regen
transforming energy

Floating offshore wind opportunity study for the Heart of the South West

CONTENTS

You can navigate this report by clicking on the green arrows or by returning to this page by clicking the contents button in the top right. There is also extra information contained within rollovers (highlighted text). Click on these to find out more. To minimise the rollovers, either click on the cross or click on the highlighted text again.

Cover image and contents image credit: Principle Power

CONTENTS

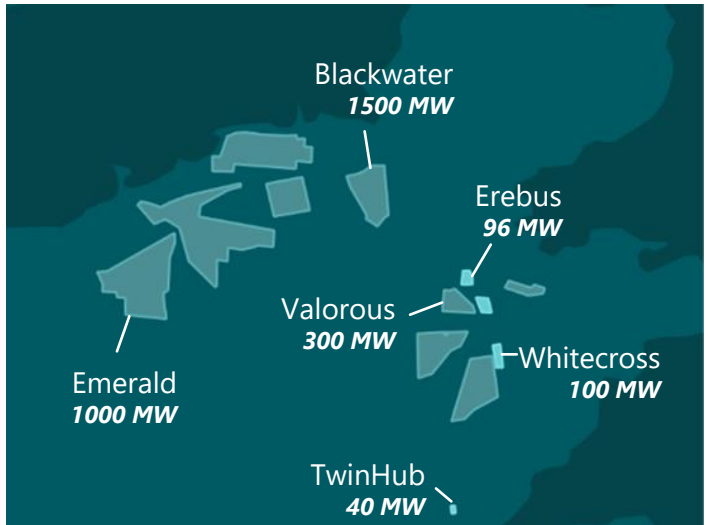
EXECUTIVE SUMMARY

The Celtic Sea has previously been overlooked for fixed offshore wind development due to the seabed depths. However, floating offshore wind (FLOW) has reignited the opportunity for high-integrity, mission-critical renewable energy projects in the South West.

This report identifies the challenges and opportunities for FLOW in the Celtic Sea. It also outlines the existing strengths of the Heart of the South West (HotSW) region and the role the area can play in helping to support the development of FLOW, overcome challenges, and maximise the potential benefits for the area.

FLOATING OFFSHORE WIND IN THE CELTIC SEA

In November 2021, The Crown Estate announced its ambition to award 4 GW of seabed rights to FLOW projects in the Celtic Sea, to be deployed by 2035. FLOW projects currently take between eight and ten years to develop.



Current FLOW projects announced for the Celtic Sea

The Offshore Renewable Energy Catapult suggests that FLOW in the Celtic Sea could provide 3,000 jobs and £682m in supply chain opportunities for both Wales and the South West of England by 2030. Processes involved in developing FLOW supply chains, including the decisions around the location of critical infrastructure, have already begun.

The economic opportunities of FLOW will only be fully realised if a significant proportion of the supply chain elements are provided by local companies at the early stages of development. Therefore, there is an urgency for local businesses and sector organisations to position themselves quickly to take full advantage of the opportunities presented by FLOW project development in the Celtic Sea.

The HotSW, covering Devon, Plymouth, Somerset and Torbay, is well situated to maximise supply chain opportunities, with the North Devon coast being approximately 60 miles from the closest Celtic Sea leasing zone.

A CHANGING APPROACH TO DEVELOPMENT

While there is no lack of appetite from both industry and regional and national governments for FLOW in the Celtic Sea, there are a number of challenges facing this burgeoning sector:

- **Grid connectivity** – providing the necessary offshore and onshore electricity network infrastructure, whilst minimising costs, project risks and impacts on marine and coastal communities and the environment.
- **Ports and logistics infrastructure** – ensuring that there is the space, suitable quaysides and adequate water depths needed to manufacture, assemble and operate FLOW projects.
- **Supply chain development** – ensuring there are the qualified companies and the skilled workforce needed for the scale of the FLOW opportunity.
- **Innovation** – the challenges of FLOW in deeper waters require a high degree of innovation in construction, logistics, mooring and operations.
- **Data and spatial planning** – enabling actions to reduce cost and risk by sharing data and conducting an integrated spatial design and Habitats Regulations Assessment (HRA).

EXECUTIVE SUMMARY

While the FLOW developments in the Celtic Sea represent a significant long-term opportunity for the HotSW region, as well as the wider South West and South Wales, a lot of the skills and capabilities needed in the supply chain will be transferrable between many marine engineering and offshore renewable energy sector applications. This study identifies the key opportunity areas for HotSW presented by FLOW developments in the Celtic Sea, and across the UK:

- Areas of strength in the supply chain, including environmental and professional services, marine engineering and marine operations
- Appledore as a centre for new vessel design and marine engineering in northern Devon, with a focus on clean maritime propulsion
- Plymouth marine cluster and Oceansgate as a centre for marine industries
- Skills and training, leveraging the existing maritime and engineering training facilities across the region
- Innovation and test facilities, including Smart Sound Plymouth and university test facilities in Exeter and Plymouth
- The development of marine technologies ('blue tech'), including clean propulsion systems, marine autonomy, anchoring and mooring systems
- Leveraging Hinkley C supply chain capabilities and skills
- Collaboration with broader South West and South Wales stakeholders.

The following page explores each of these opportunity areas in more detail.

University of Exeter

Oceansgate, Plymouth

Appledore

Hinkley C

University of Plymouth

Exeter Science Park

➢ SUPPLY CHAIN CAPABILITIES

The Sector Deal between the UK Government and the offshore wind sector, agreed in March 2019, sets a target of achieving 60% of the offshore wind supply chain to be UK based by 2030. The HotSW has a long history in the marine and maritime industries, and there are already many companies working in relevant supply chain elements. This includes environmental and professional services, marine engineering and design and marine operations.

➢ APPLEDORE AS A CENTRE FOR NEW VESSEL DESIGN

With its existing facilities and links with industry, as well as its recent acquisition by Harland & Wolff, Appledore shipyard is well placed to capitalise on demand for the new vessels that will be needed for offshore wind development. There is also significant brownfield space adjacent to the main Appledore site, including Harland & Wolff's New Quay site and Torridge District Council's Middle Dock site.

➢ PLYMOUTH MARINE CLUSTER

With a city-wide focus on delivering clean growth and decarbonising the marine industry, the presence of the UK's first Marine Enterprise Zone, Oceansgate, and the recent allocation of Freeport status, Plymouth's role in the development of FLOW is a key opportunity for the HotSW region. Plymouth is also internationally recognised for its world-leading maritime research facilities.

➢ SKILLS AND TRAINING

By investing in the development of relevant transferable skills, HotSW can ensure that the necessary expertise is available across the entire FLOW supply chain. The growth and development of FLOW in the Celtic Sea represents a long-term employment opportunity for the HotSW, and it is crucial to ensure younger generations have the required knowledge and skills to keep the industry evolving, not just locally, but also on a national and global scale.

➢ INNOVATION AND TEST FACILITIES

FLOW is still in its infancy, which presents an opportunity for extensive research and development to inform and enable the supply chain. The HotSW region is renowned for its academic and research capabilities, including the University of Exeter and the University of Plymouth. HotSW also boasts world-leading marine test facilities, such as the COAST test facility, Smart Sound Plymouth and Brixham's marine laboratory.

➢ MARINE TECHNOLOGIES (BLUE TECH)

The development and advancement of marine technologies ('blue tech') are becoming ever-more prominent for FLOW, supported by reductions in costs and carbon emissions alongside improvements in efficiency and data granularity. The region's experience in clean propulsion systems and marine autonomy could place the region at the forefront of marine development.

➢ LEVERAGING HINKLEY C's SUPPLY CHAIN

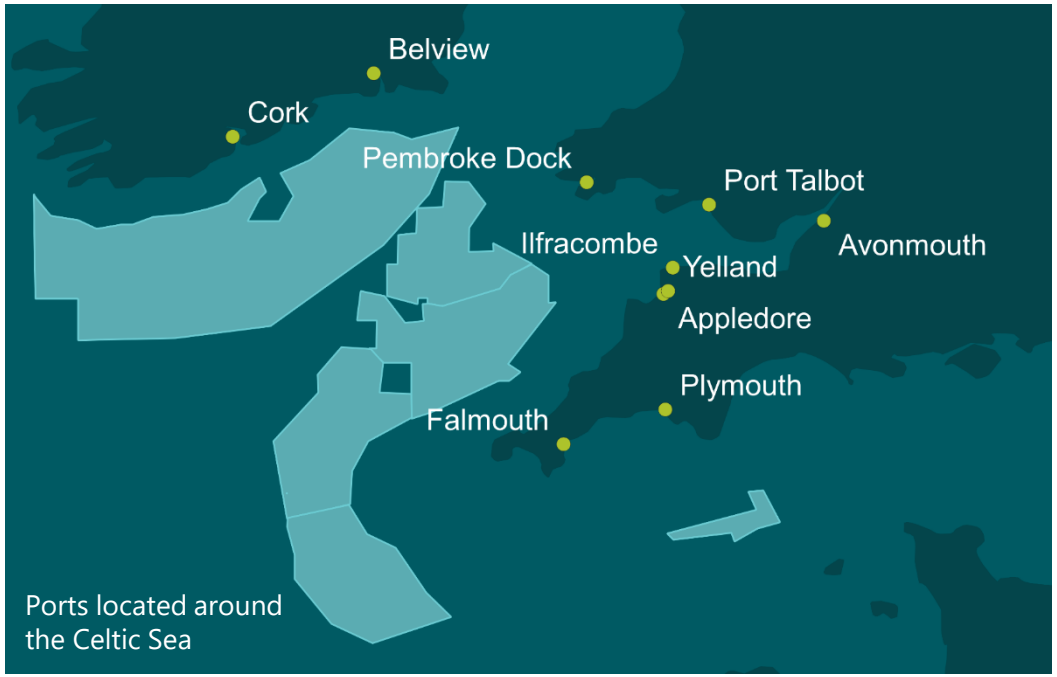
As a nationally significant infrastructure project, Hinkley C demonstrates that HotSW has the necessary skills and supply chain to construct a high-integrity, mission-critical development. The development and construction of Hinkley C is projected to finish towards the end of the decade, which coincides with the anticipated development of the first FLOW projects in the Celtic Sea. Coordination between the two developments is recommended.

➢ COLLABORATION WITH SOUTH WEST AND SOUTH WALES STAKEHOLDERS

The Celtic Sea leasing round has an increased emphasis on collaboration, from both government and The Crown Estate. As a result, many collaborative organisations have been established, such as the Celtic Sea Cluster and the Celtic Sea Developers Alliance. It is clear from discussions with stakeholders and industry that the economic opportunity will be best realised as part of a wider collaboration with other broader South West stakeholders, as well as partners in South Wales and Ireland.

PORTS AND LOGISTICS IN THE CELTIC SEA REGION

The physical scale of FLOW components, as well as the expected number of turbines to be deployed, will place high and wide-ranging demands on port infrastructure. Celtic Sea FLOW developers will be seeking suitable ports to meet their needs across the South West, South Wales, Ireland and possibly northern France. Owing to limitations of space and access, the HotSW region is unlikely to host the main manufacturing and operational ports for the Celtic Sea projects in the way that, for example, Lowestoft and Hull have developed in the east. The Celtic Sea will very likely require a multi-port strategy, due to the lack of a single all-purpose port that could accommodate the scale of FLOW development, and the need to serve such a large area of ocean.



Ports located around the Celtic Sea

Appledore is the most likely port in the HotSW to be used in the FLOW supply chain. It could provide a base for marine operations, but its core strength lies in shipbuilding and marine engineering. Plymouth, with its number of smaller docks and wharf areas, as well as sheltered port and naval bases, could be used as a port for some component manufacturing and to support offshore vessels. Other ports in the area, including Yelland, Ilfracombe, Brixham and Teignmouth, could all provide supporting services.

INWARD INVESTMENT OPPORTUNITIES

With South Wales, Cornwall and Ireland all bordering the Celtic Sea, the key to attracting inward investment to the HotSW will be to build a case focusing on the strengths of the HotSW and the supply chain elements that match these strengths. Investment and support are crucial to establishing a strong FLOW supply chain, as many companies will need help establishing themselves and promoting their capabilities to developers. As well as pushing FLOW up the HotSW's agenda, and encouraging more conversations about the opportunity, the HotSW LEP can attract inward investment by working with the Department for International Trade (DIT).

A secure pipeline of FLOW projects could trigger private investment, bringing jobs and activity to the region. There are numerous supply chain companies in the HotSW that could operate in the FLOW sector, and it is crucial that HotSW-based companies are included in developers' Supply Chain Plans. There may also be the possibility of FLOW developers physically forming or locating in the area which will support HotSW-based supply chain companies.

There are also opportunities for inward investment due to the potential surplus of low-cost electricity coming into the region from FLOW developments. A number of high energy users, such as hydrogen electrolyser or battery storage developers, could look to locate in the area for this reason.

LOCAL AND COMMUNITY BENEFITS

Local and community benefit is an established element of renewable energy developments and is strongly encouraged by UK and devolved governments. Benefits can be realised in many forms, but community benefit schemes tend to focus on financial benefits paid to local communities that are located near to or around renewable developments. For onshore renewable projects, the community around that development is easily identified, and it is usually clear who should benefit from the renewable development. However, for offshore wind, where there is not a well-defined geographical region that relates to the project, it may be unclear what makes up the "local community" and to whom the benefits should be targeted. In the limited cases where offshore wind has involved community benefit funding, communities have been identified on a site-specific basis through extensive local stakeholder engagement.

As FLOW developments are so far offshore and have limited visual impact, the communities around the onshore cable route are likely to be the most impacted, and thus the most obvious choice for community benefit schemes. HotSW could work with FLOW project developers to further explore local community benefit schemes, specifically in relation to the many projects that are seeking to connect into the electricity network at Alverdiscott in Torridge.

Another way of benefitting the local community is by involving local stakeholders in renewable energy projects through a community or local ownership scheme. While many FLOW developers have announced plans to include an element of community ownership in their projects, it is still a challenging business model that is difficult to deliver successfully.

RECOMMENDATIONS

1. Raising awareness of the FLOW opportunity amongst companies and stakeholders.
2. Promoting the Heart of the South West offer as part of a wider Celtic Sea regional offer.
3. Ensuring the South West has a strong voice in key decision areas and communicating shared messages with national policy makers.
4. Collaboration with broader South West and South Wales stakeholders, recognising that the scale and challenge of FLOW development requires a joined-up and integrated approach.
5. Starting a supply chain development programme to support and enhance the pioneer companies who are already working in the offshore wind supply chain or are in sectors in which the HotSW has existing strengths.
6. Supporting the development of offshore wind projects by supporting industry asks for policy support and infrastructure, while ensuring that community and societal benefits are realised.
7. Supporting the development of Appledore as a centre for marine technology by working with Harland & Wolff and local partners.
8. Supporting the existing marine cluster in Plymouth and Oceansgate by positioning it as a key inward investment opportunity.
9. Developing the skills in the Heart of the South West, focusing on core skill and capability development for FLOW and other marine sectors.
10. Encouraging research, development and innovation through academic partners including the University of Exeter and the University of Plymouth.

CONCLUSION: WHAT THE HEART OF THE SOUTH WEST CAN OFFER THE FLOATING OFFSHORE WIND SECTOR

There is no question that the development of FLOW in the Celtic Sea will create significant economic opportunities for the region. However, entry into the offshore wind supply chain will be difficult, especially at the scale at which the FLOW sector will operate, and the sector is already moving very quickly.

HotSW has a strong history in the marine and maritime industry, and has a number of place-based strengths including Appledore, Plymouth, Exeter as well as the potential to leverage the existing supply chain built around Hinkley C. The experience of Hinkley C also suggests that a well-coordinated support programme, targeting key companies and skillsets, can make a significant contribution to maximise regional economic benefits.

The most effective economic development plan for HotSW will be to focus on the considerable strengths of the region and to work with developers and their tier 1 partners that are looking for partnerships in the Celtic Sea region. HotSW and local partners should encourage high levels of collaboration between companies and with partners across the Celtic Sea region, recognising that the scale and challenge of FLOW developments requires a joined-up and integrated approach.

Crucially, in order to attract sufficient inward investment to retain significant value for HotSW and see strong, viable businesses develop, the region will need to look beyond FLOW to identify transferrable skills across marine industries.

Image credit: Principle Power

CONTENTS

FLOATING OFFSHORE WIND AND THE CELTIC SEA

INTRODUCTION

Regen has been commissioned by the Heart of the South West Local Enterprise Partnership (HotSW LEP) and Devon County Council, in partnership with North Devon and Torridge District Councils, to conduct a short study to understand the supply chain opportunities and wider economic benefits that could result from the development of floating offshore wind (FLOW) projects in the Celtic Sea area.

This study provides evidence and information that will enable the HotSW LEP and its local authority partners to develop an economic development plan to support the development of the floating offshore wind industry across the Celtic Sea area, and to maximise the regional economic potential of these projects.

It is also hoped that this study will enable the LEP and local partners to prioritise and secure additional investment for HotSW-based companies, and to further develop the existing cluster of maritime industry, engineering, innovation and research organisations and the environmental science sector in the region.

This study builds on previous work done by the Offshore Renewable Energy Catapult, The Crown Estate and the Offshore Wind Industry Council to define the supply chain requirements of the offshore wind sector. It also draws on the supply chain development work that has already been started by the Celtic Sea Cluster and the Celtic Sea Developers Alliance.

Rather than repeat the broad supply chain and economic analysis that has already been undertaken, this study has focused on identifying real and practical opportunities from FLOW to form the basis of an economic development, business support and investment plan for the HotSW region. It has also focused on the role that the HotSW could play as part of a wider Celtic Sea cluster. The study has been informed by engagement with numerous stakeholders across supply chain development, construction, academia, project developers and local authorities. These stakeholders are listed in Appendix A.

At an initial scoping and opportunity workshop, the following priority areas were identified:

- Supply chain mapping and HotSW capabilities that could be applied to FLOW.
- Research and development, and support for innovation.
- The role of Appledore/northern Devon as a centre for marine engineering.
- The Plymouth marine technology cluster.
- Leveraging Hinkley C – supply chain, skills and approach.
- Building on skills and training capability.
- Opportunities for inward investment.
- The role of HotSW partners as part of the wider Celtic Sea collaboration.

FLOATING OFFSHORE WIND (FLOW)

While fixed-bottom offshore wind has demonstrated its ability to scale up, reduce costs and deliver large volumes of clean energy, its confinement to shallower waters limits deployment. FLOW has the potential to open up huge areas of high wind resource in deeper water. According to The Crown Estate, FLOW represents **"the next frontier in the UK's green growth story"** and is likely to become a key pillar of our future clean energy mix.

The UK is the current leader in FLOW deployment, home to Hywind Scotland and Kincardine, the first and the largest commercial FLOW farms respectively. The Hywind One demonstrator was able to prove the viability of FLOW, operating reliably since 2009 and surviving wind speeds over 40 m/s and swells of 19 m.

In 2017, Hywind Scotland became the world's first commercial floating wind farm and has consistently had the highest capacity factor of any UK offshore windfarm (54%, compared to a UK average of 40%). Costs per MWh have consistently fallen, and Hywind now projects a 40% reduction in capital expenditure for its next project, Hywind Tampen, off the coast of Norway.

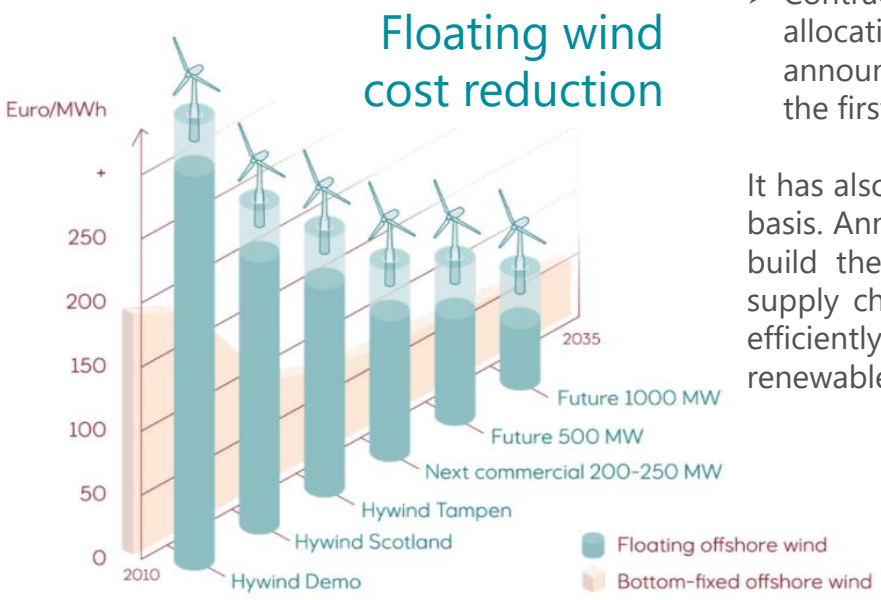


Illustration: Equinor

UK COMMITMENTS TO EXPAND OFFSHORE WIND

The British Energy Security Strategy, published in April 2022, has confirmed a target of 50 GW of offshore wind by 2030, including a sub-target of 5 GW of FLOW. This is significantly more ambitious than the Net Zero Strategy, which only detailed a target of 1 GW of FLOW by 2030.

