are also providing a plan for how this can be achieved.

This is only the start. We are continuing to work across our public-private partnership to see how the area can put this plan into action. We know it is the private sector's innovation that will be a key driver for delivering this and we want to support that.

Follow the Western Gateway as we look to create a greener fairer future.

Katherine Bennett CBE,
Chair of the Western Gateway Partnership

Last year, we mapped our Hydrogen ecosystem across South Wales and Western England. We now want to look at how we use those assets and local skills to play a significant role in making the UK a world leader in decarbonisation.

The Western Gateway Hydrogen Delivery Pathway to 2050 outlines that vision. It presents in practical detail how low carbon hydrogen could help meet our net zero targets.

We demonstrate that Hydrogen will not answer all our energy needs. We show that it will play an important role in providing energy security for several key sectors.

Producing this work, we have benefitted greatly from the work and specialist experience of our members and partners. We are especially thankful to:

- The South Wales Industrial Cluster partners, whose Cluster Plan was launched in April.
- The ambition of Hydrogen South West, an industry-led collaboration of major national and international organisations driving the transition to a hydrogen economy.
- Our strategic partnership with the GW4 Alliance and other universities and innovation organisations who have contributed knowledge and expertise
- Our public sector partners who continue to support the work of our partnership.

Our Net Zero mission presents opportunities for new technologies, for inventions, for new skills. To find new ways of powering our dynamic economy.

We want to become a UK model for that future economy. We seek to understand what barriers need to be removed to allow full use of Hydrogen. Deployment will support existing and create new jobs. It will open new opportunities for our businesses locally, nationally and internationally.

Our pathway shows how these clean energy production methods can work alongside established electrification solutions, in an integrated way that makes sense. It sets out to show where we are currently strong, from skills to private sector capacity. We are also clear where we need to do more work, by when.

We are very grateful to everyone who has invested their time responding to our consultation, helping us to develop our pathway to 2050. It is that partnership working, public and private, that will deliver us the greener future ahead.

Paul Moorby OBE,
Chair of the Swindon and Wiltshire Local Enterprise Partnership and Chair of the Western Gateway Hydrogen Committee.

Our hydrogen opportunity

The amount of low carbon energy generation the area needs is dependent on many variables but there are critical points in determining the scale of demand for hydrogen and the means by which this supply could be met. These include:

1. The UK Government's decision to move to 20% blend and 100% hydrogen in the gas network, with decisions due in 2023 and 2026 respectively.
2. The decision on the use of hydrogen in decarbonising the UK's steel industry. 2035 is a critical milestone for this decision and could establish a base load for hydrogen demand and the infrastructure to support it.
3. The capacity of the national grid to support new connections and its ability to transmit electricity from large and smaller scale, distributed renewable energy generation projects.

Research and innovation-led Green Energy Powerhouse

The Western Gateway Partnership has committed to ensuring that the area can become the UK's Green Energy Powerhouse. In our 2022 prospectus, our local leaders and business representatives committed to five missions designed to create a Greener, Fairer Future.

Together, we want to harness the capabilities of our research and innovation centres of excellence, alongside the ambition and drive of the area's industry leaders, energy generators and infrastructure providers to decarbonise our economy and create opportunities.

Home to world leading industry, innovative business and internationally recognised research organisations, the Western Gateway area is ideally positioned to become the test bed for hydrogen production, distribution and use enabled by our access to research and innovation excellence developed in our area. These include expertise in propulsion systems, future fuels, hydrogen storage and nuclear energy.

Key facts based on our research

‘The UK Government’s ambition is to generate 10 GW of hydrogen by 2030 of which at least half is to be low carbon hydrogen produced using renewable energy sources’

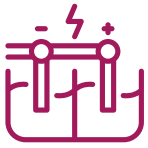
Our research has looked at three scenarios to forecast hydrogen supply and demand

- Necessities - essential uses of hydrogen
- Balanced use of electrification and hydrogen solutions
- Widespread use of hydrogen

Hydrogen forecasts GWh in 2050	Necessities	Balanced	Widespread
Energy demand	28,000	38,000	81,000
Energy supply	31,000	39,000	61,000

(A gigawatt hour is a measure of electricity generation of 1 GW produced over one hour.)