With this target in mind, the UK Government has provided support measures for floating wind, including:

- A £160m fund dedicated to developing port infrastructure for FLOW, which was announced in October 2021.
- A £60m fund for innovation, which has already supported a number of South West based companies.
- Contract for Difference (CfD) Allocation Round 4 supported a reserve allocation of £24m for FLOW, with results of the auction due to be announced in summer 2022. This will help provide a route to market for the first large-scale FLOW projects.

It has also recently been announced that future CfDs will be run on an annual basis. Annual CfDs will send a positive signal to investors, allow developers to build their project portfolios, utilities to invest in grid infrastructure and supply chain companies to build the jobs, skills and capabilities needed to efficiently deliver net zero. This will help to accelerate the deployment of renewable generation, including emerging technologies such as FLOW.

LATEST DEVELOPMENTS

UK TARGETS

The UK leads the world in offshore wind deployment with over 10 GW installed. The British Energy Security Strategy, published in April 2022, has confirmed a target of 50 GW of offshore wind by 2030, including a sub-target of 5 GW of FLOW. This is significantly more ambitious than the Net Zero Strategy, which only detailed a target of 1 GW of FLOW by 2030.

OIL MAJORS ENTER THE MARKET IN LEASING ROUND 4

The Round 4 leasing round for England and Wales in February 2021, which brought forward 8 GW of new offshore wind projects, was notable for two reasons: the amount that developers were willing to pay in annual lease fees, and the entry into the market of oil majors such as BP and Total.

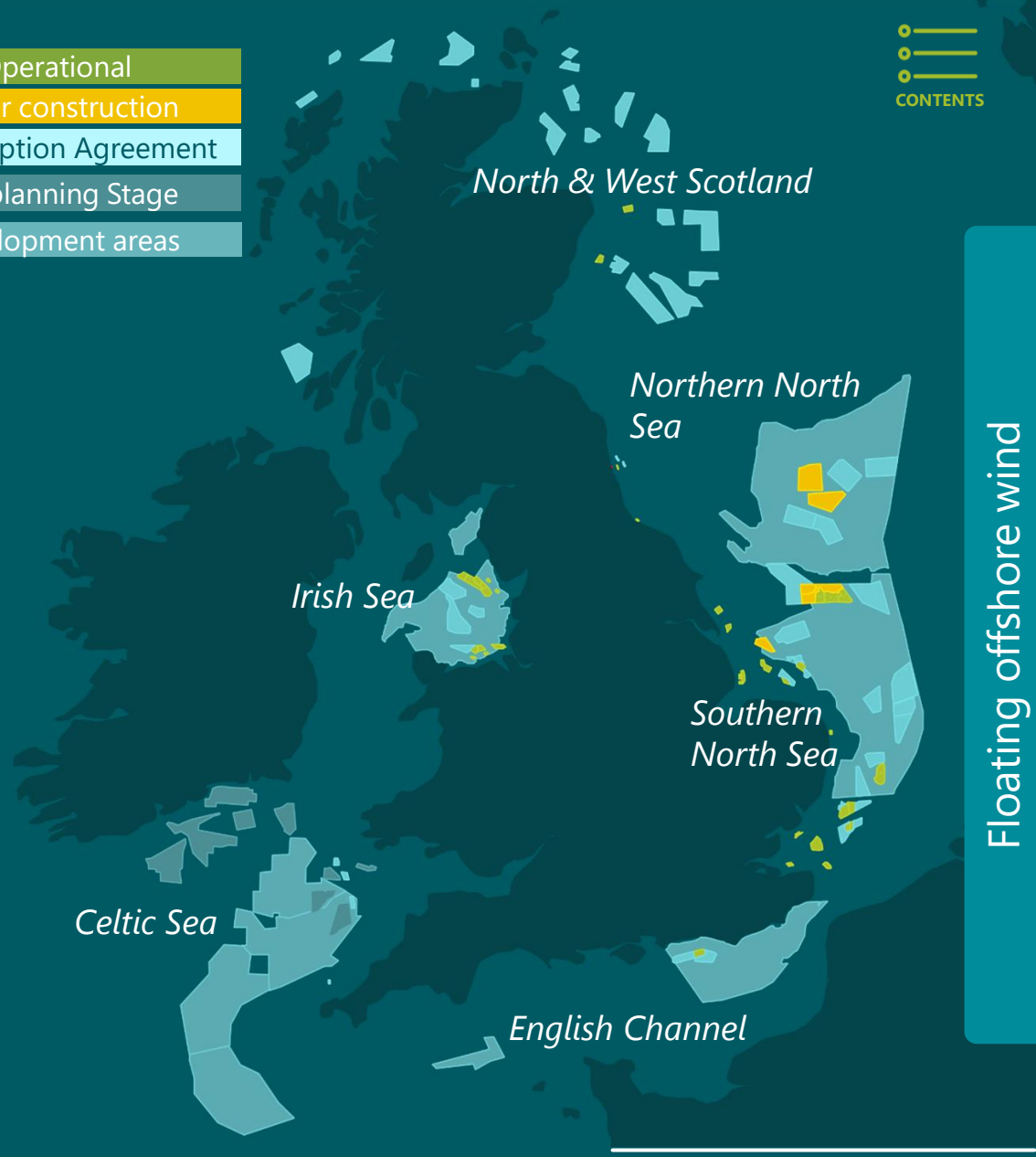
HUGE EXPANSION IN SCOTTISH AMBITIONS

The recent ScotWind leasing round aimed to procure at least 10 GW of offshore wind, but with over 70 bids into the auction, the final capacity of awarded provisional seabed rights reached 25 GW. This is spread across 17 offshore wind projects and includes 15 GW of floating wind.

ACCELERATED DEPLOYMENT PLANS FOR THE CELTIC SEA

In November 2021, The Crown Estate announced its ambition to award 4 GW of seabed rights to FLOW projects in the Celtic Sea, to be deployed by 2035. This marked a new stage in the growth of the industry, with large-scale projects being located in the waters around Wales and the South West for the first time.

The announcement sparked significant developer interest, with at least 20 developers actively exploring projects in the Celtic Sea. Due in part to this notable appetite from developers, The Crown Estate is already consulting with industry on the potential for a larger leasing round, which could stretch to 10 GW or more. If 10 GW were to be installed, this would equate to c. £30 billion worth of investment.



UK OFFSHORE WIND DEVELOPMENT

The development of the offshore wind supply chain in the UK has been broadly successful in terms of capability development, cost reduction and UK content.

There are arguments to consider about the measure of UK content, but broadly it can be said that the earlier offshore windfarms (e.g. London array, a decade ago) generated low levels of UK content at c. 15%, whereas the typical UK content target for the latest offshore windfarms is over 50%. This is despite the fact that the main windfarm component, the turbine, is still manufactured abroad. Part of the increase in UK content has been driven by the requirement for project developers to include a Supply Chain Plan as part of the CfD qualification process.

One of the earliest offshore wind assembly ports, the Port of Mostyn in North Wales continues to support offshore wind developments and O&M in Liverpool Bay and the Irish Sea.

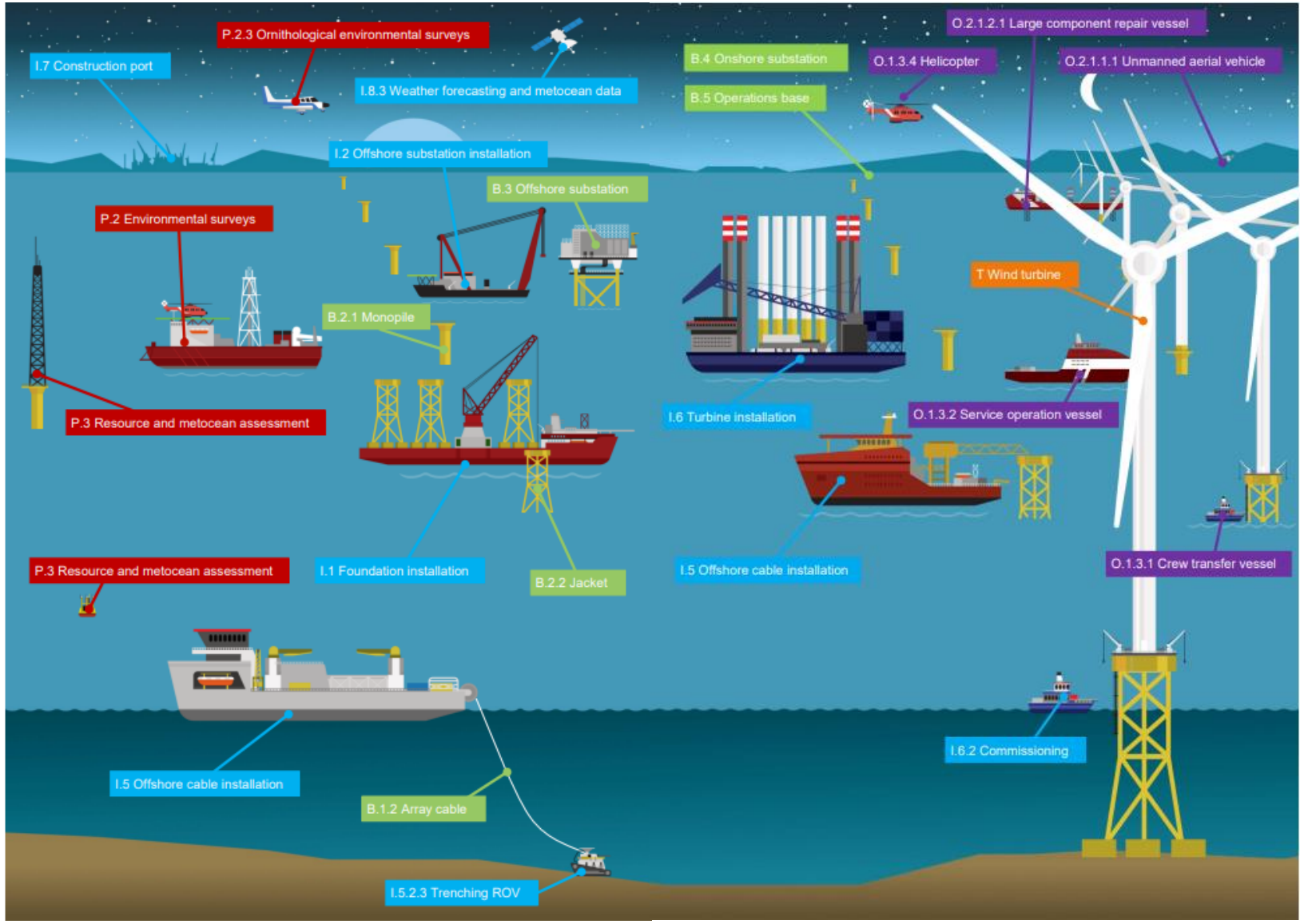
Lowestoft has become a centre of offshore wind operations and maintenance. Investments include port development, new O&M bases for Scottish Power Renewables and the Orbis Energy centre.

Hull and Humberside has become a major centre for offshore wind deployment and manufacturing with core investment from Siemens Gamesa and GRO Renewables. The region recently benefited from a further £160m from the Offshore Wind Manufacturing Support Scheme.

The trust port of Belfast Harbour has invested heavily to create a world-class offshore wind facility. Nearby, Harland & Wolff provide major shipbuilding, marine engineering, dockyard and fabrication services. Harland & Wolff now owns the shipbuilding and engineering facility at Appledore in northern Devon.

This focus on UK supply chain development has been supported by a number of national initiatives (Offshore Wind Sector Deal, Cost Reduction Task Force, supply chain and skills initiatives) and by a number of regional supply chain and skills development programmes. The east coast of GB, in areas around Humberside, Lowestoft, Aberdeen and Tyneside, has done particularly well. The Offshore Wind Industry Council has estimated that the private sector will invest over £60 billion across the UK between 2021 and 2026, and could support around 70,000 jobs.

A key attraction of offshore wind is the richness of its supply chain and the links to existing UK sectors in manufacturing, offshore development, marine operations, marine engineering, electrical engineering and a very wide range of professional services. Analysis conducted by the ORE Catapult estimates that the first gigawatt of FLOW in the Celtic Sea could potentially deliver over 3,000 jobs and £682m in supply chain opportunities for Wales and the South West by 2030.



Graphic from The Crown Estate's Guide to an Offshore Wind Farm, 2019. Produced by BVG Associates.

FLOW IN THE CELTIC SEA

THE CASE FOR FLOATING OFFSHORE WIND IN THE CELTIC SEA

A strong argument has been made that floating wind on the western side of the UK is needed, along with greater interconnection with Ireland and Europe. Westward expansion of renewable generation would result in:

- Access to new areas of seabed and wind resource
- Reduced cumulative impacts affecting the east coast and North Sea
- Better system balancing and reduced whole system costs
- Opportunities for regional economic development and 'levelling up'
- Export and commercial opportunities from new technology development

The energy system benefits of a more diverse wind portfolio have become especially powerful given the high wholesale price volatility currently being experienced, alongside high system balancing costs.

Wind conditions 7 am, 17 December 2021 Wind conditions 8 pm December 2021

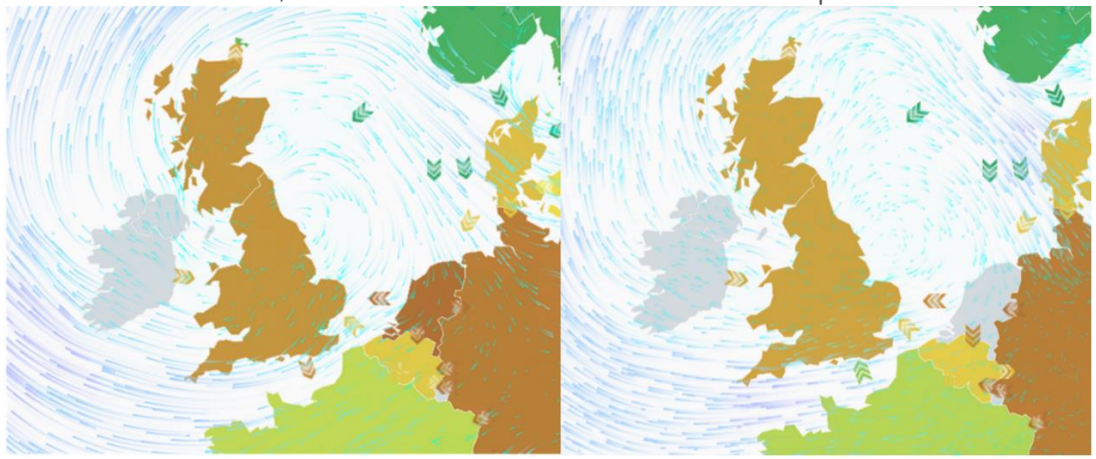


Image from Regen's Go West blog

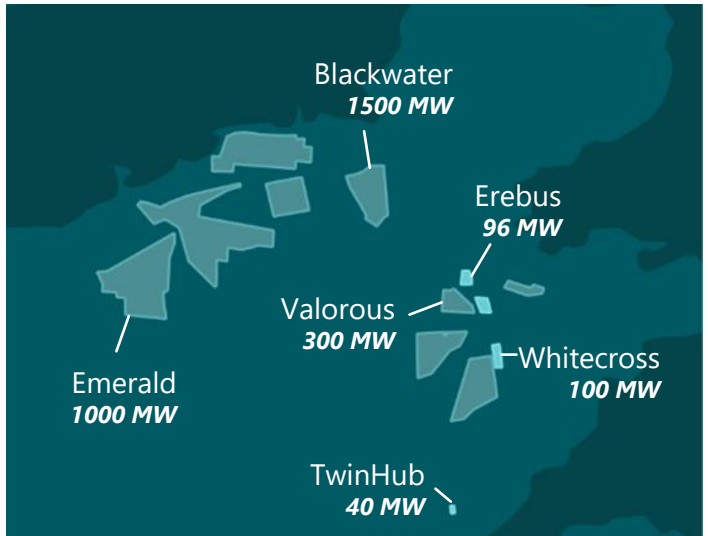
DEVELOPER INTEREST

There are at least 20 development organisations that have declared an interest in the development of FLOW in the Celtic sea. Significantly, this includes a number of new partnerships, including major oil companies with experience in offshore energy production. Many of these companies will be unfamiliar with the supply chain and R&D capabilities available in the South West.

As an example, French energy major Total has partnered with Irish marine developer Simply Blue to progress two sites: Erebus (100 MW) and Valorous (300 MW). Shell has also become a partner in Simply Blue's Emerald (1 GW) project off the coast of Cork. In February 2021, Spanish major Iberdrola acquired majority stakes in DP Energy's two Irish projects, as well as the side of the business responsible for developing the offshore wind pipeline in Ireland.

IRISH CONNECTION

When thinking of the Celtic Sea, and indeed projects across the western seaboard, it is important to consider projects that will be within Irish and Northern Irish waters. In terms of both energy integration (via multi-purpose interconnectors) and supply chain integration, there are opportunities to leverage infrastructure and capabilities across the region.



Current FLOW projects announced for the Celtic Sea

CELTIC SEA POTENTIAL DEVELOPMENT PATHWAY

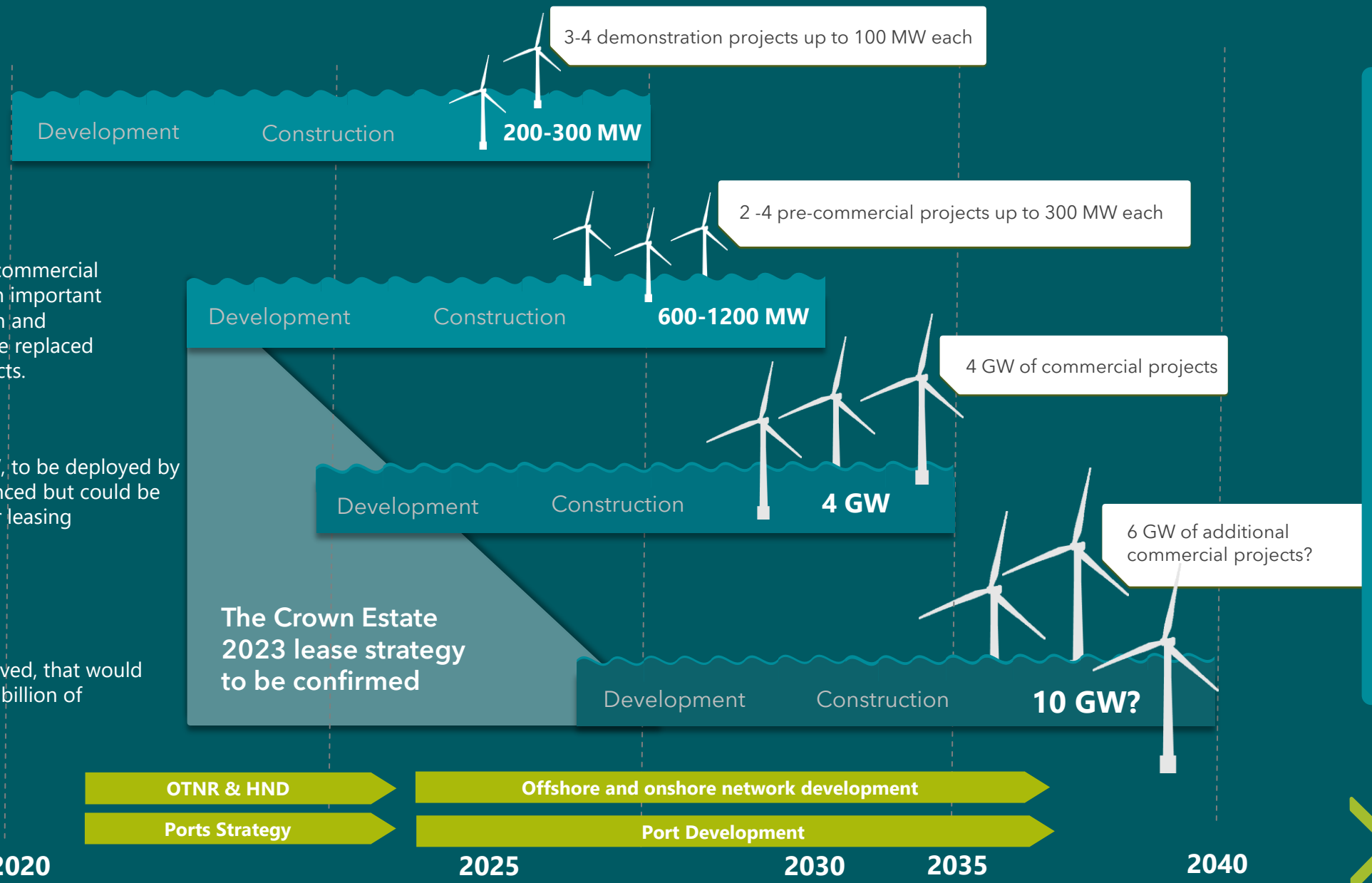
CONTENTS

The development pathway for the Celtic Sea is not yet defined and is subject to an industry consultation on the timing and scale of future leasing rounds.

Development of 300 MW pre-commercial projects, which were seen as an important stepping stone for supply chain and regional development, could be replaced by or merged into larger projects.

A target of up to 4 GW, to be deployed by 2035, has been announced but could be superceded by a larger leasing programme.

If 10 GW is achieved, that would equate to c. £30 billion of investment



A CHANGING APPROACH TO DEVELOPMENT

BIG CHALLENGES REQUIRE A DIFFERENT APPROACH

While there is no lack of appetite from both industry and regional and national governments for FLOW in the Celtic Sea, there are a number of challenges facing this burgeoning sector:

- **Grid connectivity** – providing the necessary offshore and onshore electricity network infrastructure, whilst minimizing costs, project risks and impacts on marine and coastal communities and the environment.
- **Ports and logistics infrastructure** – ensuring that there is the space, suitable quaysides and adequate water depths needed to manufacture, assemble and operate FLOW projects.
- **Supply chain development** – ensuring there are the qualified companies and the skilled workforce needed for the scale of the FLOW opportunity.
- **Innovation** – the challenges of FLOW in deeper waters require a high degree of innovation in construction, logistics, mooring and operations.
- **Data and spatial planning** – enabling actions to reduce cost and risk by sharing data and conducting an integrated spatial design and Habitats Regulations Assessment (HRA).

The government is attempting to address many of these challenges through its Offshore Transmission Network Review and National Grid's Holistic Network Design. Many developers are currently looking to connect at Alverdiscott. If multiple FLOW farms were to connect either onshore or offshore near Alverdiscott, this could result in significant inward investment looking to utilise the amount of low-cost renewable energy coming into North Devon and Torridge.

FOCUSING ON REGIONAL STRENGTHS

To maximise the economic benefits of offshore wind in the Celtic Sea region, it will be crucial for HotSW LEP and local authority partners to focus on and invest in existing areas of strength:

1. **There will be significant opportunities for marine industries, especially at Appledore and Plymouth.** Owing to limitations of space and access, HotSW is unlikely to host the main manufacturing and operational port for the Celtic Sea projects in the way that, for example, Lowestoft and Hull have developed. However, the Celtic Sea will very likely require a multi-port strategy due to the lack of one all-purpose port that could accommodate the scale of FLOW, and the need to serve such a large area of ocean, thus HotSW ports could form a part of this strategy.
2. **The most effective economic development plan for HotSW will be to focus on the considerable strengths** described in the next sections of this study. These strengths, in areas such as marine technology and engineering, environmental and natural sciences, R&D, innovation, and skills and training have the added benefit of being applicable to a wide range of new green industries.
3. **Alongside support for existing businesses, the development of FLOW will provide new opportunities for inward investment, including:**
   - Working with developers, and their tier 1 partners, that are looking for partnerships in the region, especially in technology development.
   - Targeting companies that could form part of the South West's marine industry and blue tech cluster.
   - Targeting industries that will be attracted to the abundance of low carbon/low-cost electricity provided by offshore wind, nuclear and other renewables.

COLLABORATION

The Crown Estate, in its FLOW position paper, is taking an evolved approach to deliver this opportunity, building on valuable experience and previous leasing, acquiring marine spatial data to accelerate planning, and investing in enabling programmes to support infrastructure, data and evidence. The Crown Estate is taking an active role in working with partners to support the development requirements for supply chain companies, support a coordinated grid solution and unlock investment in port infrastructure.

Launched in Dublin in 2019 by the then Welsh Minister for Environment, Energy and Rural Affairs, Lesley Griffiths, the Celtic Sea Alliance was formed to support FLOW projects. Since then it has seen several successful and productive years, expanding its reach to include over ten floating wind project developers active in the Celtic Sea region, alongside organisations such as ORE Catapult, R-UK Cymru, Wind Energy Ireland and Marine Energy Wales.

The Celtic Sea Cluster has been established to help drive market creation for FLOW, accelerate supply chain readiness and develop a strategy for enhancing regional infrastructure. The Cluster is formed of members from the Welsh Government, Cornwall & Isles of Scilly LEP, Marine Energy Wales, Celtic Sea Power and ORE Catapult. Membership of the Celtic Sea Cluster is open to all companies with an established base in Wales and/pr the South West, or companies seeking to provide inward investment into these regions.

The increased emphasis on collaboration, from both government and The Crown Estate, could allow HotSW to be involved with FLOW developers and in government legislation and consultations. Not only will this help to establish HotSW as an area for inward investment, but it will also allow the region to showcase and enhance its existing strengths.

It is clear from discussions with stakeholders and industry that the HotSW economic opportunity will be best realised as part of a wider collaboration with Cornwall and the Great South West, and with partners in Wales and Ireland. As a general point, the 'offer' from the Great South West will be greatly enhanced as part of a wider regional prospectus. There are a number of different aspects to this collaboration:

- Working together to ensure that the plans, policies and infrastructure is in place for FLOW in the Celtic Sea to become a reality. This is especially important around the key areas of grid and port infrastructure and marine planning. More generally, there is still a considerable amount of work to be done to inform and motivate national decision-makers to support Celtic Sea projects.
- Joining with regional partners to present a compelling case for investment in the region, both from the private sector and public funding. The HotSW's contribution to the overall regional 'offer' as a place to invest and develop new industries could be considerable.
- Working together, sharing resources and funding, to deliver cross-regional supply chain development, skills and training programmes.
- Supporting cross-regional initiatives, like the Celtic Sea Cluster and Celtic Sea Developers Alliance.
- Encouraging partnership working between HotSW businesses, universities and institutions in areas such as research and innovation, to amplify the attractiveness of the overall region for inward investment.

KEY OPPORTUNITY AREAS

KEY OPPORTUNITY AREAS

This study identifies the key opportunity areas for the HotSW presented by FLOW developments in the Celtic Sea and across the UK. HotSW has many supply chain capabilities, including existing companies working in maritime and marine supply chains, as well as research and development expertise and port facilities. This section details the major clusters of activity that could be harnessed for FLOW.

Several areas within HotSW could be utilised as hubs of activity capable of inputting into and developing the FLOW supply chain. These include: the cluster of activity around Plymouth, including the University of Plymouth's world-renowned marine research reputation; the research capabilities of the University of Exeter and Exeter's STEM cluster; the existing supply chain capabilities from the construction of Hinkley C; and the future opportunities for Appledore as a shipbuilding yard.

As well as these cluster-based opportunities, HotSW also has a broader opportunity in skills and training, both upskilling existing companies and individuals in the HotSW area and training up the next generation to pursue careers in renewable energy. There are already examples of this around the HotSW area, including the South Devon College Marine Academy.

While the FLOW developments in the Celtic Sea represent a significant, long-term opportunity for HotSW, a lot of the skills and capabilities needed in the FLOW supply chain are transferrable between many marine engineering and offshore renewable energy applications. In order to maximise the economic opportunity for HotSW, companies should be encouraged to work across all marine industries, and the location of Plymouth, Exeter and Appledore within the region provide significant opportunities for current and future workforces.

University of Exeter

Plymouth Oceansgate

Appledore

Hinkley C

University of Plymouth

Exeter Science Park

APPLEDORE SHIPYARD

With its existing facilities and links with industry, Appledore is well placed to capitalise on high demands for new vessels.

Appledore is a port with an extensive history in shipbuilding, having built over 300 vessels over its lifetime. At the end of 2020, Harland & Wolff, a multisite fabrication company operating in maritime and offshore industry, bought Appledore shipyard, which had closed in March 2019. Since then, the workforce has expanded and they now have a catalogue of existing and future work, having received high demand for vessel building, conversion and repair from various clients, including the RNLI.

While Harland & Wolff's Scottish ports in Arnish and Methil have been involved in renewable offshore wind through the fabrication of jackets, Appledore is more suited to supplying and servicing the fleet of clean propulsion vessels that will be needed in future offshore wind developments. They may also be able to manufacture some components needed in the FLOW supply chain including, for example, anchoring systems and offshore substation topsides.

There is also significant brownfield space adjacent to main Appledore site, including Harland & Wolff's New Quay site and the Middle Dock site, which is owned by Torridge District Council. With Harland & Wolff's expanding workload, there could be development across these two sites to support their work in vessels and offshore energy, while Middle Dock could be used for R&D and skills development and training to support the clean maritime sector, with strong opportunities to engage with both higher education and the private sector.

Appledore shipyard has deep roots within the community at Appledore, and many previous employees remained in the local area and have now been re-employed by Harland & Wolff. However, looking to the future, a key constraint for the port's growth will be the availability of housing in and around Appledore, as well as providing a prospering environment to attract and retain a highly skilled workforce.

Collaboration with Petroc College
Harland & Wolff are focused on skills development and training, as the shipyard tends to be a generational employer and is well placed to train up the next generation of workers. This is focused on construction and engineering skills, as well as highly skilled jobs in ship design and clean propulsion systems. In September 2021 Harland & Wolff took on five apprentices from Petroc College, and is hoping to take on a further twenty in September 2022.

LEVERAGING HINKLEY C'S SUPPLY CHAIN

As a large-scale infrastructure project, Hinkley C demonstrates that the HotSW area has the necessary skills and supply chain to construct a high-integrity, mission-critical development. Learnings from Hinkley C can be applied directly to FLOW and can aid the development of its supply chain.

Prior to the initial development of Hinkley C, a significant amount of research and investment was put in place to maximise local supply chain content. Knowledge-based and financial contributions from the developer, local authorities and other stakeholders were incorporated within supply chain plans that were formulated across the ten years prior to the construction of Hinkley C. This ensured that service and manufacturing opportunities were available to local organisations, providing the region with socio-economic benefits and coining a sense of legacy. According to EDF, approximately 600 suppliers based in the HotSW area have been used in the Hinkley C supply chain to date, having invested £2.2bn with suppliers from across the South West.

A key outcome for local companies was the creation of a bespoke supply chain programme which provided SME companies with the tools and resources to bid for and win large agreements with tier 1 contractors. The programme is funded by HotSW LEP, West of England Combined Authority and Welsh Government and, as of March 2021, was successful in providing business support for approximately 800 companies and has resulted in approximately £23 million of contract wins. In addition to direct supply chain support, the Hinkley C supply chain programme offered support for foreign companies to relocate to the region, providing inward investment opportunities. HotSW could look to fund a supply chain programme for FLOW, as has been done for Hinkley C, or could support and feed into existing schemes such as Fit 4 Offshore Renewables. Either way, the region can greatly benefit from the experiences gained by companies that have progressed through the supply chain programme.

Timing and communication are key for collaboration between Hinkley C and FLOW in the Celtic Sea. The development and construction of Hinkley C are projected to finish towards the end of the decade, and EDF and HotSW LEP are starting to focus on their legacy. This coincides well with the projected development of the first FLOW farms in the Celtic Sea, and coordination between the two developments is recommended. Local companies are already well-equipped with a variety of high-level transferrable skills that can help across a large proportion of the FLOW supply chain; however, the opportunity that FLOW offers needs to be communicated as early as possible to engage these individual companies and provide them with tangible work opportunities that encourage them to stay in the HotSW area.

Image credit: EDF

HINKLEY C SKILLS AND TRAINING

As part of the Hinkley C supply chain, EDF worked with local partners and stakeholders to leverage significant investments in upskilling local companies and individuals to work in nuclear. This investment is playing a key role in developing the UK's industrial capability for major infrastructure projects.

In addition, Hinkley C is also helping to overcome the critical skills shortage within the construction industry whilst providing new, sustainable career opportunities for people in the South West. It is doing this by supporting:

- Local employment, by creating a wide range of occupations and careers
- The local community, by minimising local disruption and setting up a community fund
- Students, through aspirational educational programmes and a jobs service
- Suppliers and local businesses, through contracting local companies and setting up training centres, such as the National College for Nuclear.

In most supply chains, approximately 80% of jobs are made up of core skills, such as welding and construction, with only 20% being specific to the infrastructure project itself. Hence, even though Hinkley C and FLOW are very different infrastructure projects, a large proportion of the supply chain is shared.

Skills interventions that have been put in place by Hinkley C can therefore be utilised within the FLOW supply chain, including Centres of Excellence for Welding and Electrical engineering. Skillsets developed in project management, customer communication, site behaviour and health and safety can be used to de-risk projects and save time on construction by offering swift mobilisation. By ensuring individuals are certified to the latest techniques and standards, organisations within HotSW gain a competitive advantage.

Hinkley C has undoubtedly been a success in supporting and upskilling local companies. Now, it is important that offshore renewables are equally placed among opportunities for HotSW.

Centres of Excellence

Hinkley C is training a pool of skilled supervisors and technicians to support the ramp-up of mechanical and electrical installations, through 'Centres of Excellence'. These include:

- The Welding Centre of Excellence, which opened in Autumn 2020 to address the national welding skills shortage. Using the latest equipment, the Centre is ensuring the highest possible training standards for welding across nuclear projects.
- The Electrical Centre of Excellence, which will be located at the Somerset Energy Innovation Centre in Bridgwater.
- The Mechanical Engineering Centre of Excellence, which will help to train mechanical engineering disciplines and house Hinkley C mock-ups.

756

apprentices trained on the project to date three-quarters of the way towards the target of training 1,000.

14,000

people have now been trained and assessed at the Construction Skills and Innovation Centre and the Welding Centre of Excellence.

1,240

people have been helped into new jobs by the Hinkley Jobs Service. The team are currently supporting 450 people struggling with employment as a result of the Coronavirus pandemic.

1,841

members of the workforce who up-skilled in classroom-based training in 2020.

PLYMOUTH AS A CENTRE FOR MARINE TECH

Plymouth has a strong existing maritime industry and long-standing skills within the marine sector, including the University of Plymouth, which was ranked 1st in the world for research towards Sustainable Development Goal 14 (Life Below Water). With a city-wide focus on delivering clean growth and decarbonising the marine industry, Plymouth's role in the development of FLOW is a key opportunity for the Heart of the South West region.

Plymouth benefits from being a hub for a wide range of marine organisations and operations. As stakeholders in Maritime UK South West, Plymouth benefits from key connections across regional academic and industrial sectors, including institutions at Falmouth, Southampton and Portsmouth, alongside national government. This diverse array of skills and connections provide a significant strength for HotSW. Opportunities for Plymouth in the FLOW supply chain range across:

- Construction and design engineering
- Port capabilities
- Research and development
- Skills and training

ENGINEERING AND PORT CAPABILITIES

The city has a long history of supporting marine and naval operations, which has made it a major centre for shipbuilding and marine engineering, with an estimated 300 marine-related businesses (employing over 13,000 people) operating in and around Plymouth's four port sites. This provides a clear opportunity for Plymouth to be involved within design and engineering aspects across the FLOW supply chain, such as component design and vessel refabrication. With the inclusion of the Freeport, this could give the opportunity to attract national and international investment as the FLOW sector expands.

Research and development

Plymouth is an internationally recognised centre of excellence for marine science and provides world-leading research facilities from institutions such as the University of Plymouth, Plymouth Marine Laboratory, Marine Biological Association and the Sir Alister Hardy Foundation for Ocean Science. Plymouth-based organisations have substantial involvement within world-renowned marine renewables research groups such as PRIMaRE and Supergen ORE Hub, and test facilities such as the COAST lab and the recent FLOW simulator at the Marine Navigation Centre offer world-class services for FLOW research and development.

The University of Plymouth is also currently investing in the design of marine autonomous systems which could be used for the collection of environmental and operations and maintenance data. These pioneering devices can deliver significant socio-economic benefits when compared to conventional vessels used for offshore wind projects, providing R&D opportunities for HotSW and the greater FLOW sector.

SKILLS AND TRAINING

There are already several well-established schools and colleges that provide further education courses on skills relevant to the FLOW supply chain. Institutions such as Plymouth City College and University Technical College (UTC) Plymouth offer specialist courses in engineering and manufacturing, with the University of Plymouth and the Plymouth Marine Academy offering bespoke higher education and lower-years courses respectively that can be both directly and indirectly applied to the FLOW supply chain. Several higher education institutions have formed partnerships with reputable organisations and offer high-level apprenticeships and industry-based opportunities for further development of these skills.

CASE STUDY: OCEANSGATE

The progressive advancement of FLOW will require a collaborative approach between a variety of industries. As the first marine Enterprise Zone in the country, Plymouth City Council's Oceansgate stands as a world-class hub for marine organisations, boasting facilities that have already attracted significant investment from reputable companies.

Plymouth City Council's Oceansgate is an ongoing development that aims to provide a collaborative hub for marine-based industries with innovation at its core. Built in three phases, the total area spans 35 hectares and provides commercial use of industrial buildings and office suites, alongside docks and jetties that will provide direct deep-water access to the English Channel. This unique complex of terrestrial and marine industrial space means that Oceansgate is a world-class hub for marine-based businesses, and has facilities that cater for opportunities in research and innovation, marine production and academia.

The flexible employment facilities for marine and advanced manufacturing companies within Phases 1 and 2 have attracted interest from over ten establishments. These currently range from higher education institutions to marine engineering companies, including:

- Babcock
- CMS-Geotech Ltd
- Maritime and Coastguard Agency
- Princess Yachts International
- Plymouth City College
- Plymouth Marine Laboratory
- Relay Engineering
- Valeport

Oceansgate, coupled with Plymouth's reputation for maritime innovation, has already demonstrated itself as a significant attraction for marine-based organisations and is a key motive for internal investment. Attracting prospective internal investment opportunities that could feed into the FLOW supply chain would benefit from a collaborative approach between Oceansgate and other facilities around the HotSW area. For example, Brixham Laboratory, owned by the University of Plymouth, offers similar office space and laboratory facilities and already hosts over 200 employees across a wide range of innovative organisations including Applied Genomics, Arc Marine and Tides Marine. From a geographical perspective, ports such as Appledore and Falmouth can massively benefit from being within two hours of Oceansgate.

Situated within Plymouth's proposed Freeport, Oceansgate is the UK's first marine Enterprise Zone, offering significant socio-economic benefits for the local economy. Incentives such as tax breaks, enhanced capital allowance and a 25-year investment period encourage employers to invest in Plymouth.

Oceansgate has already attracted numerous institutions to the city, safeguarding and creating new high-skilled jobs across the marine, defence and technology sectors and playing an important role within Plymouth's local economy.

By offering collaboration opportunities across a larger pool of organisations, all within relatively close-proximity and within different aspects of the FLOW supply chain, the case for internal investment within the HotSW area has been significantly strengthened.

CASE STUDY: SMART SOUND PLYMOUTH

Harsher environmental conditions faced by FLOW turbines will require pioneering efforts in autonomous technology. As the UK's leading marine robotics proving ground, Smart Sound Plymouth is ideally positioned to aid the advancement of autonomous marine vessels and their specialised integrated communications systems, ready for future FLOW projects.

Smart Sound Plymouth provides over 1000 km^2 of ocean environment to trial, prove and validate marine autonomous systems using a network of carbon neutral monitoring platforms (a system or vessel used to carry the sensor to the necessary part of the ocean). A marine autonomous system typically comprises a number of platforms that include uncrewed surface vessels (USVs) and autonomous underwater vehicles (AUVs); the communication systems between both the platforms and the shore-side data collection point is also incorporated within the marine autonomous system. These systems can aid in environmental surveying, routine O&M checks and system monitoring for FLOW deployments, while providing operational time and cost benefits due to rapid deployability and the lack of need for a crew.

Autonomous systems are still developing. Conditions within Smart Sound Plymouth range from sheltered bays to hostile waters, providing up-and-coming autonomous technologies the chance to test in the variety of marine environments seen across a floating wind farm deployment. As of 2021, investment in Smart Sound Plymouth has seen the launch of several advanced autonomous technologies, including a remotely operated, net-zero data buoy developed by Plymouth Marine Laboratory.

As marine autonomy becomes more popular, there is a significant opportunity for Smart Sound Plymouth to take the global lead in its progression and become a hub for investing in and exporting autonomous systems for FLOW.

FAST Cluster

Based around Smart Sound Plymouth, the Future Autonomous at Sea Technologies (FAST) cluster is a group of organisations ranging across academia, industry and local government bodies that specialise in the delivery of pioneering marine autonomous technologies. Over 30 organisations from around the South West are involved within the FAST cluster, including:

- Babcock
- Fugro
- Marine Tech Systems
- Sonardyne
- UKHO
- Valeport

The FAST cluster is a significant opportunity for HotSW. It brings together the manufacturers and owners of marine autonomous platforms with sensor manufacturers and system integrators, and allows this consortium of companies to collaborate on the development of marine autonomous systems for specific purposes in Plymouth.

By acknowledging the progression of marine autonomous systems for FLOW, this cluster can lead in its development and become a global exporter in autonomy knowledge and platforms.




MARINE TECHNOLOGIES AND 'BLUE TECH'

The development and advancement of marine technologies and 'blue tech' are becoming ever-more prominent for FLOW. Reductions in costs and carbon emissions, alongside improvements in efficiency and data granularity, make a strong case for the uptake of marine technologies, which should be at the heart of the FLOW supply chain to retain a competitive advantage.