Hydrogen use could create around **40,000** jobs and protect over **60,000** existing jobs in the area



The UK Government pledged over **£340m** in hydrogen demonstrator projects

Sectors with largest demand for Hydrogen:

Industrial process

Heating

Road transport

Potential sectors who could use Hydrogen:

Aviation

Maritime

Stimulate up to **£9bn** of private sector investment

Green House Gas savings from hydrogen: between **7,000kt** and **21,000kt** by 2050

Western Gateway capital investment requirement	Necessities	Balanced	Widespread
2030	£11m	£450m	£994m
2050	£8bn	£32bn	£62bn

Decarbonising the economy of the Western Gateway area

We are confident that the area has the right combination of partners, ambition and expertise to help play a significant role in driving the national transition to net zero, protecting jobs and creating new opportunities.

Western Gateway Hydrogen opportunities

1. Jet Zero and Hydrogen Aviation Gateway

The Western Gateway area is home to an internationally recognised and embedded aerospace cluster, with 14 out of the 15 world's largest aerospace engineering firms based in the area. Our global aviation companies are leading the world in hydrogen aircraft design and engineering, hydrogen and hybrid engine design and research to cryogenic fuels. Our area could become the UK's Hydrogen Aviation Gateway securing the UK's position as an international leader in sustainable and low carbon flight.

Airbus

2. Decarbonising energy intensive industry

Industrial processes are one of the major sources of carbon emissions globally. Finding solutions to decarbonising this sector is critical to the UK and the world reaching net zero. The South Wales Industrial Cluster Plan clearly demonstrates the commitment of large industrial players across Wales to decarbonise their activities as well as articulating the levers they require from governments to do so.

The Western Gateway area could play an important role in generating a potential base load demand for hydrogen for industrial decarbonisation, facilitating the development of the infrastructure required to distribute hydrogen across the South Wales as part of the national distribution network 'Project Union'. Our area stands ready to ensure the UK can be a global leader in the crucial issue of industrial decarbonisation.

Port Talbot

3. Rail Gateway

Our area is already a centre for rail innovation with industry leaders like CAF in Newport, Siemens in Chippenham, Bristol's Station Innovation Zone and the Global Centre for Rail Excellence (GCRE) in South Wales. Opening in 2025, GCRE will provide world class research, testing and certification of rolling stock, infrastructure and innovative new rail technologies. Our area is ideally placed to combine its rail innovation assets with the need to trial new solutions for the UK and overcome the challenges that decarbonising rail presents especially in hilly and mountainous areas and where routes have not been electrified.

There are common barriers which need to be overcome to achieve net zero and enable low carbon energy production solutions. These will require the public and private sectors to work together on a range of issues including a clear national policy, improved grid capacity, access to finance and skills development. Organisations like the Western Gateway can help provide the link between the public and private sector to provide regional strategies to enable the UK to take advantage of the opportunities available.

National policy

Having the right policy, planning, regulatory and financial business models in place will be critical in enabling projects to be developed and delivered within reasonable timescales. This will require local planners and regulatory teams to have the right skills and capacity to respond effectively to manage the pipeline of projects seeking approvals.

Capital investment

The scale of capital investment our area required to build out the supporting hydrogen infrastructure to 2050 is substantial, ranging from £8bn to cover the minimum requirements to meet existing demands for low carbon hydrogen by industry, through to £62bn if hydrogen has widespread use and incorporates the demand for hydrogen for industrial process, domestic and commercial heating and transport uses. Access to sufficient finance, from both the private and public sector sources, will be a critical and a potentially limiting factor in delivering the area's ambition.

Skills

The transition to a low carbon economy will not progress without investment in the development of skills within the existing workforce and to inspire the future pipeline of workers needed to support a net zero economy. Skill demands are likely to be far-reaching and include engineering design, manufacturing, project design, project management, distribution, construction, logistics, maintenance and servicing, health and safety, finance, legal, procurement and planning services.

Work is underway nationally, to foresight the future skills needed to deliver the UK's transition to a net zero economy including hydrogen-related specific skills. Training providers in the area have already started to come together to support emerging hydrogen skills requirements with more work needed to map our area's specific future skills demands.

Next steps

The detailed technical review of the Western Gateway area's existing energy supply and demands and hydrogen forecasts through to 2050 has been compiled.

It presents three hydrogen use scenarios, all of which enable our area to reach net zero by 2050 and take into account a wide range of decarbonisation solutions including the use of hydrogen.

Whilst hydrogen is unlikely to be the whole answer in achieving net zero, there is broad agreement that it needs to be part of the solution. Building on our area's skills, resources and innovation assets, we want to unlock the potential of hydrogen technologies to ensure the UK leads the world in finding solutions to enable the transition to net zero by 2050. Based on our partnership's work, our vision is that:


GW4 Alliance

> By 2050, the Western Gateway area is internationally recognised the UK's foremost green energy supercluster delivering a productive net zero economy for its businesses and residents which is driven by research and innovation, delivered by major capital investment, and enabled by an appropriately skilled workforce, powering a greener fairer future for all.