Marine technologies, or 'blue tech', encompass the wide range of devices and systems that are used to ensure safe use, protection and development of the marine environment, and are becoming an increasingly integral part of FLOW. Blue tech is incorporated within the majority of supply chain elements, including:

- Environmental monitoring
- Development of materials
- Installation and operation of components
- Data collection and storage
- Personnel training, through the use of virtual reality

Specific tools and equipment used for FLOW are rapidly developing as technology advances and systems improve. 3D modelling of the sea floor has become a standard approach across the past decade due to advancements in sonar devices, with companies such as Sonardyne championing developments. Recent advancements in autonomous vessels and clean propulsion systems also demonstrate a shift in the industry towards decarbonisation and digitalisation. While FLOW benefits from the learnings of fixed-bottom offshore wind, the industry is still in the process of developing a standardised approach to some key operations.

By design, the nature of FLOW and the technologies involved in the assembly, installation and maintenance of the supply chain play a key role in the Blue Economy. At present, 80% of capital expenditure in the Blue Economy is invested in offshore oil and gas, but that is expected to shift, with offshore wind projected to provide over 50% of capital expenditure by 2050, according to the 2021 DNV Ocean's Future to 2050 report.

The UK Government published the ambitious Maritime 2050 strategy in 2019 and identified innovation in maritime technology as a critical element to maintaining the UK's leading reputation in the sector. In January 2022, BEIS reinforced this ambition and awarded £31.6 million to 11 companies developing marine technologies for FLOW, including a novel anchoring approach by Reflex Marine, based in Truro. Current funding opportunities include Horizon Europe (2021-2027), which includes €95.5 billion to boost growth, trade and investment in maritime innovation; the programme is open to UK organisations. The Maritime UK South West Ocean Technology Cluster has driven career events and funding opportunities for technology companies looking to move to the South West, while the Ocean Futures Programme is currently underway to reinforce the marine industry in the South West, with a focus on the innovation and use of marine technologies for autonomy, digitilisation and decarbonisation.

Marine Navigation Centre

Situated within the University of Plymouth, the Marine Navigation Centre provides world-class facilities that support research and training programmes for work within the maritime industry. As of March 2022, the University of Plymouth has announced the proposed installation of a Dynamic Positioning (DP) simulator, provided by Kongsberg Digital. This facility will be used to simulate marine operations, allowing project teams to test and optimise installation and maintenance procedures to increase safety, efficiency and cost-effectiveness. The simulator also provides a safe environment to train industry professionals, filling the gap in national and international demand for expertise.

MARINE AUTONOMY

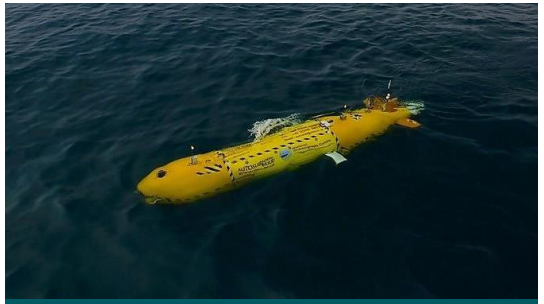
As FLOW farms extend further out to sea, the marine conditions experienced by the components get tougher. Factors such as costs and personnel health and safety therefore limit the use of crewed vessels for routine inspections and transfers, shifting the reliance to marine autonomous systems.

USVs and AUVs have already been used for routine inspections for fixed-bottom offshore wind thanks to their rapid deployability, scalability and high reconfigurability. However, an increase in their use is expected in order to de-risk floating wind farm operations in the harsher marine environments found at FLOW deployment sites. As the use of autonomous systems becomes standardised, the need for larger crewed vessels will be limited, thus reducing fuel consumption and carbon emissions. Since constant safety improvements, cost reductions and decarbonisation are seen as key drivers to the success of FLOW in the long run, the ability to design and develop marine autonomous systems is key. In particular, marine autonomous systems will have a big part to play in:

- Bathymetric surveys
- Water column analysis
- Marine mammal surveys
- Routine O&M check-ups
- Cable, anchoring and mooring inspections

Marine autonomous systems are still very much in the research and development stage, and there are multiple world-renowned organisations that operate within the HotSW that are currently developing marine automated technologies, including Sonardyne, Seiche, Valeport and Fugro. Maritime UK South West is building upon centres of excellence within marine autonomy, and Smart Sound Plymouth provides a world-leading test bed for autonomous systems, demonstrating the current lead and ongoing investment the region is seeing within the sector.

Uncrewed Surface Vessel (USV)



Autonomous Underwater Vehicle (AUV)

The Crown Estate is currently looking into procuring environmental data for HRAs that cover all potential FLOW deployment sites; this is not limited to the Celtic Sea. The vast amount of data required for this objective offers the marine autonomous sector a significant opportunity to be involved and invested in the collection of marine environmental data. An operation such as this requires a collaborative approach to marine autonomous technologies, between marine robotics developers as a cluster and end-users. However, interoperability issues between devices and communication systems designed by a variety of developers currently limits the ability of the sector to tackle joint operations.

With a cluster of marine autonomy companies and Smart Sound Plymouth's investment and reputation in the sector, the HotSW should capitalise on this opportunity to create and advise on regulatory standards and quality assurance in marine autonomous systems. This would put the HotSW at the forefront of this inevitable shift towards marine automation, leading the opportunity for the sector and becoming the go-to place for the testing and development of such systems.

CLEAN PROPULSION

The UK's net zero target has resulted in a continual focus on the decarbonisation of supply chains. Whilst FLOW provides the promise of green energy, the current construction, installation and operation of an offshore wind farm has a significant carbon footprint, which is likely to come under greater pressure as the sector evolves. Marine autonomy and vessel advancements allow clean propulsion systems to play their part in the FLOW supply chain.

With huge growth expected in the FLOW sector, and the need for decarbonisation of subsequent supply chain elements, one area that is becoming increasingly important is the reduction of carbon emissions from the vessels involved in the 20+ years of O&M services.

The ORE Catapult recently conducted a report into the fuel consumption and carbon emissions of: crew transfer vessels (CTVs), which transit between wind farms and ports and between turbines; and service operation vessels (SOVs), which transit from an offshore station at the turbine site or between the turbines alongside fortnightly transits to the port to resupply. Both are used in FLOW O&M. Assuming average transit speed and idle time, CTVs and SOVs currently using marine fuel oil and marine gas oil emit over 472 kg CO_2/hr and 1,570 kg CO_2/hr respectively. Hence, with consistent use anticipated across a number of decades, these vessels are a prime area for decarbonisation.

As many as 1,400 new vessels will be required for FLOW O&M up until 2050, including over 300 SOVs. Achieving a decarbonised approach for this growth requires significant innovation in clean propulsion systems. The UK Department for Transport and the ORE catapult recently announced ambitions to develop zero emissions vessels for the North Sea wind farms by 2025. However, there is no reason why the HotSW can't get involved within these discussions and contribute to design innovations, particularly as similar results will be needed for the decarbonisation of FLOW O&M vessels in the Celtic Sea.

In the immediate term, developing fully electric CTVs and SOVs is implausible due to energy storage and charging requirements. However, battery electric hybrid vessels and green hydrogen-powered vessels are steps in the right direction, with the HotSW and surrounding areas are already working on these technologies:

- Funded through the Clean Maritime Demonstration Project, Teignbridge Propellers International Ltd. is working with the National Composite Centre (NCC) to improve the design and scalability of composite propulsion systems.
- Bristol Hydrogen Boats currently use hydrogen to power a maritime taxi, and the University of Exeter has recently received funding to create a new Marine Hydrogen testing facility at the Penryn Campus which is dedicated to testing small-to-medium-sized vessels, which could be used as SOVs.
- Additionally, a collaboration between Plymouth Boat Trips, the Centre for Future Clean Mobility at the University of Exeter and Naval Architects at the University of Plymouth created the UK's first electric ferry.
- Appledore is well suited, as a shipyard, to work with innovators to build and test clean propulsion systems and explore the retrofit opportunities for existing vessels.

Although significantly smaller than the scale of vessels needed for O&M operations, technology developments like these can enable the transition to low emission and zero-carbon energy systems and provide a good basis to determine electrification logistics for battery-powered boats. These developments, plus the uptake of ROVs and USVs, provide a solid basis for reducing carbon emissions in the FLOW supply chain.

RESEARCH AND DEVELOPMENT

FLOW is still in its infancy, which presents an opportunity for extensive research and development to inform its supply chain, operation and maintenance.

Unlike fixed offshore wind, there is still much work to be done in optimising FLOW design. Whilst academic research hubs and testing facilities do not usually feed directly into the supply chain of commercial scale projects, they are invaluable in developing and proving new products and services may than be taken forward to market. Research and development is currently ongoing into many aspects of the FLOW supply chain, including:

- Mooring and anchoring systems
- Engineering, fabrication and assembly
- Materials and components
- Blade design and optimization
- Propulsion systems
- Autonomous vessels

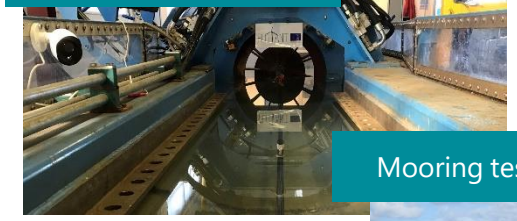
The HotSW is renowned for its academic and research capabilities, including the University of Exeter and the University of Plymouth. The HotSW also benefits from hosting world-renowned marine test facilities, which attract international investment, and key connections with several test facilities across the South West through associations with the Universities and the Marine-i programme, such as the Falmouth Bay test site (FaBTest) and the National Composites Centre.

According to the UK government, research and development will help maintain UK's position as a world leader in offshore wind. This was reflected through £31m in government funding, matched by more than £30m from industry, to develop new technologies that will further FLOW development.

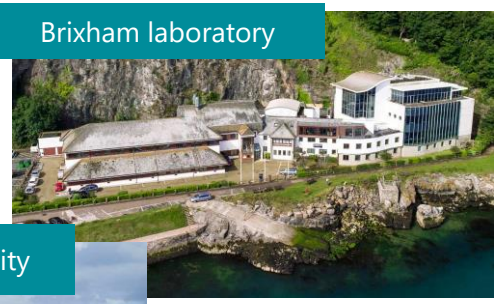
Funding opportunity

In 2021, the Department for Transport and Innovate UK launched the Clean Maritime Demonstration Competition, a competition for feasibility studies and technology trials to accelerate maritime decarbonisation in the UK. The first round allocated £33.5m to 55 projects across the UK, including the University of Plymouth's Marine e-Charging Living Lab project, installing a port-side charger for small electric maritime vessels. There are now talks of a second round of funding under the same competition, with potentially over £100m of funding for large-scale demonstrator projects available.

Dynamic Marine Component test facility

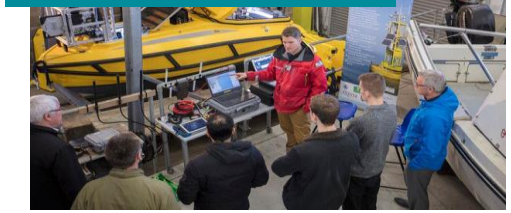


Brixham laboratory



Mooring test facility

Marine Business Technology Centre



COAST test facility

SKILLS DEVELOPMENT AND TRAINING

The FLOW supply chain requires a wide range of high-level skills and expertise. By investing in the development of relevant transferable skills, HotSW can ensure that the necessary expertise is available across the entire FLOW supply chain.

The supply chain of a FLOW farm demands a diverse range of skills from a variety of sectors, which can support careers in:

- Environmental Science
- Engineering
- Construction
- Business and Economics
- Politics



The HotSW already has several specialist skillsets that can be directly applied to FLOW, particularly around environmental surveys and consultancy services. There is also significant opportunity to expand upon and develop existing expertise, particularly around the engineering and manufacturing aspect of the FLOW supply chain. Approximately three-quarters of the skillsets needed for offshore wind supply chains are classed as 'core' skills - skills that are often used across all large-scale infrastructure projects - with only a quarter directly related to offshore wind itself.

The transferability of these 'core' skillsets to the FLOW supply chain demonstrates that companies and individuals in the HotSW already have a lot of the necessary skills required to engage within FLOW opportunities. Additional support to develop skills that are directly applicable to FLOW can put HotSW companies in good stead to feed into the supply chain, allowing them to diversify their revenue and secure future income as an ever-increasing number of FLOW projects are developed to meet net zero targets.

Numerous schemes have been created to help get the UK supply chain ready to bid for offshore renewables work. These include supply chain programmes that can offer grant funding and business support to companies interested in expanding into offshore wind. Such schemes include the Offshore Wind Growth Partnership (OWGP) and the Fit 4 Offshore Renewables scheme.

Fit 4 Offshore Renewables (F4OR)

The Fit 4 Offshore Renewables scheme is a business support activity co-funded by the North East Local Enterprise Partnership and the Offshore Wind Growth Partnership. It offers businesses the chance to assess and enhance their readiness to partake in the offshore renewables supply chain by increasing their industry engagement, market awareness, profile and confidence in bidding for offshore renewables work.

Successful businesses obtain an industry-recognised 'Granted' status after completion of the programme, meaning they are better equipped to engage with major industry stakeholders and potential future clients. The scheme has already helped 15 companies across the UK achieve 'Granted' status, with some companies winning major contracts with offshore renewable companies such as Total and Steisdal Offshore; over 40 more businesses are currently being supported by F4OR programmes nationwide.

The programme is available to businesses ranging from those with no offshore renewables experience to established suppliers, and companies can register interest for the scheme on a nation-wide or regional basis at any time. At present, there is no South West application programme; however, with the growth of FLOW in the Celtic Sea, the prospect of a regional programme may be on the cards.

CASE STUDY: CENTRES OF EXCELLENCE

Centres of Excellence are a proven way of upskilling and supporting local companies, as proven through Hinkley C. There are a handful of existing Centres of Excellence that are focused on marine energy and offshore renewables.

The **Marine Energy Engineering Centre of Excellence (MEECE)** is run by the Offshore Renewable Energy Catapult and is delivering research, development and demonstration activities to support marine energy supply chains. The centre provides support in three main ways:

1. Research, development and innovation
2. Commercialisation support
3. Company growth support.

MEECE is focused on the Welsh supply chain and accelerating the commercialisation of marine technologies, including wave, tidal and offshore wind sectors.

A multi-million-pound collaboration between ORE Catapult and four Welsh universities - Swansea University, Cardiff University, Cardiff Metropolitan University and Bangor University - the centre is based at Pembroke Dock and is part-funded by the European Regional Development Fund and Swansea Bay City Deal. Working alongside the Marine Energy Test Area (META), the Port of Milford Haven, Pembrokeshire Demonstration Zone, local universities and the local supply chain, the Centre offers unique facilities and capabilities to the Welsh marine energy sector.

MEECE

The ORE Catapult has also now established the **Floating Offshore Wind Centre of Excellence** to help develop an internationally recognised initiative to reduce the cost of energy from FLOW. The Centre will accelerate the build out of floating wind farms, create opportunities for the UK supply chain and drive innovation in manufacturing, installation and O&M. The Centre is developed in collaboration with industry, academia and supply chain partners.

The objective of the Floating Offshore Wind Centre of Excellence is to:

- Establish the UK as the leading FLOW market in the world
- Establish an internationally recognised centre of excellence in FLOW
- Reduce the levelised cost of electricity from FLOW to a commercially manageable rate
- Cut back development time for FLOW farms
- Develop opportunities for the UK supply chain
- Attract investment in FLOW research and development in the UK

The Centre has developed an initial core work programme across four workstreams:

1. Technology development
2. Supply chain and operations
3. Development and consent
4. Delivering net zero

SKILLS DEVELOPMENT AND TRAINING

The growth and development of FLOW in the Celtic Sea is a long-term opportunity for the HotSW. It is crucial to ensure that younger generations have the required knowledge and skills to keep the industry evolving, not just locally, but also at a global-scale.

While skills development is something that can be invested in today and will have noticeable short-term effects, it is crucial to ensure that training is available for younger generations to obtain necessary skills to continue the sector. With four universities, ten further education colleges and numerous schools across the HotSW, the LEP can play a pivotal role in empowering the future workforce and ensuring FLOW and offshore renewables skills are at the forefront of the curriculum.

Engaging in discussions with FLOW developers will establish the sought-after skills and requirements in the supply chain and can help build a pipeline that offers a variety of routes into the FLOW supply chain. This would allow younger generations to become more aware of the opportunities provided by FLOW, offering employment and investment opportunities in the region for decades.

Colleges such as Petroc and Bridgwater and Taunton College already offer a number of courses in manufacturing and construction, including technician engineering, pipe fitting and welding. Many higher education colleges also collaborated with Hinkley C to design specific courses on key skills. As well as developing FLOW supply chain skills, it is crucial to ensure that trainees coming out of development programmes are certified to the latest techniques and standards. In doing so, the HotSW can gain a competitive advantage to secure future supply chain opportunities for FLOW development across other parts of the UK. This is where the HotSW could set up or support a training programme dedicated to the skills needed for FLOW.

To ensure the development of existing skills, a strategic skills development plan should be implemented to design higher education courses that focus on skills relevant to FLOW and the broader renewables sector. These may include specific marine skills, such as sea faring, navigation and marine operations, or more general academic courses, such as marine renewable energy or aeronautical engineering. The desire to learn and develop such skills is in demand across younger generations, and it is crucial that this opportunity is maximised by making students aware of the career opportunities in FLOW and other offshore renewables.

Petroc College

Based in Barnstaple, Petroc College offers a wide range of higher education courses and trainee apprenticeships, with a focus on environmental conservation, construction, digital and technology and engineering. Petroc is an education partner of the South West Institute of Technology (SWIoT), with a focus on Advanced Engineering. The SWIoT is helping to deliver skilled local people, economic growth and prosperity in the South West.

Harland & Wolff (Appledore) have recently partnered with Petroc College to create a yearly apprenticeship scheme that takes on students across a mix of genders and ages. The apprenticeship gives students the opportunity to work across all aspects of the shipyard within their first year. They can then focus into a specialist area across their final years, with opportunities in trade (welding, fabricating, rigging etc.), technical (engineering, naval architecture) and business support (sales, administration). The first intake in September 2021 saw five apprentices welcomed onto the site, with the intention to increase the intake number for September 2022.

CONTENTS

SUPPLY CHAIN ANALYSIS

FLOW SUPPLY CHAIN

The breadth of elements included within the FLOW supply chain means that that HotSW is well-positioned to take advantage of the opportunities presented by its development. The Sector Deal between the government and the sector, agreed in March 2019, sets a target of achieving 60% UK content by 2030, and according to the Offshore Renewable Energy Catapult, the first GW of FLOW in the Celtic Sea could potentially deliver over 3000 jobs and £682m in supply chain opportunities for Wales and the South West by 2030.

Many domestic companies are already competitively working in the offshore sector, including in offshore wind, oil and gas and other marine industries. However, skills in project development, balance of plant and component design, project management, installation and O&M, together accounting for over 50% of lifetime project expenditure, could be easily transferred from other sectors.

The scale of supply chain activity will depend on collaboration between developers, wider industry and government, but The Crown Estate's ambition for the Celtic Sea will see employment in the region for decades. It is important that FLOW projects in the Celtic Sea maximise local content. This means there is an opportunity to develop a local supply chain in the Heart of the South West region.

Primarily, employment opportunities are expected to be delivered in technology development, professional services, manufacturing and assembly, installation and marine operations and O&M. For HotSW, key opportunities in the FLOW supply chain include initial environmental surveys, fabrication and assembly of mooring and anchoring systems, project management, vessels, subsea operations and R&D.

Supply chain plans

UK government recently consulted on changes to the regulator and administrative frameworks of the Supply Chain Plans (SCP) that developers have to submit as part of their CfD application. The SCP proposals aim to build on the new SCP format introduced in 2021. Having clearer and more stringent SCPs will be positive for supply chain companies, as they will have the guarantee of work and an understanding of the timelines. Previously, developments of less than 300 MW did not require SCPs, but this consultation proposes this be brought in for FLOW. This could, however, negatively affect small-scale initial developments which should be supported and not subjected to additional regulatory processes.

In October 2020, over 200 members of DeepWind, Scotland's offshore wind supply chain cluster, formed a subgroup to ensure Scotland's energy supply chain companies benefit from FLOW projects in Scotland and the UK. The aim of the new subgroup is to develop close ties with centres of innovation, such as the FLOW Centre of Excellence and the Carbon Trust's FLOW Joint Industry Project.

Many developers have set up supply chain registers to keep track of companies that can input into the FLOW supply chain. These databases enable onshore and offshore suppliers to add their company details, services and record their capabilities. This will become more important when FLOW developers have to write supply chain plans prior to being awarded a CfD, as developers will have to preempt which companies they will be able to use, as well as ensure that they hit the required percentage of local content.

ENVIRONMENTAL SERVICES

The ability to undertake environmental and marine surveys as part of the FLOW supply chain is one of the key opportunities for HotSW.

In the development of a FLOW farm, many marine and environmental surveys are required. Previous projects have commissioned surveys into the following three aspects:

- The physical environment
- The biological environment
- The human environment

Marine and environmental surveys are the first steps in securing a seabed lease from The Crown Estate. According to The Crown Estate's guide to an offshore wind farm, approximately £4m is spent on environmental surveys per GW developed, which offers a significant economic opportunity for the HotSW. This is key, as many of the developers currently interested in the Celtic Sea have not yet started surveying.

Environmental surveys can benefit from the site-specific knowledge and expertise available from local companies. However, due to the flexibility of survey work, there is also the prospect for companies within the HotSW to work on offshore wind or other surveying projects outside of the region. This also provides opportunity for inward investment. There are a significant number of specialist companies in the Heart of the South West that currently provide geotechnical site information, habitat surveys and marine mammal monitoring, with several of these companies have previously worked in the offshore wind sector.

The completion of marine and environmental surveys requires large amounts of data, which can take several years to collect, but holds immense value and opportunities to learn about the marine environment. At present, environmental data is primarily collected using manned vessels, however, there is a growing opportunity for the use of marine autonomous systems.

The Crown Estate has recently announced that they intend to streamline the deployment of FLOW by carrying out Habitats Regulations Assessment (HRA) ahead of tender. This will identify key environmental impacts as early as possible which will de-risk investment and speed up the leasing process. Developers will still need to carry out site-specific environmental surveys, but this could mean that companies will need to liaise with a range of contractors including developers and The Crown Estate. Floating windfarms Whitecross, Llŷr 1 and Llŷr 2 are the first to be involved in this trial.

Case Study

Partrac is a metocean consultancy that employs c. 20 people. They have a South West office in Heathfield, Devon as well as offices in the North West and Scotland. They have been involved in multiple offshore wind projects since their formation in 2003, including carrying out measurements for NextGen's ScotWind leasing bid. They have also recently been contracted by StatKraft to deliver metocean measurements for the developer's North Irish Sea Array offshore wind site.

PARTRAC

CASE STUDY: NORTH DEVON BIOSPHERE

The North Devon UNESCO Biosphere is dedicated to unlocking the economic, social and environmental impact of natural capital, and hopes to inspire a positive future by connecting people and nature. Not only is there a focus on protecting natural capacity and delivering the UN's Sustainable Development Goals in northern Devon, but also on benefiting local residents and businesses and supporting individuals to explore new career opportunities in environmental jobs. Education is an important focus of the Biosphere Foundation's work, and the North Devon Biosphere team are engaging with schools to create courses, talks and resources and to provide funding.

Through their work, the North Devon Biosphere team have found how important it is to support local businesses to allow them to diversify and scale up. However, the teams have also found that there are social and economic challenges facing the region, including:

- The area GDP per head is around 25% lower than the national average
- The economy lacks resilience to respond to issues like climate change
- Traditional industries need to be supported in order to make a transition to a more sustainable economy and protected from automation risks
- Businesses need support to make a transition to being more environmentally friendly and find niche markets

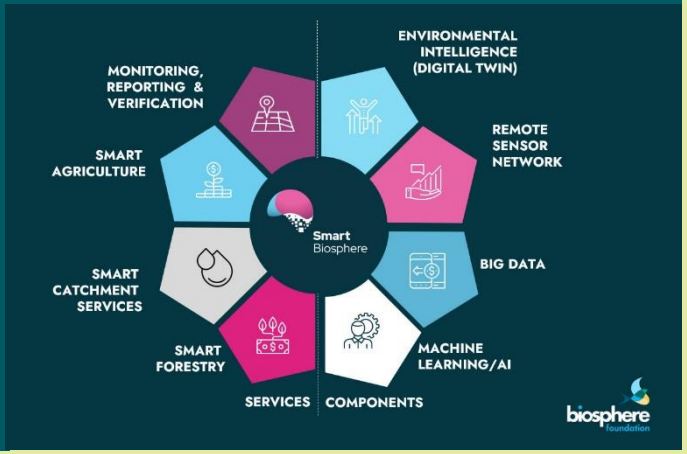
To address some of these challenges, the Biosphere has launched the 'Biosphere Business Partner Eco Accreditation Scheme' which allows businesses to share the work they are doing in northern Devon and requires them to sign up to at least five commitments across three categories: local conservation, raising awareness, and local development. This helps to support local companies while also working towards a common goal.

Smart Biosphere – Using Data

The Smart Biosphere project seeks to create a "UK-first; a landscape-scale environmental intelligence program harnessing artificial intelligence, big data, Internet of Things remote sensing and satellite earth observation to build real-time and predictive models of the inter-relationships between the agri-food system's land-use, soil health/carbon, run-off, water quality, natural flood management and flood risks". The Smart Biosphere project focuses on the catchment basin of the River Taw and the River Torridge.

This is a cutting-edge project in terms of data and digitalisation, with significant investment from Siemens, the Met Office and AWS, as well as receiving funding from South West Water, HotSW LEP and the UK government. The need for coordination has been recognised as part of this project, including the importance of not duplicating effort and work, with the aim of the Smart Biosphere being to be able to share the data collected. This could be beneficial to FLOW, as there are likely to be many offshore and onshore surveys carried out as part of the selection of site location, onshore substation and cable route.

This echoes The Crown Estate's aim for coordinated and shared Habitat Regulation Assessments (HRAs) for the Celtic Sea, and leveraging the data already gathered by the Smart Biosphere project could help to speed up the planning process for FLOW developers.



PROFESSIONAL SERVICES

The Heart of the South West region has many companies that work in professional services and consultancy, including many that are focused solely on offshore and marine work. There is scope for many existing companies to diversify to provide these services for FLOW.

Professional services and consultancies are involved in the development, operation and decommissioning stages of a FLOW project. This is intrinsically linked with the need for environmental and marine surveys, which can often be carried out by the same companies. The development of FLOW in the Celtic Sea provides an opportunity for surveyors to diversify to provide services during the whole supply chain.

This also extends beyond offshore-focused companies and services, to more general services, including:

- Planning
- Legal and insurance
- Accountancy and finance
- IT and data services

This type of work tends to lend itself to remote working, and with the recent move to more flexible working arrangements, it may be that many companies not located in the Heart of the South West region will have staff based in the region.

Many professional services companies and consultancies that have worked as part of Hinkley C could be well placed to be involved with future FLOW development, as they have experience of the supply chain involved in a high-integrity, mission-critical project.

Across the HotSW, there are over 300 companies working in environmental consultancy, employing over 600 people. These are mainly centred around Exeter and have a cumulative annual turnover of c. £95 million.

Case Study

GoBe is one of the leading providers of services to the marine renewable energy sector, having provided support in relation to a number of wave, tidal and offshore wind developments. Based in Devon, they also have offices in Scotland, and could be involved in developments in the Celtic Sea and as part of ScotWind. GoBe has experience in the Celtic Sea, as they provided professional services for the Wave Hub site in 2015.

MATERIALS AND COMPONENTS

Fabricating a turbine requires a number of components, typically made from steel. The HotSW has several companies with experience of manufacturing components such as bearings and shafts, where these skills could be applied to FLOW.

The main mechanisms of a turbine (nacelle, rotor, generator etc.) make up approximately 30% of the capital expenditure of a floating wind farm. The manufacturing supply chain of these components can be challenging to enter, as it can be dominated by well-established companies such as Siemens, Vestas and GE. However, these main mechanisms are constructed from a large series of smaller components, including shaft bearings, gearboxes and braking systems, alongside many others.

FLOW manufacturers typically obtain smaller components from a range of suppliers, based upon comprehensive specifications or detailed design drawings. Materials used to manufacture these components typically comprise of steels and cast irons. As more local content is required within the FLOW supply chain, and as warranty periods end, HotSW companies may be able to contribute to the manufacturing of these constituent parts. At present, several companies within the Heart of the South West region produce materials such as steel and a variety of composites, which could be adapted to suit the needs of FLOW.

Also incorporated within the main mechanisms of a turbine are sensors, which give continuous information about component condition (including temperature, stress and vibration, level, position and pressure) and calibration. These specialist sensors are built into the turbine mechanisms across the fabrication and assembly stages, but are also provided by external companies.

HotSW has a large pool of reputable design and manufacturing companies, offering scope to expand their services to FLOW. A proportion of these companies have already worked within the Hinkley C supply chain and have demonstrated that HotSW is extremely proficient in manufacturing high-integrity parts. Although most have not worked directly in offshore wind before, these companies have the necessary skills and materials required to construct the smaller components of a turbine.

The opportunity to provide components for floating turbines is not limited to the initial manufacturing process. Companies also have the ability to provide replacements parts for turbines as and when components become faulty; this offers the opportunity to be engaged within FLOW supply chain across a floating offshore turbine's lifecycle.

Case Studies

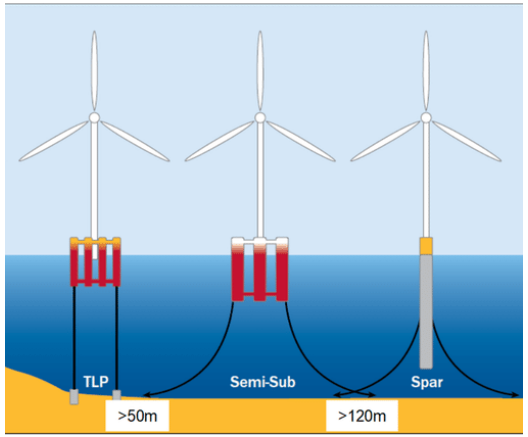
Based in Somerset, Bridgwater Welding Supplies has become a reputable supplier of quality welding gear and products since its establishment in 2013. The company has experience of handling high-integrity products from within the Hinkley C supply chain and already produces a variety of steel products that could be utilised in FLOW.

Beran Instruments is a Great Torrington-based company that provides conditional monitoring systems to the global market, with subsidiaries in Italy and the USA. Although Beran Instruments have not worked in offshore wind before, they provide a range of sensors that monitor vibrational load, frequency response and system calibration, all of which can be adapted for use in a wind turbine.

FLOW FOUNDATIONS

Floating substructures have widely been constructed from steel, as a handover from previously deployed monopile foundations. However, there may be a strong case for the use of concrete to make FLOW substructures, where the HotSW can greatly benefit.

Due to the infancy of the industry, designs for floating foundations are yet to be standardised. FLOW developers typically use one of three floating substructure designs, based upon conditions such as the resource available, size of the turbines and port and harbour facilities.



Substructures currently used in floating offshore wind. Floating platforms used in water depths >50m.

Most demonstration projects, such as Hywind (Five 6 MW turbines) and Kincardine (Five 9.5 MW turbines) in Scotland, use floating substructures that have been manufactured from steel. Steel's survivability in the marine environment is well-understood from its use in fixed-foundation offshore wind, and steel manufacturing facilities are already available with materials that are readily obtainable. Companies in the HotSW such as Relay Engineering, Clifford Friend and Blackhill Engineering have experience in structural steel manufacturing and could contribute to the fabrication of large foundations.

Kincardine

Semi-submersible foundations
- 67m wide
- Max. 12m above waterline
- Steel weight ~3,000 tonnes

Hywind

Spar foundations
- 91 m in length
- 14.5 m in diameter
- Steel weight ~2,300 tonnes

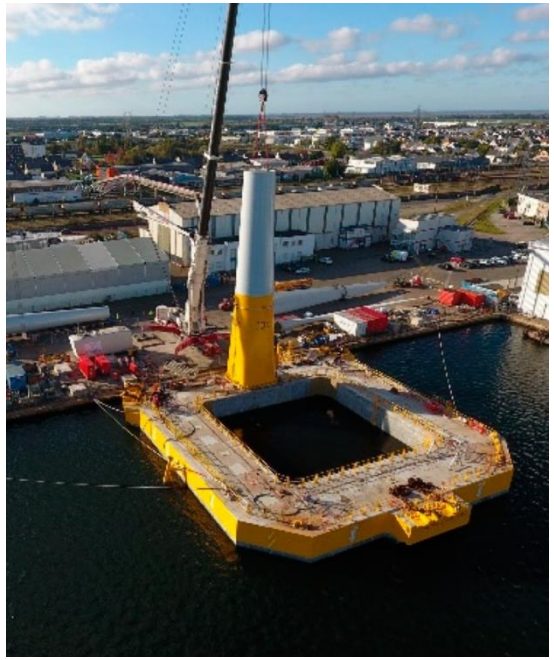
Recent discussions in industry have suggested a shift towards the use of concrete for floating substructures, either fully or as a composite design with steel, due to its lower manufacturing costs and lower carbon footprint; approximately 0.8-2.8 tonnes of CO_2 are emitted per tonne of steel, whereas concrete has a footprint of approximately 0.1 tonnes of CO_2 per tonne. Innovations in low carbon concrete have helped with this potential industry shift. However, there are still concerns over the durability of concrete structures in the extreme conditions that FLOW foundations have to endure. Arc Marine has designed innovative carbon-neutral concrete structures for the sea floor with an expected lifetime of 100 years; however, the durability of concrete at the ocean-air interface is still unknown.

Some FLOW developers have stated that concrete would not be used in their developments due to survivability issues. Although there is still uncertainty as to whether concrete will be used for FLOW foundations, if it was applied, the HotSW would be able to benefit from its use due to companies such as Hanson Ready-mixed Concrete and RGB Building Supplies.

FLOW FOUNDATIONS

With the potential for industry to shift to concrete foundations, HotSW is well placed to take advantage of the increased demand for skills and services that come with fabricating large-scale, high-integrity structures.

The weight and dimensions of FLOW substructures result in the need for very large manufacturing and assembly areas, as well as access to high crane lifting capabilities. Currently, the HotSW does not have the port infrastructure capable of the large-scale fabrication of these substructures, with the nearest UK fabrication ports likely to be centred around Avonmouth, South Wales, Belfast, Mostyn or along the East Coast. This is expanded upon further in the ports and logistics section.



Avonmouth, in particular, provides a good opportunity for the HotSW to get involved with this part of the supply chain. With a 30.5 m by 266 m lock and around three hectares of warehousing and rail connections, Avonmouth is a good contender for the South West's concrete production centre. Although not based within the HotSW, the LEP can benefit from this supply chain element as commuter distances from the Northern section of the LEP (i.e. Mendip) can be typically travelled within an hour.

The HotSW does have experience in large-scale, high integrity concrete fabrication from the construction of Hinkley C. In addition to this, there is a range of companies that have engineering experience of these materials, and companies that have a history in supplying aggregates for the concrete mix. Therefore, there are several opportunities in concrete and steel that the HotSW can capitalise on, including: design engineering; project management; quality control, safety and monitoring (of the whole manufacturing process); low-carbon concrete R&D; consultancy; and concrete recycling.

RESEARCH AND DEVELOPMENT OPPORTUNITIES

Research and development into how best to use concrete and/or steel for floating substructures is ongoing, and there is a significant opportunity for the HotSW to be at the forefront of this area. Areas where research and development is needed include:

- **Severe exposure conditions** – the air-sea interface provides a challenge as the material will shift from being fully submerged to unsubmerged. This movement from sea to air and back increases the fatigue of concrete and will require in more maintenance on the structures.
- **Deployment of substructure** – concrete substructures could benefit from using a "shell" concept, where a concrete shell could be floated to the site and sunk to position using concrete as an infill. This reduces the required lifting capacity at the port and mitigates the need for barges. However, increased weather windows and additional support vessels would be needed.

ANCHORS AND MOORING SYSTEMS

Unlike fixed-bottom offshore wind, a FLOW turbine is mounted on a platform that is anchored to the seabed using mooring lines. The sector is still in a period of innovation, with no universal method of anchoring and mooring collectively adopted yet.

ANCHORS

The type of anchor used for a particular project is driven by characteristics such as the project size, substructure foundation and seabed properties. There are currently three main types of FLOW anchors:

- Drag-embedded
- Suction
- Driven pile

The manufacture of these anchors typically requires large laydown areas for storage, and is preferably carried out in close proximity to deep water access for transport ease. Access to cranes with approximately 300 tonnes lifting capacity is also needed, though this is significantly less than the 1000 tonnes lifting capacity needed for a turbine's nacelle.

At present, there are no companies located within the HotSW manufacturing anchors; however, there are companies with bases in Cornwall that are exporting anchoring products and drilling services that would be capable of handling a commercial-scale contract, including Fugro and Acteon. As FLOW is an emerging technology, the design of anchoring systems is ever-developing. Cornwall-based Reflex Marine has developed a javelin-like anchor which is capable of being drilled in a wide range of seabed geologies – beneficial for the range of geologies present in the Celtic Sea. If the HotSW can capitalise on this development, then these piled anchors can be manufactured locally and at a competitive price.

Drag-embedded anchor


Driven pile anchor

MOORINGS

Typical configurations state that mooring lines are at least four times longer than the water depth of the site; according to OREC, a 300 MW project (the smallest commercial capacity set to develop in the Celtic Sea) requires approximately 51 km, or 23,000 tonnes, of mooring lines. Mooring lines are currently made from large diameter chains and require large factory and laydown areas, and cranes with an excess of 500 tonnes lifting capacity. However, there is a shift towards the use of synthetic rope for future FLOW mooring solutions to minimise costs of the floating wind farms. This period of innovation could support the numerous R&D and testing facilities around the HotSW.

This development means there is a growing need for experienced rope makers. There are several HotSW companies that currently manufacture rope for boat moorings, but expansion would be needed to diversify into synthetic materials. Bristol Rope and Twine currently manufacture, import and distribute synthetic rope to a range of marine industries worldwide; however, the diameter required for FLOW is in excess of 1.5 m, requiring a significant increase in manufacturing facilities. Although not based in the HotSW, FLOW in the Celtic Sea could provide a good basis for Bristol Rope and Twine to invest in such manufacturing facilities within the region.

ELECTRICAL INFRASTRUCTURE AND CABLES

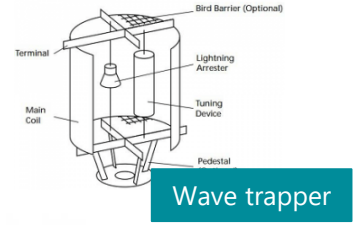
A grid connection is a vital component of FLOW development. To accommodate up to 4 GW of new capacity from the Celtic Sea, the onshore substations around South Wales and the South West need significant investment and upgrades, and potentially a new approach is needed.

For HotSW, it is likely that FLOW developments would connect to the north coast, as this is the closest part of the region to the Celtic Sea leasing zones. On the distribution network, operated by Western Power Distribution, the closest bulk supply stations are located at Yelland, Barnstaple and Watchet, while on the transmission network, operated by National Grid, the major substations along the north coast are located at Alverdiscott and Hinkley C.

National Grid is currently looking at how to best prepare the network for an influx in offshore renewable energy capacity, from both FLOW and interconnectors such as Xlinks, a 3.6 GW interconnector project between Morocco and the UK. One option they are investigating is an offshore substation, to which all nearby developments would connect, with one cable then connecting to the onshore substation. This reduces the need for multiple developers to dig up similar routes to lay cables; however, it does pose other challenges and would mean a serious upgrade to the existing substations at Alverdiscott and elsewhere.

According to the OREC supply chain study, electrical infrastructure makes up 13-20% of project capital expenditure. For previous demonstration projects, such as WaveHub and the Pembrokeshire Demonstration Zone, existing onshore infrastructure was used. However, for the larger projects now being developed, more extensive infrastructure is required. This includes switchgears, converters, reactive power compensation and earthing systems in both the onshore substation and for any potential offshore substation.

An additional element of the supply chain is manufacturing and laying of cables, both offshore and onshore. There are a number of companies in the HotSW that may be able to be involved in the construction and installation of an onshore substation, including Morgan Sindall and Balfour Beatty. HellermannTyton, an international group that has a manufacturing site in Plymouth, also has experience in cable management solutions. They have experience in the offshore industry and have developed products that are designed to withstand extreme conditions.



Wave trapper

Lightning arrester

Isolator

Instrument transformers

Current transformers

Potential transformers

Insulator

VESSELS AND SUBSEA OPERATIONS

The capacity to perform a variety of marine and subsea operations is a necessity in the FLOW supply chain. Specialised vessels and personnel are sought after for the expansion of FLOW, and HotSW has the ability to provide several of these services.

Installing and maintaining a FLOW project requires a number of marine and subsea operations that cover:

- The installation of structures, including turbine and substructures, offshore export cables, inter-array cables and anchoring and mooring installation
- Offshore communication systems
- Ongoing support and maintenance, including surveying, crew transfer and vessel support.

These operations require access to specialist vessels alongside a support network of experienced personnel, such as divers and engineers. Floating wind farm developers will contract these services out to specialist companies who undertake these operations for the necessary period of time; this can range from 12 - 18 months for the installation of structures, to the entirety of the project lifetime for CTVs and SOVs.

The HotSW already has a variety of specialist companies that have the services and skills suitable for the marine and subsea operations needed for FLOW. These include subsea diving and cable installation, provision of offshore engineers, and vessels capable of towing large structures. Several of these companies have previous experience working in offshore renewable energy, but would need expanding to provide the same services at the scale required for FLOW.

Plymouth Marine Laboratory is also in the process of testing a new fleet of autonomous survey instruments and vessels to deliver high-speed underwater communication and data collection. Autonomous mechanisms minimise restrictions from weather and environmental conditions, providing an extended deployment window, and require skilled personnel to collate and interpret the data, providing employment for data handlers and specialists across the lifetime of the project.