Our call to action

Collaboration will be at the heart of realising this ambition and delivering the Western Gateway's Hydrogen Delivery Pathway to 2050.

An extensive set of actions have been suggested through interviews and the consultation exercise, some of which the Western Gateway Partnership and its members could lead on in the short to medium term. This includes working with UK and Welsh Governments, industry, academia and innovation organisations, and skills providers to:

1. Ensure low carbon hydrogen production comes on stream where and when it is required;
2. Enable hydrogen distribution networks and storage solutions to be available to facilitate its movement and use;
3. Build confidence amongst off-takers to invest in hydrogen solutions where there is a clear case for them to do so;
4. Enable the hydrogen innovation expertise developed by academic institutions and centres of excellence to be translated into industrial application and commercialised;
5. Develop the supply workforce skills needed to enable hydrogen projects to be delivered when required; and
6. Speak with a common voice to urge the UK Government to set in place the policy framework and financial instruments required to attract investment and achieve net zero.

The next phase of work which the Western Gateway Partnership will undertake will be to work with our partners and stakeholders to develop a delivery plan which clearly sets out the actions which can be progressed identifying the lead organisation and collaborations best placed to do so.

We are very grateful to our stakeholders who have invested their time in providing evidence as well as reviewing and testing the work undertaken to date as well as those organisations which participated in the consultation exercise.

Aerial view of the Milford Haven Energy Kingdom

	2020s	2030 to 2034	2035 to 2039	2040s
Supply	• Small floating offshore wind projects in Celtic Sea (Erebus and Valorous) to be built • Blue hydrogen production plans finalised (Milford Haven and Port Talbot are likely locations)	• Floating offshore wind capacity in Celtic Sea expected to ramp up, large scale electrolytic production increases • Blue production plants building begins	• Electrolytic production continues to increase. Fully decarbonised electricity grid by 2035 enables zero carbon grid top-up for electrolysers • Blue hydrogen production plants built and begin serving large industrial demands by 2035	• Large scale electrolytic production active • Blue production plants expand to serve wider heating and industrial demands in South Wales (Balanced and Widespread scenarios only)
Networks	• Blending to 20% vol to begin (likely post 2025) (Balanced and Widespread scenarios only) • Feasibility studies for dedicated hydrogen distribution lines (e.g. HyLine)	• Hydrogen transmission line (HyLine) built to connect Milford Haven to Port Talbot • Blending to 20% vol complete (Balanced and Widespread scenarios only) • Distribution zones to be repurposed for 100%vol hydrogen identified (Balanced and Widespread scenarios only)	• Possible extension of HyLine hydrogen transmission line from Port Talbot across the rest of South Wales (Widespread scenario only) • Repurposing distribution networks 100%vol hydrogen begins (Balanced and Widespread scenarios only)	• Hydrogen transmission line (HyLine) extended further east across the rest of South Wales to serve industrial and heating demands (Widespread scenario only) • Hydrogen transmission line built from Dorset Salt Caverns running up north to towards Bristol (Widespread scenario) • Repurposing to 100%vol is finalised (all networks under Widespread hydrogen, only localised networks to blue production under Balanced hydrogen)
Demand	• Blending to 20% vol kickstarts demand for hydrogen (Balanced and Widespread scenarios only) • Aviation: Acceleration of demonstration/trial projects (e.g. SAF production at Lanzatech) • Transport: Hydrogen demonstrators commence e.g. at the Global Centre of Rail Excellence in Neath Port Talbot • Heating: First installation of hydrogen ready boilers commences in Western Gateway • Industry: Feasibility studies into fuel switching to hydrogen	• Significant demand due to blending to 20% vol by early 2030s (7% of energy demands of gas grid) (Balanced and Widespread scenarios only) • Heating: Installation of hydrogen ready boilers in distribution zones identified for 100% hydrogen conversion (Widespread and Balanced scenarios) • Transport: Uptake of hydrogen buses, LGVs, HGVs and small number of cars begins. Uptake of hydrogen for rail begins in order to meet target of removing all diesel trains in UK by 2040 • Industry: Demonstrator projects for hydrogen use as a fuel	• Heating: Gas boiler ban accelerates hydrogen for heating (Widespread scenario), or electrification for heating (Balanced and Necessities only scenarios) • Industry: Fuel switching to hydrogen begins • Aviation: Direct hydrogen aircraft start to enter fleet, synthetic kerosene starts to enter aviation fuel mix • Marine: Ammonia powered ships start to enter fleet	• Gas grid demands (heating, industry) fully switched to hydrogen by late 2040s • Uptake of hydrogen HGVs to accelerate post 2040 after conventional ICE ban