Case Study

Based in Brixham, MTS has a fleet of 23 vessels that can offer towage, engineering support and crew transfer services. Their access to large tugs, shoalbusters and multicats has given them experience in working in the offshore wind sector, having previously provided support vessels for the extension of the Walney fixed-bottom offshore wind farm off the Irish coast.

MTS MARINE & TOWAGE SERVICES

There is a growing opportunity for HotSW companies that specialise in vessel construction and operation, particularly in light of the recent launch of the UK government's new unit, UK SHORE, and the associated £206m in funding for clean propulsion and skilled maritime jobs. The number of vessels needed, and their tonnage requirements, are expected to grow rapidly by the end of the decade as the scale of FLOW farms increase, according to Rystad Energy. Harland & Wolff, based in Appledore, have already acknowledged a gap in the market for the construction of SOVs, and capitalising on this progression before the end of the decade can put the HotSW in a favourable position when contracts are being offered.

OPERATIONS AND MAINTENANCE

The operation and maintenance (O&M) of a FLOW farm can secure work within the FLOW supply chain for decades. Supply chain elements such as continuous monitoring systems, autonomous vessels and experienced personnel can provide HotSW companies with long-term investment and employment opportunities.

The O&M of a FLOW farm comprises the facilities and services which carry out major repairs, routine inspection and proactive maintenance. Across the initial operation period of 5-10 years, a wind farm may be predominantly serviced by the plant owner; however, after this warranty period, contracts for on- and off-site operations are typically handed out to external companies. There is still speculation on how major repairs will be undetaken for FLOW. Primarily, discussions are based on determining whether repairs will be carried out on- or off-site, both of which will require different amenities and services:

- On-site repairs will likely take several days and may require a 'mother-daughter' method, where smaller marine vessels travel to and from the plant from a larger 'base' vessel, acting as a hub for personnel. This requires an extensive understanding of the maritime industry to optimise solutions and provide quick and efficient vessels that can carry out major repairs.
- Off-site repairs will employ a tow-to-port strategy where the turbine and its substructure are towed onshore (either dry dock or inshore) by available vessels and repaired with cranage at a capable port. This strategy is complex and costly, both in terms of operations and downtime, yet is currently the most accessible approach for the present scale of FLOW.
- An increase in helicopter use for routine O&M operations may also be included in the future O&M mix as FLOW farms stretch further out to sea. Companies like Helitune can aid in such operations.

The dimensions of proposed turbines and their substructures, alongside current port facilities, mean that the HotSW will not be the primary basis for major O&M repairs for the Celtic Sea. However, there are multiple supply chain elements that are applicable for the routine inspection and proactive maintenance aspects of operating a floating wind farm. Existing companies that can provide a selection of routine O&M services include:

- Alpha Marine Services, suppliers of qualified diving personnel experienced in subsea operations
- Beran Instruments, manufacturer of condition monitoring systems
- Keynor MorLift, marine contractors specialising in marine construction and operations

The lifetime of a FLOW farm is anticipated to be between 20-25 years, based on current fixed offshore structures, allowing local organisations within the HotSW to play a key role in O&M services and providing the chance for long-term local employment. This provides a significant investment opportunity for the HotSW, with the Crown Estate estimating that approximately £75 million per GW is spent on offshore wind O&M activities annually.

As FLOW projects increase in size and volume, optimisation of O&M activities is required to streamline the process and reduce costs. Autonomous vessel innovation at Plymouth can progress subsea monitoring of cables and mooring lines, and port facilities and vessel servicing expertise at Appledore can optimise vessel design and provide refurbishment capabilities for marine logistics. As the Celtic Sea provides one of the first opportunities for large-scale maintenance of floating wind turbines in the world, the HotSW is well-placed to advance and optimise the O&M process of FLOW.

CONTENTS

PORTS AND LOGISTICS

PORT REQUIREMENTS

The physical scale of FLOW components, as well as the expected number of turbines to be deployed, will place high and wide ranging demands on port infrastructure. These demands will vary across the project lifetime:

Near-term requirements → **Future requirements**

Planning

In project planning, surveying vessels will be active and in need of construction, maintenance and docking space. Port activity will be highest in the construction phase, with demand from installation vessels, tow vessels and crew transfer vessels.

Construction / Assembly and launch

While the manufacture of turbines and towers themselves is highly likely to remain at the OEMs existing sites, fabrication of floating substructures will require ports with both construction facilities and suitable quayside areas, and depths to store and float the structures. High tonnage cranes and/or a floating drydock are needed, with road and rail access also key. Local port capabilities can be considered to an extent in the choice of substructure type; the ORE Catapult has completed work estimating the specific port requirements for each. Mooring chains and anchoring systems can be manufactured and stored separately and will also require portside space, likely strengthened.

Following construction, a staging port for final assembly and launch will be needed. This port must have large and strengthened laydown and working area, cranes with lifting capacities of 500 tonnes at a minimum, and navigation channels wide and deep enough to safely float and launch the structures. Ease of land and sea access is also critical. This very specific role will be only be possible at a limited number of sites.

O&M

Once operational, an O&M base will be needed for the lifetime of the windfarm. This site must have secure storage and lay down areas, space for offices and workshops and a quay with 24/7 access capable of handling SOVs.

Decommissioning

There is a final role for ports as a decommissioning base.

A "WindFloat" semi-submersible substructure at port. At present, only a few ports globally can handle the scale of these structures.

PORT REQUIREMENTS

Key FLOW component	Port activity	Key requirements
Turbine manufacturing	Manufacturing of main turbine nacelle	- Likely to remain at OEM manufacturing sites, which are in Europe
Fabrication of main components	Fabrication in steel and/or concrete of the main FLOW substructures	- Very large laydown area - Water depth, quayside and slipway access - Proximity to steelworks and aggregates - Land transport
Assembly of main components	Assembly of the main components including sub-structure, tower, turbine blades	- Most likely done at quayside - Large laydown area and cranage - Water depth for substructures
Staging	Holding of assembled FLOW structures prior to tow out to site and installation	- Large area of sheltered deep water, potentially Milford Haven or Carrick Roads Falmouth - Ideally close to site
Mooring and anchoring system fabrication	Fabrication of mooring system components: anchors, piling system components, ropes etc.	- Could be completed at a variety of ports with fabrication and manufacturing capabilities
Mooring and anchoring system assembly and staging	Bringing mooring system together before deployment	- Laydown area and warehousing - Water depth sufficient for anchor handing/drilling vessels - Close proximity to Celtic Sea sites
Site survey	Mobilisation port for site survey vessels	- Ports in close proximity to Celtic Sea sites, good quayside access, land transport routes
O&M activities	Main hub port for operations and maintenance, including inspections	- Close proximity to site - Water depth to handle offshore service vessels - Laydown and warehousing - Supply chain

OPPORTUNITY FOR CELTIC SEA PORTS

Celtic Sea FLOW developers will be seeking suitable ports to meet their needs across the South West, South Wales, Ireland and possibly northern France. They will be seeking the lowest-cost solutions and are open to a range of approaches.

There is a precedent in developers seeking solutions outside the immediate area of the wind farm to save on manufacturing costs. To date, major fabrication works for pilot FLOW projects have taken place in Spain and Norway, with structures being towed to the north of Scotland. At a commercial scale, developers will want to avoid long transportation distances, and ports around the Celtic Sea must be able to meet their requirements to accommodate FLOW development.

There are various ways of achieving this, ranging from a focus on developing a single port as a one-stop-shop for fabrication, assembly, launch and continuing operations, to a multi-port approach spreading activities across the region. As the Celtic Sea represents the single largest wind resource area in UK waters, a single port solution could create a global industry hub, akin to Aberdeen for North Sea oil and gas. However, this would require huge public investment to construct and may not be the most efficient approach. A multiport solution could have lower total investment requirements and make better use of existing facilities; there is also the benefit of economic opportunity being more evenly spread around the region. Existing work by the ORE Catapult has investigated these approaches for Welsh ports.

The Crown Estate identifies the UK's port capacity as **"a key challenge and opportunity"** presented by FLOW and although the range of ports and facilitie in the Celtic Sea area is a potential strength, it is also the case that all these ports have some constraints in terms of available land space, quaysides, water depths or tidal access restrictions. There is also the challenge of the scale of facilities needed, and the very large area of ocean that must be served. For these reasons, it is likely that the development of FLOW in the Celtic Sea will require a multi-port solution, with different ports providing different services during each stage of the wind farm construction. It is also possible that more distant ports will play a role, for example Belfast and Mostyn, or that structures could be towed in from the east coast or non-UK manufacturing sites.

THE ROLE OF SOUTH WEST PORTS

The South West has a wide variety of port infrastructure available for marine engineering, ship building and repair, manufacturing, installation and ongoing operations and maintenance for marine related projects and cargo handling, as well as fishing, marine leisure and tourism.

With the exception of Avonmouth/Bristol, it is unlikely that South West ports will be used to provide the main fabrication and assembly ports for FLOW sub-structures and turbines. All other South West ports have limitations of space for the 20-40 hectares of laydown area that would be needed. Avonmouth/Bristol Port could play a role in construction, especially if, in the future, concrete substructures are preferred. Avonmouth is already being used to construct pre-cast sections for Hinkley C, including very large outfall and intake heads which are 40 m long, 8 m high and weigh 4,650 tonnes.

Options for the main fabrication and assembly ports could include Port Talbot, Mostyn, Belfast or further afield on the east coast or Europe. Assembled FLOW structures could be staged afloat at Milford Haven and/or potentially Carrick Roads, prior to tow out to site and installation.

South West ports could, however, play a role in the fabrication, assembly and staging of anchoring and mooring systems, and as mobilisation ports for a variety of pre-construction activities including site survey work. More generally, the main opportunities for South West ports are likely to lie in the areas of marine engineering and technology development, including the shipbuilding and servicing of the supply boats and service vessels that will be required to install and maintain the offshore wind farms.

There was consensus across the HotSW stakeholders that the role of its ports as centres of marine engineering and technology development is a better fit with the South West's core strengths in areas such as marine operations, shipbuilding, subsea engineering, marine surveys, bespoke fabrication, engineering design, naval architecture and marine sciences. There are also strengths in supporting technologies such as hydraulics, electronics, IT, remote sensing, condition monitoring and composites.

The HotSW study has focused on the main opportunities at Appledore and Plymouth. Several smaller ports offer the potential for project support and technology development, including at Ilfracombe in North Devon and along the south coast at Brixham and Torquay.

It should also be recognised that HotSW-based companies are also very likely to benefit from the port infrastructure available in Cornwall, with many companies and research organisations also using port facilities at Falmouth and potentially Truro.

Avonmouth

Falmouth

Avonmouth/Bristol and Falmouth could play an important role to support FLOW projects.

APPLEDORE

Situated on the Celtic Sea coast, Appledore is the nearest South West port to the likely FLOW development areas. It could provide a base for marine operations, but its core strength lies in shipbuilding and marine engineering.

As discussed previously, the main opportunities at Appledore are expected to come from marine engineering, vessel design, shipbuilding, repair and servicing. There is also the opportunity to develop Appledore as a centre of blue tech industries and clean propulsion systems, working closely with the region's research expertise at the University of Exeter and the University of Plymouth. Most importantly, Appledore's long association with marine engineering means that there is a skilled workforce in the area which continues to grow thanks to apprenticeship schemes with Petroc college.

The relationship between Appledore and Harland & Wolff's other sites in Belfast, Methil and Arnish could also become important, especially if these sites are involved in offshore wind fabrication and assembly. Appledore could potentially play a supporting O&M role for FLOW. It is only 60 miles from the nearest FLOW project site and, despite space and tidal limitations, it would provide an additional option for vessels conducting survey work, deploying ROV and autonomous vessels or carrying out routine inspection and maintenance.

The Appledore site features a number of facilities

- Main Hall with a 118x3.5 m drydock, two 60-tonne main hoists and seven 10-tonne gantry cranes
- Fabrication (panel) hall with two 30-tonne overhead cranes and gas cutting facilities
- Burning hall with plate rollers, cranage and plasma cutters
- Steel stockyard and shot blast plant
- Design office and training rooms
- Joinery and electrical workshops

There are a number of development opportunities at Appledore that were highlighted by stakeholders during a site visit in March 2022. These include the areas adjacent to the dockyard at New Quay, and Middle Dock, owned by Torridge District Council.

PLYMOUTH

Plymouth has a number of smaller docks and wharf areas, as well as a sheltered port and naval bases. With strong maritime capabilities, Plymouth could be used as a port for some component manufacturing and to support the vessels needed in FLOW.

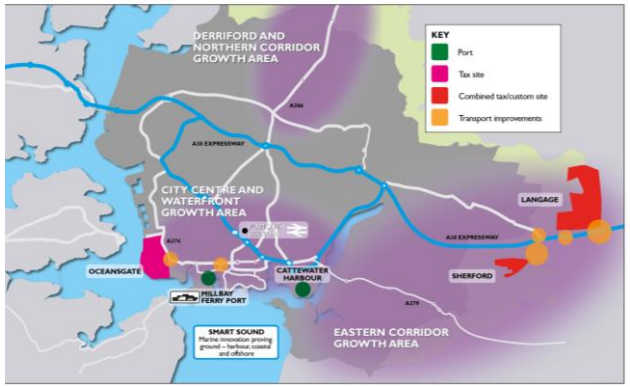
The city of Plymouth has a long history of supporting marine and naval operations, and is a major centre for shipbuilding and marine engineering. An estimated 300 marine-related businesses, employing over 13,000 people, operate in and around Plymouth's four ports.

These include:

- Devonport, a 236 ha naval base and dockyard with 14 dry docks and 25 tidal berths
- Oceansgate/South Yard, a 16 ha site that could be released for marine energy industries, with former dry docks and quayside with deep water
- Millbay, an 18.6 ha ferry terminal and freight port with 1.4 ha of land available for potential marine use. Millbay can accommodate virtually any roll-on, roll-off vessel up to 180 tonnes, typically handling c. 170,000 tonnes of freight per annum.
- Cattewater, located at the eastern end of the city's waterfront, can handle vessels up to 150 m in length and is home to two leading marine civil engineering firms who use it for mobilisation and operations activities.

There are evidently significant port capabilities in Plymouth, and it could be a good location to support the fabrication and manufacturing of FLOW components, as well its potential as a dock for FLOW vessels. The role of Plymouth could expand further if FLOW projects are developed off the south coast and in the western approaches to the English Channel.

PLYMOUTH AND SOUTH DEVON FREEPORT



The development of the Plymouth and South Devon Freeport could offer additional incentives for manufacturing companies using imported components, and for the trial of new technologies prior to certification.

Investment opportunities at Plymouth Oceansgate include the potential reinstatement of dry dock facilities and quayside manufacturing.

Plymouth Oceansgate

YELLAND

Yelland was considered as part of the proposed Atlantic Array Wind Farm development and was identified as a potential construction and/or O&M base.

The site of an old coal-fired power station, Yelland offers 14 ha of brownfield development land on the Taw-Torridge estuary, some of which is contaminated ash. The site is currently used for aggregate processing, with occasional shipments to and from the site using an existing jetty. Despite its location and land space, after a number of studies, the site was not considered viable for the proposed Atlantic Array Wind Farm and remains difficult to develop as a marine construction base. Issues identified include:

- Limitations on water depth and the need for extensive dredging, with the jetty only accessible around high water at present
- Surrounding environmental designations and sensitivities, including Braunton Burrows Special Area of Conservation (SAC), an RSPB reserve and the North Devon Biosphere
- Cost of site clean-up and remedial actions
- Limitations on road access
- Planning risk due to lack of political support and likely opposition

These challenges are likely to persist and, without a strong drive from local stakeholders, Yelland is unlikely to be developed for FLOW use. The site currently has a planning application, which was turned down but is now in the appeal stage, for a mixed-use housing development.

There is, however, a secondary opportunity at Yelland due to its proximity to a Western Power Distribution bulk supply point substation, which is itself connected to the Alverdiscott 440 kV transmission substation. If FLOW provides an abundance of low carbon electricity, Yelland could be an ideal site for energy storage, hydrogen electrolysis and/or use by high energy users such as data centres. Therefore, there is significant inward investment potential for companies seeking access to low carbon electricity.

Yelland

ILFRACOMBE

The potential for Ilfracombe to provide a secondary operations and maintenance facility to serve the proposed Atlantic Array Wind Farm was investigated in 2012.

At the time, Ilfracombe was considered as an option due to its proximity to the wind farm and ability to provide a better passage to the site across the prevailing wind and wave direction. There was also potential for investment to extend the breakwater for marine and leisure users.

However, after several studies, it was concluded that Ilfracombe was not suitable as a marine operations port due to its tidal depth restrictions, the available land space, and likely impacts on existing harbour users and tourism revenues.

The development of FLOW in the Celtic Sea is unlikely to directly lead to investment in the harbour. However, the increased marine traffic in the Bristol Channel could bring tangential benefits, especially if Bristol/Avonmouth is used as a main construction and assembly port. For example, Ilfracombe could be a useful waypoint port, and safety port during bad weather, for tugs and other support vessels.

Ilfracombe is also the European HQ to TDK-Lambda, manufacturer and supplier of a wide range of electrical system components, AC/DC converters and accessories, which will have a number of applications in the offshore wind and renewables sector.

Ilfracombe

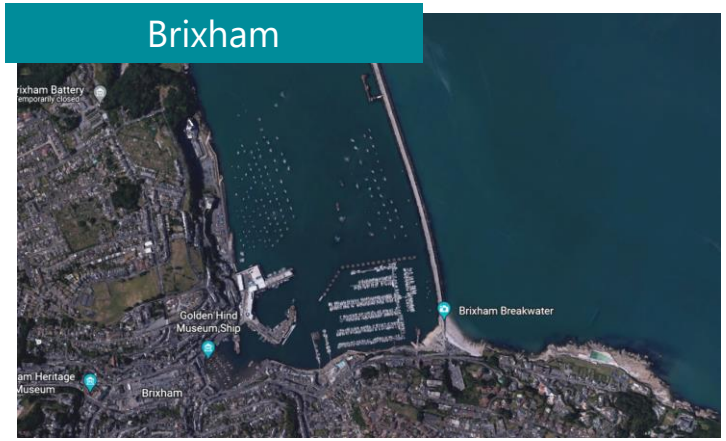
Famous for its 'Verity' statue, Ilfracombe is mainly a fishing and leisure harbour.

Located mid-way along the Bristol Channel, it could become a waypoint port for vessels supporting the FLOW sector.

OTHER SOUTH WEST PORTS

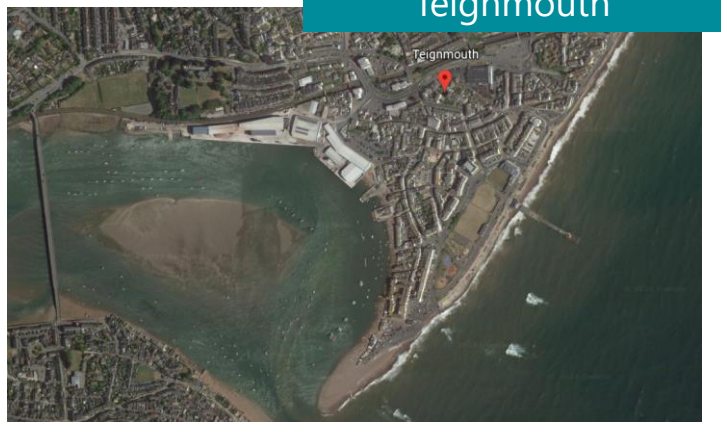
These ports are unlikely to feature in the early development of FLOW in the Celtic Sea but could come into play if windfarms are developed off the south coast.

Brixham



Brixham Harbour boasts one of the largest fishing fleets in the UK. Brixham is home to Marine & Towage Services (MTS), who provide a wide range of international marine services from towage and civil engineering support. Brixham Laboratory is a hub for environmental industries.

Teignmouth



The Port of Teignmouth serves the South West and is a key hub for the construction, agriculture and ball clay markets. Together with its customers, the Associated British Ports of Teignmouth and Plymouth contribute over £110m to the UK economy every year.

Bristol/Avonmouth could play a key role in the fabrication of FLOW substructures, especially if there is a shift from steel to concrete.

Bristol/Avonmouth

Bristol Port lies on the Severn Estuary at the mouth of the River Avon and is situated on two sites: Avonmouth and Royal Portbury. Avonmouth has a drydock 267 m in length and a 200 m lockgate. Although the Avonmouth drydock was originally built for shipbuilding and repair, there are fabrication, mobilisation and O&M opportunities presented by FLOW.

The link with Hinkley C and Avonmouth's concrete producing facilities could mean it is a significant port of interest for FLOW developers.

CONTENTS

INWARD INVESTMENT OPPORTUNITIES

INWARD INVESTMENT OPPORTUNITIES

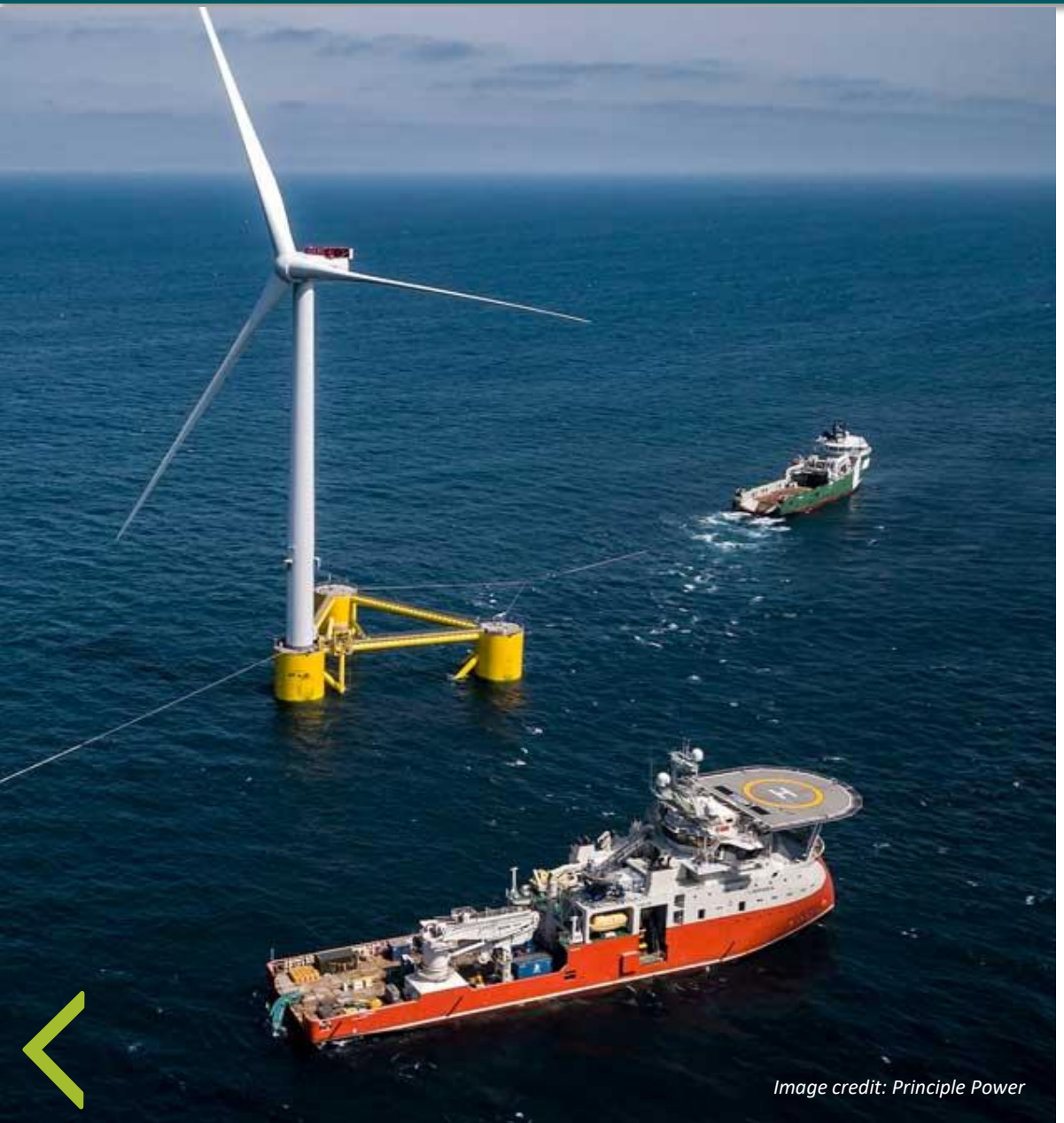


Image credit: Principle Power

This study has explored many of the HotSW's existing strengths and the opportunities that could arise through the upskilling and diversification of companies and individuals already located in the region. However, there is a significant opportunity for the HotSW to attract new businesses and investment into the region in order to realise the opportunity presented by FLOW and the wider energy system transition.

The Heart of the South West region has already garnered significant inward investment in various forms through the development of Hinkley C (EDF) and Appledore (Harland & Wolff). Not only have these two companies supported the region financially through direct investment, such as buying land and facilities, but they also have a strong focus on local supply chains and community benefit, which has kickstarted regeneration in areas of the Heart of the South West region which had previously seen below-average levels of social mobility.

With South Wales, Cornwall and Ireland all bordering the Celtic Sea, the key for attracting inward investment to the HotSW will be to build a case focusing on the strengths of the HotSW and the supply chain elements that match these strengths. Investment and support are crucial to establishing a strong FLOW supply chain, as many companies will need help establishing themselves and promoting their capabilities to developers. As well as pushing FLOW up the HotSW's agenda, and encouraging more conversations about the opportunity, the HotSW LEP can increase its favourability by working with the Department for International Trade (DIT).

Crucially, in order to attract inward investment sufficient to retain significant value for the HotSW and see strong, viable businesses develop, the region will need to look beyond FLOW to identify the transferrable skills that will not only place it in a strong position for FLOW development, but also allow it to secure other marine work in the meantime.

INVESTMENT IN SUPPLY CHAIN COMPANIES

A large-scale, high-integrity infrastructure project, such as a FLOW farm, has an equally large-scale supply chain. As projects increase in size, from the c. 50-100 MW farms we are seeing today, to the 1 GW or larger farms that could be deployed in the 2030s, the supply chain moves beyond the current scale and capability of one region alone. To build this capability, the regions around the Celtic Sea, and across the UK, will need to invest in facilities to support the supply chain, as well as unlocking the opportunity to export these skills further afield and use them on other related work.

The Sector Deal between the government and the offshore wind sector agreed in March 2019 set a target of achieving 60% of the offshore wind supply chain to be UK based by 2030, including an emphasis on increasing the UK share of capital expenditure beyond 29%. The sector proposes capitalising on naturally existing clusters and providing sector leadership to create more opportunities for investment and local economic growth. For the HotSW, it is critical that they promote and publicise the existing strengths of the region and use this to gain inward investment.

A secure pipeline of projects could trigger private investment, bringing jobs and activity to the region. There are numerous supply chain companies in the HotSW that could operate in the FLOW supply chain, mainly focused on:

- Surveying and environmental impact assessments, which are already operating and ready to feed into early-stage project development
- Long-term vessel building and maintenance, through the numerous HotSW ports
- Component supply
- Specialist materials, including research and development
- Test and demonstration facilities.

There are also a number of opportunities and supply chain areas that the HotSW could see businesses operating in if there was sufficient support and investment, including:

- Driven or piled anchor foundations
- Design engineering companies
- Wind turbine component fabrication, including nacelle, blades and tower fabrication.

Examples of HotSW-based supply chain companies

- Alpha Marine Services, Plymouth
- Babcock International, Plymouth
- Balfour Beatty, Plymouth
- Beran Instruments, Great Torrington
- Bridgwater Welding Supplies, Bridgwater
- Centek, Newton Abbot
- CMS GeoScience, Plymouth
- GoBe consultants, Newton Abbot
- Helitune, Great Torrington
- HellermannTyton, Plymouth
- Keynvor Morlift, Appledore
- Marine Business Technology Centre, Plymouth
- MTS group, Brixham
- Partrac, Heathfield
- Quantum Geotechnic, Exeter
- RPS Energy, Exeter
- Seiche, Holsworthy
- Supacat, Honiton
- TDK Lambda, Illfracombe
- Teignbridge Propellers, Newton Abbot
- Valeport Ltd, Totnes

HIGH ENERGY USERS

One of the lesser-discussed benefits of large-scale renewable development for is the amount of low-cost energy potentially available at times of curtailment for surrounding areas. With significant capacity potentially connecting in Torridge, North Devon and Somerset, there is likely to be a large amount of renewable energy that is at risk of being curtailed at times of low demand and high generation.

The Celtic Sea is uniquely placed to harness different weather patterns to the majority of the UK's offshore wind portfolio, which is predominantly located off the east coast of the UK, and so may be able to avoid some curtailment by operating at different times to existing renewable assets. However, curtailment is still inevitable for such large-scale projects, and this is likely to be a more significant factor in the future as more renewable energy generation connects around the UK.

Developers will want to ensure that each MWh of renewable energy generated by their assets makes money, and so they must ensure they have different customers with a variety of energy demand patterns. Not only will there be curtailed energy, as with all renewable developments, but the sheer scale of the proposed FLOW developments will mean that there is significant energy potentially going to waste. One alternative option for this low-cost renewable energy would be to divert the energy to a number of 'high energy users', which could include hydrogen electrolysers, data centres or large-scale energy storage systems.

These high energy users are crucial in achieving net zero emissions, by encouraging the flexible use of energy to help balance the system. They also provide FLOW developers with a diversified revenue stream, reducing volatility.

Data centres

There has been an increased interest in data centres in the last few years, which can be partially related to a number of businesses looking to move their data server infrastructure offsite to reduce their own scope 1 and 2 carbon emissions. Data centres have significant power and energy demand, into the hundreds of MWs, and need not only baseload power for IT equipment and the facility itself, but significant ramp up and ramp down power for cooling to regulate the temperature of the servers.

Hydrogen electrolysers

Hydrogen Electrolysers can range in size from small, appliance-size equipment that is well suited for distributed hydrogen production to centralised, industrial-scale hydrogen production facilities that could be tied directly to renewable and low carbon electricity generation. Hydrogen electrolysers may offer opportunities for synergy with dynamic and intermittent power generation, allowing flexible hydrogen production to match resource availability with system operational needs and market factors. At times of excess electricity production from FLOW, electricity that would have otherwise been curtailed can be used to produce low carbon hydrogen.

Battery storage

In the future, electricity storage will take advantage of intelligent price forecasting to charge up during the cheapest hours of each day, soaking up wind and solar energy which can then be exported at times of peak demand or to aid grid operability. Renewable generators can directly co-locate with onsite battery storage, or link to long-duration storage technologies.

OTHER TARGETED INWARD INVESTMENT

Government funding streams can be a valuable source of inward investment and be a helpful method of establishing the HotSW as a key part of the FLOW supply chain. In recent years, the number of funding pots for offshore renewables, clean propulsion and the levelling up agenda has increased significantly.

Examples of some recent related funding streams include:

- Clean Maritime Demonstration Competition, as part of the Maritime 2050 funding
- Strength in Places Fund, as part of the 'levelling up' agenda
- Marine-i research funding and business support
- University of Exeter and University of Plymouth research funding
- £206m SHORE DfT funding to accelerate research into and development of clean maritime technologies and create skilled jobs
- £60m UK government and industry funding for development of innovation FLOW technologies
- £160m UK government and industry funding for port development
- Coastal Communities Fund to promote sustainable economic growth
- Horizon Europe research and innovation programme
- £10m Energy Entrepreneurs Fund (EEF) to promote new clean technologies across all sectors of the UK economy
- Swell Group provides innovation funding for clean tech companies
- Innovate UK smart grants totalling £25m for game-changing and commercially viable research and development innovation that can significantly impact the UK economy

However, many of these streams utilise European funding, and soon the UK will be unable to access these funds. Therefore, many in the marine energy industry are looking to the UK government to increase its own funds to support marine energy and the associated supply chains.

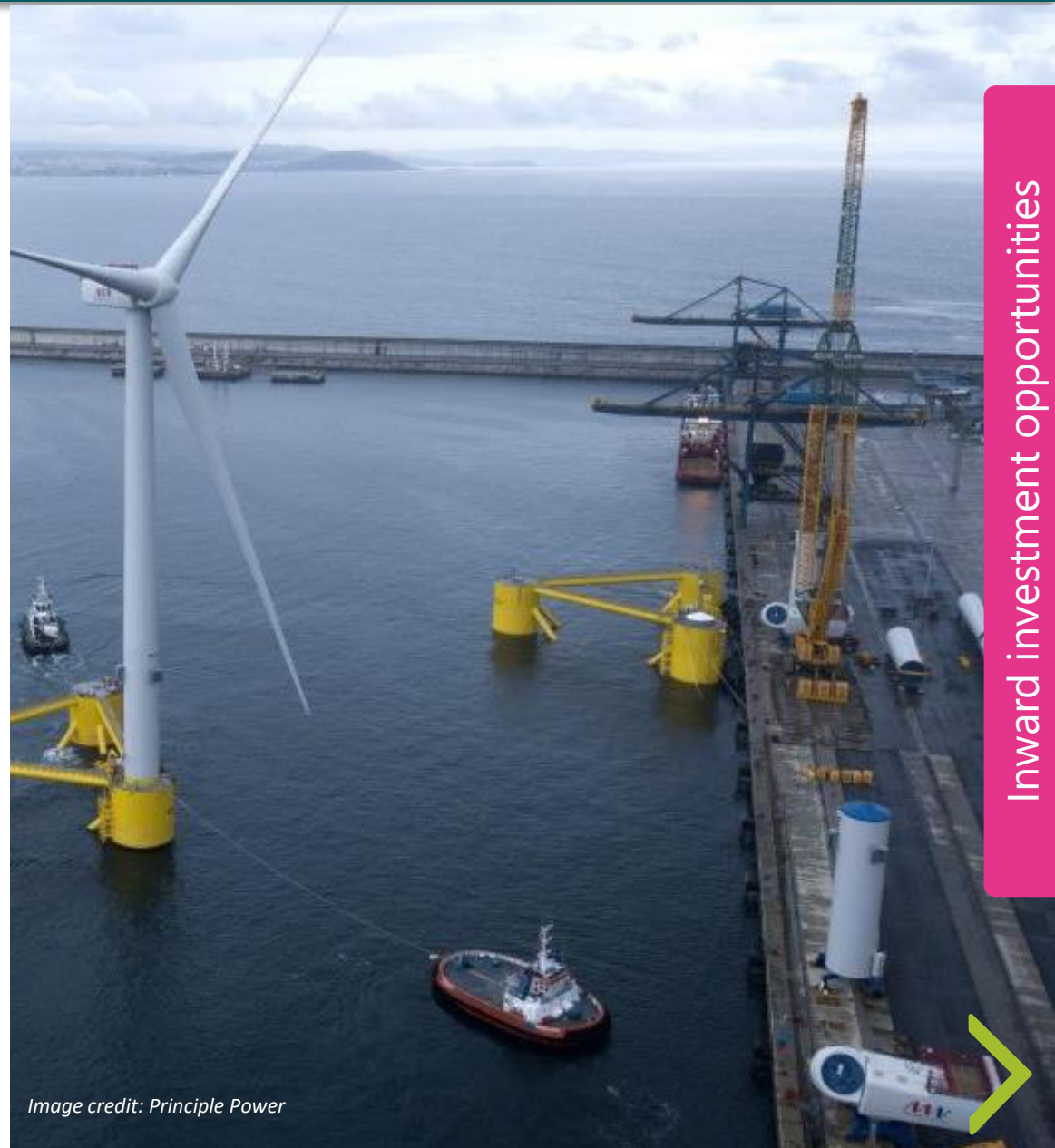


Image credit: Principle Power

CONTENTS

LOCAL AND COMMUNITY BENEFITS

COMMUNITY BENEFIT

As explored in this report, there are many benefits that can be realised through the development and operational lifetime of renewable energy projects, by creating new jobs, providing education and skills, boosting the local economy, developing local infrastructure and environment, and providing direct community investment.

COMMUNITY BENEFIT SCHEMES

Community benefit schemes are a well-established part of renewable energy developments, and often represent a positive relationship between renewable energy developers and local communities. Community benefit schemes are voluntary arrangements offered by developers to communities located near developments, and are not currently a material consideration in the planning application process.

While the UK, Scottish and Welsh governments do not currently have any formal requirements for community benefits for offshore wind, projects have historically been strongly encouraged to include an element of community benefit in the development. One example of a community benefit scheme is the Tirgwynt Wind Farm, owned by Belltown Power, which donated an upfront grant of £500,000 to support the construction of a brand-new primary school building for Ysgol Carno in Powys, Wales.

Establishing community benefit is thus predominantly the remit of developers themselves, although this could feasibly be written into local authority planning or The Crown Estate's leasing requirements. Calls for specific community benefit rules in planning processes have been made by both Community Energy England and Community Energy Scotland, although this has not yet been forthcoming.

Orsted's Offshore Community Benefit Funds

Developers Orsted have allocated a total of £6 million per year across their Burbo Bank, Walney, and Hornsea offshore wind projects for local and community initiatives.

Each project has a dedicated Community Fund, which funds community interest projects and organisations in grants typically worth £10,000-£20,000. These funds are managed by independent grant-making charity GrantScape. Decision-making in grant allocation is conducted by a local advisory group, made up of stakeholders such as local authority members, campaigners and community councils in the local area.

The structure and purpose of the community funds are agreed through extensive local community engagement, managed again by Grantscape. Through this engagement with local stakeholders across policymakers and civic society, "funding zones" (where the money is to be spent) are also identified, allowing local stakeholders a role in determining the relevant community or area of interest.

IDENTIFYING THE COMMUNITY

For onshore renewable projects, the community around that development is easily identified, and it is usually clear who should benefit from the renewable development.

However, for offshore wind, where there is not a well-defined geographical region that relates to the project, it may be unclear what makes up the 'local community' and to whom the benefits should be targeted. In cases where offshore wind has involved community benefit funding, communities have been identified on a site-specific basis through extensive local stakeholder engagement.

HotSW could be supported by developers through community benefit schemes, as many developers are currently looking to connect at Alverdiscott in Torridge. As FLOW developments are far offshore and have limited visual impact, the communities around the onshore cable route are likely to be the most impacted, and thus the most obvious choice for community benefit schemes.

EXISTING GUIDANCE FOR OFFSHORE COMMUNITY BENEFIT

While not fully legislated, the Scottish Government does have some guidance on community benefit for offshore wind. This includes guidance on identifying the community or area to benefit. Similar to Orsted's Offshore Community Benefit Funds, the Scottish Government recommends extensive engagement and an initial study to:

1. Identify the key geographic area of interest
2. Within that area, identify key stakeholders and contacts for consultation.

These stakeholders then guide the designation of the relevant area and community for benefit funding.

Vattenfall Norfolk Offshore Wind Zone

To establish who should receive community benefit funding in their Vanguard and Boreas projects, developers Vattenfall conducted extensive engagement with stakeholders and citizens across the North Norfolk region.

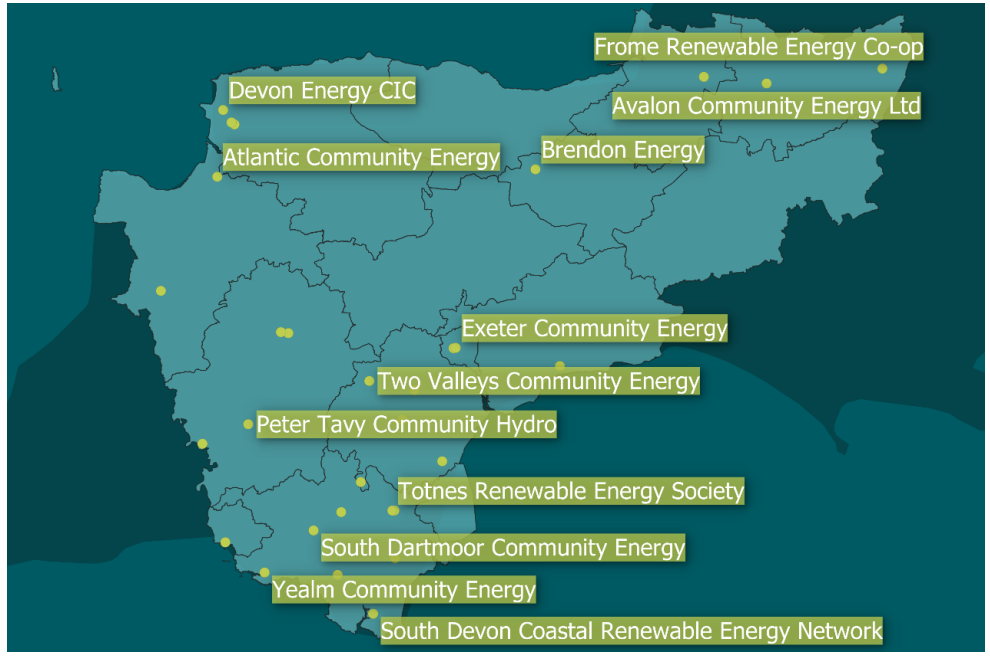
A total of 1,499 residents were surveyed and asked their opinions on what benefits they would like to see from the project and, crucially, who should primarily receive that benefit. Overall, 59% responded that "all of Norfolk", i.e. the wider region, should benefit from the new fund, while 27% responded that communities near infrastructure should benefit primarily. This split was consistent across all Norfolk districts.

Alverdiscott National Grid substation

COMMUNITY OWNERSHIP

One way of involving local stakeholders in renewable energy projects is a community ownership scheme. However, this can prove difficult to do, and has previously been used mostly in small-scale developments.

In these arrangements, developers will sell off a part of their renewable generation asset to a community energy scheme, although the operations and maintenance of the turbines are still undertaken by the developer. The investment needed from the community energy scheme is raised through a share offer, where people can invest money through purchasing shares in the asset. While investors would be paid interest on their shares, it is generally for a lower return on investment than commercial shares, normally c. 4-6%, with excesses then used for community benefit funding.



Community energy groups in the HotSW region.