Key Dates

2023
- Decision on 20% vol blending

2025
- Gas boiler ban for new homes
- Gas blending regulatory framework completion

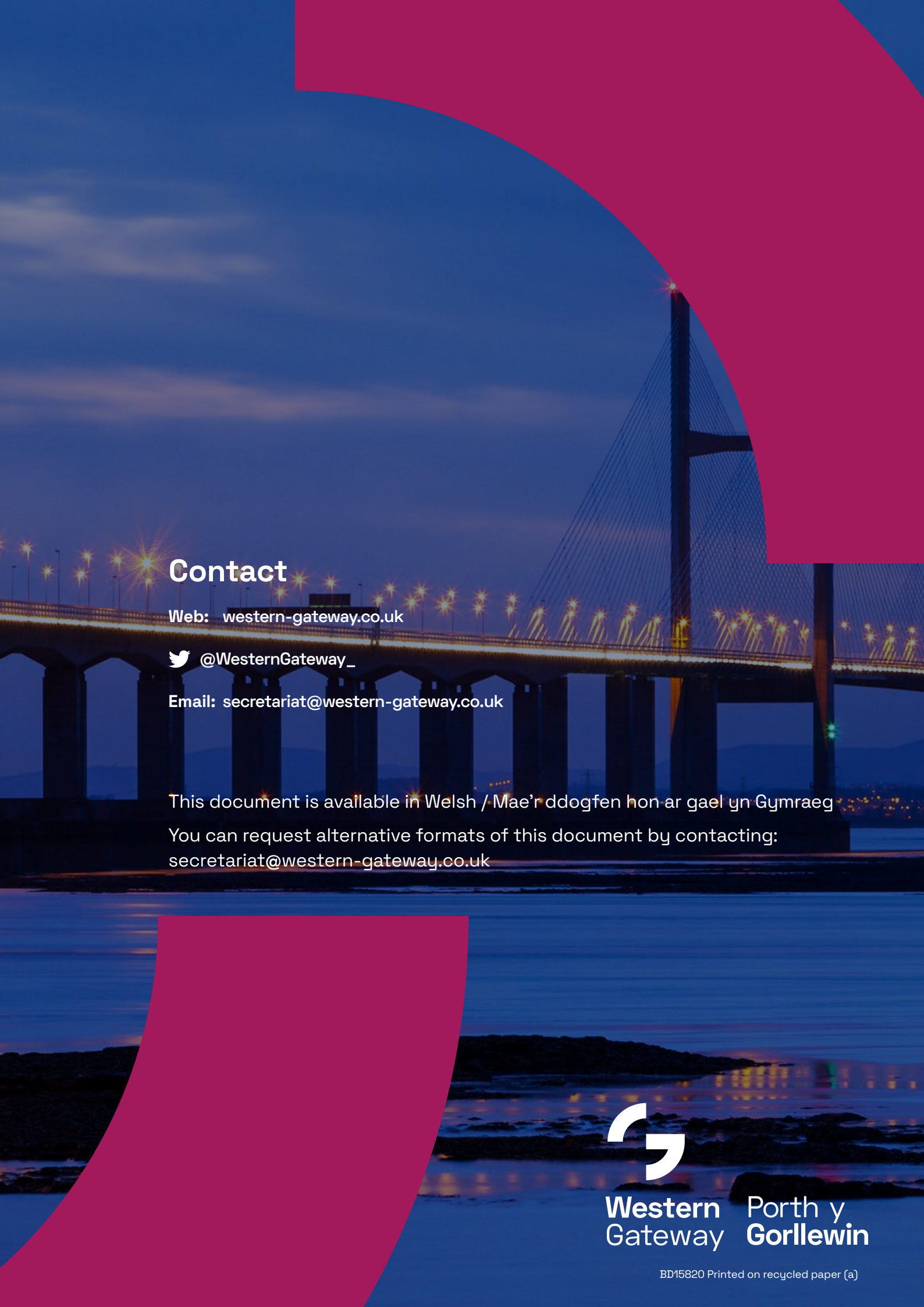
2026
- Decision in hydrogen for heating due

Early 2030s
- Future of Port Talbot to be determined – align to 2035 policy decisions
- Irons Mains Replacement Programme will be complete

2035
- UK Government target to fully decarbonise the power system
- UK ambition for industrial fuel switching to 50 TWh of hydrogen

2040
- Target of removing all diesel only trains in the UK
- Sale of new ICE HGVs to be banned completion

2050
- Wales & UK Net Zero Carbon Emissions targets



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