A key issue for offshore projects is that it may be difficult for a community to raise the capital required to purchase a FLOW turbine or shares in a project. With offshore wind, the upfront capital needed is significantly more than that typically required to fund an onshore turbine or solar array, and so achieving a share offer at a reasonable scale would be a significant challenge for a community energy group alone. One way to overcome this is with the Ripple model, detailed on the next page. Community energy groups within the region could also feasibly come together to raise the money collectively across a wider base of people.

While there are no formal UK targets for community energy, and no legal requirement for offshore developers to allocate any of their projects to this end, the Welsh Government has set a target of 1 GW of locally owned renewable generation by 2030, while the Scottish Government initially aimed for 1 GW by 2020, with a total of 750 MW community and locally owned energy systems successfully installed so far.

Case study

A few developers who have already stated interest in the Celtic Sea, or who have gained seabed leases, have declared an interest in such community ownership schemes. For example, Welsh renewable energy developer Hiraeth Energy has partnered with Magnora Offshore Wind to proceed with two floating wind projects in the Celtic Sea, Môr Glas and Môr Gwyrdd, and have committed to enabling 10% community ownership in these projects. Similarly, Falck Renewables and BlueFloat Energy have partnered with Energy4All to help develop a community ownership model for their 300 MW Petroc wind farm in the Celtic Sea, to allow local people in Devon and Cornwall to share in the value created by this project.

PUBLIC OWNERSHIP

Beyond traditional community energy, there are other ways for local actors and citizens to own part of a FLOW development.

PUBLICLY-OWNED ENERGY SCHEMES

There are more recent examples of local authorities and local enterprise partnerships financing and owning their own energy generation for community benefit and local economic development. For example, North Ayrshire Council in Scotland is currently pushing proposals to install three Council-owned turbines alongside two already-approved solar farms in the area. This would provide 277% of the Council area's energy needs and allow them to export excess generation. In addition to North Ayrshire's pioneering Community Wealth Building Strategy, these assets will help the area tackle fuel poverty and reinvest the revenues into local initiatives via the local authority and a community benefit fund.

As developers promise to allocate some proportion of their FLOW projects for community ownership, it is feasible that this opportunity could also be taken by local authorities, consortia or LEPs. Local authorities or LEPs may be better placed than traditional community energy groups to take local ownership of part of a FLOW project, in that they have better access to levers of finance from public and private sources – through government funding or public-private partnerships, for instance – which can raise money in larger sums than typical local share offers. This can still be in partnership with or supporting existing community energy groups in the area.

In addition, local authorities and LEPs can also administer community benefit funds and steward revenues into existing local priorities, serving as a more direct local link with less emphasis on citizens themselves raising revenues in the first place.

Ripple Energy

One outfit that has successfully led community ownership for onshore wind, and is currently exploring doing so for offshore wind, is renewable energy platform Ripple. With the Ripple model, citizens from across the UK (not just within the host community) can buy shares in the development and in turn receive a reduction in their energy bills by using energy from the project via the National Grid. Their first onshore turbine at Graig Tatha raised over £2m among 904 owners.

Excess revenues from selling electricity are then put into a community fund for communities local to the development. After a successful ScotWind bid, offshore developers NextGen have partnered with Ripple to bring community ownership to their first offshore project in the North Sea.

This model allows for larger-scale investment from a much broader pool of people, while providing dedicated local community benefit. To encourage local people to invest, it would also be feasible to open the share offer to the local community first, before opening to the wider public.

OTHER SOCIETAL BENEFITS

SOCIAL BENEFITS

Large-scale regional investment can help to promote strong socio-economic growth in coastal communities, stimulating local economies and increasing social mobility. This can be through investment in education and engagement on marine renewable energy, and the creation of new jobs at all stages of the projects. A common form of community benefit is through education and training funds, either to schools and higher education establishments, or even sometimes to individuals to support them in their education. Different developers may support education in different ways, including organising school site visits, supporting schools to install renewable energy and helping in the creation of higher education courses and research projects.

Blue Gem Wind, for example, has produced an animated video and education pack to work with primary school students on the impacts of climate change and what can be done to help. They also launched a competition to allow students to name their next project, and are planning to do this for all future developments.

As well as aiding education, renewable energy developments can provide wider social benefits through investing in the local economy. These include providing long-term and short-term jobs, by using local contractors and developing local businesses. From the Orsted example, a dedicated Skills Fund helps to provide training to people in the energy and environmental sectors. At Burbo Bank, youth workers have also been funded to help support vulnerable people in the local area.

In that vein, revenues and community benefit funds can also be tied directly to social issues. For instance, Community Benefit in the case of North Ayrshire's local authority-led onshore project gives priority to initiatives that reduce fuel poverty, which has been a stubborn issue in the area for some time and is rising steadily under volatile energy prices. Traditional community energy projects have tended towards addressing fuel poverty and other social justice issues; with extensive engagement, particularly with local authorities, developers can also help to support such initiatives and local priorities.

ENVIRONMENTAL BENEFITS

Naturally, renewable energy developments already provide many environmental benefits by delivering zero carbon electricity to the grid and displacing fossil-fuelled generation. However, they can also be important in supporting the protection and restoration of biodiversity in and around their sites through serving as 'artificial reef' infrastructure and reducing trawling activities. This can support increased biological productivity.

For FLOW, the focus is likely to be on marine habitats and biodiversity, such as facilitating marine productivity, reducing ocean plastic or monitoring and protecting marine species. Many offshore wind developers have launched initiatives to support and enhance marine biodiversity, although this takes careful and extensive planning and monitoring, in coordination with local authorities and experts, to ensure the impact is positive and properly managed.

Potential environmental benefits are not limited to offshore, and the funding of local initiatives can help with environmental issues within the local area and region. Some developers and community benefit funds specifically prioritise green initiatives, such as habitat restoration, green spaces, energy efficiency, and climate outreach and education. Vattenfall's offshore project in the south North Sea has promised £15m over 25 years to fund 'climate smart' initiatives in the Norfolk Zone Community Benefit Fund, demonstrating how offshore developments can support environmental benefit more widely.

KEY RECOMMENDATIONS

KEY RECOMMENDATIONS

While FLOW presents a multi-decade opportunity for local companies and developers, it is important to recognise that the process to develop supply chains and make decisions around the location of infrastructure has already started. There is therefore an urgency for businesses and organisations to position themselves to take full advantage of this opportunity.

This report sets out a number of actions that the HotSW LEP and local authority partners can take to secure the economic benefits from FLOW in the Celtic Sea:

1. RAISING AWARENESS AMONGST COMPANIES AND STAKEHOLDERS

As there have been some setbacks in offshore wind developments around the South West in the past, HotSW companies may not be aware of this new FLOW venture. Potential initiatives could include:

- Produce a short briefing note/communications material to highlight the FLOW opportunity to HotSW SMEs and provide advice on how to pre-qualify for the FLOW supply chain.

2. PROMOTING THE HEART OF THE SOUTH WEST OFFER

Feedback from stakeholders and industry suggests that more could be done to promote the HotSW facilities and capabilities as part of a wider Celtic Sea regional offer. Potential initiatives could include:

- Engagement with developers and tier 1 supply chain companies, especially oil and gas majors that may not be familiar with what HotSW has to offer, replicating in part the early supplier engagement that was undertaken for Hinkley C.
- Produce a high-level "prospectus" highlighting the HotSW offer, aimed at FLOW developers, tier 1 supply chain companies and inward investors.
- Supporting HotSW companies, universities and training/skills providers to participate in offshore wind industry events and conferences.
- Set up a working group for FLOW within HotSW LEP to create a plan based on the findings of this report.

3. ENSURING THE SOUTH WEST HAS A STRONG VOICE IN KEY DECISION AREAS

There are a number of key policy and planning topics that must be addressed in the coming 12-18 months. These include:

- The Offshore Transmission Network Review and Holistic Network Design initiatives that will develop a grid and transmission network strategy for FLOW. This is of specific importance for the development of network infrastructure in North Devon and Torridge.
- The Crown Estate's future leasing round strategy and lease round timings.
- The confirmation of policies around upcoming Contracts for Difference.
- The consultation on the use of Supply Chain Plans, in particular promoting greater regional input and governance.

4. COLLABORATION WITH THE SOUTH WEST AND SOUTH WALES

There is an increased focus on collaboration as part of the Celtic Sea FLOW developments, to reduce duplication and remove barriers to development.

- Join and participate in the various cross-regional bodies that have been established, including the Celtic Sea Cluster, APPG, ports working group and Celtic Sea Developers Alliance.
- Build upon the multi-area collaborations already in place for other sectors, including the nuclear supply chain investment.
- Work with these partners to engage with local and national government and its departments, to influence policy and encourage inward investment.

The HotSW and local partners do not need to lead in all areas of collaboration; they could play a coordinating role, especially if other South West organisations can represent the region. Specific organisations to collaborate with include Marine Energy Wales, Cornwall Council, Celtic Sea Power, the Offshore Renewable Energy Catapult, PRIMaRE, Ocean Futures Partnership, Welsh Government and Western Gateway.

5. STARTING A SUPPLY CHAIN DEVELOPMENT PROGRAMME

Although the construction of Celtic Sea projects is still a few years away, there are already significant supply chain opportunities during the project development phase. There are also opportunities in the existing offshore wind sector. The HotSW can support South West-based companies by:

- Building on this study to engage with companies that already have an interest in offshore wind, through events and direct communication.
- Ensuring that the South West is positioned within any regional supply chain development programmes – e.g. Fit 4 Offshore Renewables.
- Providing support and advice to enable developers to complete their Supply Chain Plans, using this to promote South West-based companies and building on good practice of the Hinkley C Supply Chain Service, co-funded by HotSW LEP, West of England Combined Authority and Welsh Government.
- Identifying areas of transferrable skills and utilisation of bespoke facilities (Welding, Electrical and Mechanical Electrical Heating Centres of Excellence) from Hinkley C that will complement FLOW opportunities to companies in the Hinkley C supply chain.
- Provide business support through established networks such as the Growth Hub, as well as bespoke programmes with delivery bodies such as SWMAS and universities.

6. SUPPORTING THE DEVELOPMENT OF OFFSHORE WIND PROJECTS

HotSW LEP can work with FLOW developers to:

- Support environmental consultancies to work with The Crown Estate on its plan for shared Habitat Regulation Assessments and surveying.
- Engage with developers who have grid connection offers (or plans) to connect to the grid in Devon.
- Supporting (and guiding) stakeholder engagement activities to ensure there is a good understanding and public support for FLOW.

7. SUPPORTING THE DEVELOPMENT OF APPLEDORE AS A CENTRE FOR MARINE TECHNOLOGY

The recent acquisition of Appledore by Harland & Wolff has provided direction for the shipyard that the HotSW partners can support in a number of ways:

- Support investment proposals and funding applications to develop Appledore as a centre for marine engineering and innovation, especially in the use of clean propulsion systems and new materials for low emission vessels.
- Explore opportunities for the development of Middle Dock, working alongside Torridge District Council and Harland & Wolff.
- Support Harland & Wolff in the development of New Quay.
- Support the wider development of commercial and industrial land space in Torridge and North Devon.

8. SUPPORTING THE EXISTING MARINE CLUSTER IN PLYMOUTH AND OCEANSGATE

There is already a significant amount of marine and R&D activity around Plymouth and Oceansgate. The HotSW and partners can support Plymouth by:

- Positioning Plymouth Oceansgate as a key inward investment opportunity and leveraging this to attract marine technology innovation and development across the region.
- Working with Plymouth City Council, Devon County Council and South Hams District Council on the design of the Plymouth and South Devon Freeport.

9. DEVELOPING THE SKILLS IN THE HEART OF THE SOUTH WEST

FLOW offers a multi-decade opportunity for HotSW and it is crucial that future generations are supported to pursue careers in offshore renewables:

- Work with HotSW universities, colleges and other training providers to review the courses and apprenticeships in the region for both core skills and marine/FLOW specialist skills.
- Set up, or collaborate on, creating an offshore renewables skills training centre in the HotSW area to reinforce capacity for core and FLOW-specific skills, potentially in collaboration with, or supported by, the National College for Nuclear which is looking to expand to cover other forms of clean energy.
- Support wider educational engagement around marine energy and wider marine engineering careers, with direct engagement with the sector to support career pathways.
- Encourage and support local communities to transition to the energy sector, maximising the opportunities from the levels of employment that are expected within the offshore energy sector over the next decade.

10. ENCOURAGING RESEARCH, DEVELOPMENT AND INNOVATION

FLOW is still in its infancy, which presents an opportunity for extensive research and development to inform its supply chain, operation and maintenance:

- Target higher value R&D and innovation, leveraging the assets available in the wider region and through local academic partners including the University of Exeter and the University of Plymouth.

CONTENTS

CONCLUSIONS

CONCLUSIONS

There is no question that the development of FLOW in the Celtic Sea will create significant economic opportunities for the region. This can be seen in the level of project developer interest that has already materialised.

The next two decades will be focused on getting FLOW developments from concept stage to operation. However, despite the long development timescales, it is important to recognise that the process to develop supply chains, and make decisions around the location of infrastructure, has already started. There is, therefore, an urgency for businesses and organisations to position themselves to take full advantage of this opportunity.

Companies based in the Celtic Sea region will need to compete with those companies that are already part of the offshore wind supply chain in both the UK and overseas. Geographic proximity is an advantage but, in general, the offshore wind sector will build its supply base based on price, quality and track record and experience.

Entry into the offshore wind supply chain could be difficult, especially at the scale at which the FLOW sector will operate. However, HotSW has a strong history in the marine and maritime industry, and has a number of place-based strengths including Appledore, Plymouth, Exeter and leveraging the existing supply chain built around Hinkley C. The experience from Hinkley C also suggests that a well-coordinated support programme, targeting key companies and skill sets, can make a significant contribution to maximise regional economic benefits.

heart of the south west local enterprise partnership

northdevon COUNCIL

TORRIDGE DISTRICT COUNCIL

Devon County Council

At a practical level, the approach to realise the economic opportunity for the HotSW area from FLOW in the Celtic Sea could be based around a number of recommendations:

1. Raising awareness of the FLOW opportunity amongst companies and stakeholders.
2. Promoting the Heart of the South West offer as part of a wider Celtic Sea regional offer.
3. Ensuring the South West has a strong voice in key decision areas and communicating shared messages with national policy makers.
4. Collaboration with broader South West and South Wales stakeholders, recognising that the scale and challenge of FLOW development requires a joined-up and integrated approach.
5. Starting a supply chain development programme to support and enhance the pioneer companies who are already working in the offshore wind supply chain or are in sectors in which HotSW has existing strengths.
6. Supporting the development of offshore wind projects by supporting industry asks for policy support and infrastructure, while ensuring that community and societal benefits are realised.
7. Supporting the development of Appledore as a centre for marine technology by working with Harland & Wolff and local partners.
8. Supporting the existing marine cluster in Plymouth and Oceansgate by positioning it as a key inward investment opportunity.
9. Developing the skills in the Heart of the South West, focusing on core skill and capability development for FLOW and other marine sectors.
10. Encouraging research, development and innovation through academic partners including the University of Exeter and the University of Plymouth.

Regen, Bradninch Court, Castle Street, Exeter EX4 3PL

+44 (0)1392 494399 www.regen.co.uk

regen transforming energy

INTRODUCTION

Click here to minimise rollover...

Regen has been commissioned by Heart of the South West Local Enterprise Partnership (HotSW LEP) and Devon County Council, in partnership with North Devon and Torridge District Councils, to conduct a short study to

...or click here to minimise rollover

Heart of the South West LEP

Covering Devon, Somerset, Plymouth and Torbay, the HotSW's £35bn economy and 1.8m population is equivalent to that of a major UK city. HotSW has excellent industrial, academic and research assets aligned with clean growth, including the Met Office, Universities of Exeter and Plymouth, and the UK's largest cluster of marine researchers in Plymouth, exploring marine autonomy and digital ocean technology. It is also the home of the Hinkley C nuclear reactor development – currently the largest civil engineering project in the UK.

This study builds on previous work done by the Offshore Renewable Energy Catapult, The Crown Estate and the Offshore Wind Industry Council to define the supply chain requirements of the offshore wind sector. It also draws on the supply chain development work that has already been started by the Celtic Sea Cluster and the Celtic Sea Developers Alliance.

Rather than repeat the broad supply chain and economic analysis that has already been undertaken, this study has focused on identifying real and practical opportunities from FLOW to form the basis of an economic development, business support and investment plan for the HotSW region. It has also focused on the role that HotSW could play as part of a wider Celtic Sea cluster. The study has been informed by engagement with numerous stakeholders across supply chain development, construction, academia, project developers and local authorities. These stakeholders are listed in Appendix A.

At an initial scoping and opportunity workshop, the following priority areas were identified:

- Supply chain mapping and HotSW capabilities that could be applied to FLOW
- Research and development, and support for innovation
- The role of Appledore/northern Devon as a centre for marine engineering
- The Plymouth marine technology cluster
- Leveraging Hinkley C – supply chain, skills and approach
- Building on skills and training capability
- Opportunities for inward investment
- The role of HotSW partners as part of the wider Celtic Sea collaboration

The Celtic Sea Cluster

The Celtic Sea Cluster has been established to help drive market creation for floating wind, accelerate supply chain readiness and develop a strategy for enhancing regional infrastructure. It hopes to support FLOW developers working in the Celtic Sea.

The Celtic Sea Developers Alliance

The Celtic Sea Developers Alliance intends to showcase the opportunity to parliamentarians for FLOW in the Celtic Sea and to review how the region can deliver economic benefits on the road to net zero.

This study builds on previous work done by the Offshore Renewable Energy Catapult, The Crown Estate and the Offshore Wind Industry Council to define the supply chain requirements of the offshore wind sector. It also draws on the supply chain development work that has already been started by the Celtic Sea Cluster and the Celtic Sea Developers Alliance.

Rather than repeat the broad supply chain and economic analysis that has already been undertaken, this study has focused on identifying real and practical opportunities from FLOW to form the basis of an economic development, business support and investment plan for the HotSW region. It has also focused on the role that HotSW could play as part of a wider Celtic Sea cluster. The study has been informed by engagement with numerous stakeholders across supply chain development, construction, academia, project developers and local authorities. These stakeholders are listed in Appendix A.

At an initial scoping and opportunity workshop, the following priority areas were identified:

- Supply chain mapping and HotSW capabilities that could be applied to FLOW
- Research and development, and support for innovation
- The role of Appledore/northern Devon as a centre for marine engineering
- The Plymouth marine technology cluster
- Leveraging Hinkley C – supply chain, skills and approach
- Building on skills and training capability
- Opportunities for inward investment
- The role of HotSW partners as part of the wider Celtic Sea collaboration

INTRODUCTION

Stakeholder	Type of engagement
Biosphere foundation	Online meeting
Devon County Council	Workshop and continual input
EDF (Hinkley C)	Online meeting
Somerset Council and Hinkley C team	Workshop
Harland & Wolff	Site visit
HotSW LEP	Workshop and continual input
Marine Energy Wales	Online meeting
Maritime UK	Online meeting
MorWind	In person conversation
North Devon Council	Workshop and continual input
ORE Catapult	Email exchange
Simply Blue Group	Online meeting
South West Infrastructure Partnership	Online meeting
SWMAS	Online meeting
Torridge District Council	Workshop and continual input
University of Exeter	Online meeting
University of Plymouth	Workshop and online meeting
Xlinks	Online meeting

Rather than repeat the broad supply chain and economic analysis that has already been undertaken, this study has focused on identifying real and practical opportunities from FLOW to form the basis of an economic development, business support and investment plan for the HotSW region. It has also focused on the role that HotSW could play as part of a wider Celtic Sea cluster. The study has been informed by engagement with numerous stakeholders across supply chain development, construction, academia, project developers and local authorities. These stakeholders are listed in Appendix A.

At an initial scoping and opportunity workshop, the following priority areas were identified:

- Supply chain mapping and HotSW capabilities that could be applied to FLOW
- Research and development, and support for innovation
- The role of Appledore/northern Devon as a centre for marine engineering
- The Plymouth marine technology cluster
- Leveraging Hinkley C – supply chain, skills and approach
- Building on skills and training capability
- Opportunities for inward investment
- The role of HotSW partners as part of the wider Celtic Sea collaboration

FLOATING OFFSHORE WIND (FLOW)

While fixed-bottom offshore wind has demonstrated its ability to scale up, reduce costs and deliver large volumes of clean energy, its confinement to shallower waters limits deployment. FLOW has the potential to open up huge areas of high wind resource in deeper water. According to the Crown Estate, FLOW represents **"the next frontier in the UK's green growth story"** and is likely to become a key pillar of our future clean energy mix.

The UK is the current leader in FLOW deployment, home to Hywind Scotland and Kincardine, the first and the largest commercial FLOW farms respectively. The Hywind One demonstrator was able to prove the viability of FLOW, operating reliably since 2009 and surviving wind speeds over 40 m/s and swells of 19 m.

In 2017, Hywind Scotland became the world's first commercial floating wind farm and has consistently had the highest capacity factor of any UK offshore windfarm (54%, compared to a UK average of 40%). Costs per MWh have consistently fallen, and Hywind now projects a 40% reduction in capital expenditure for its next project, Hywind Tampen, off the coast of Norway.

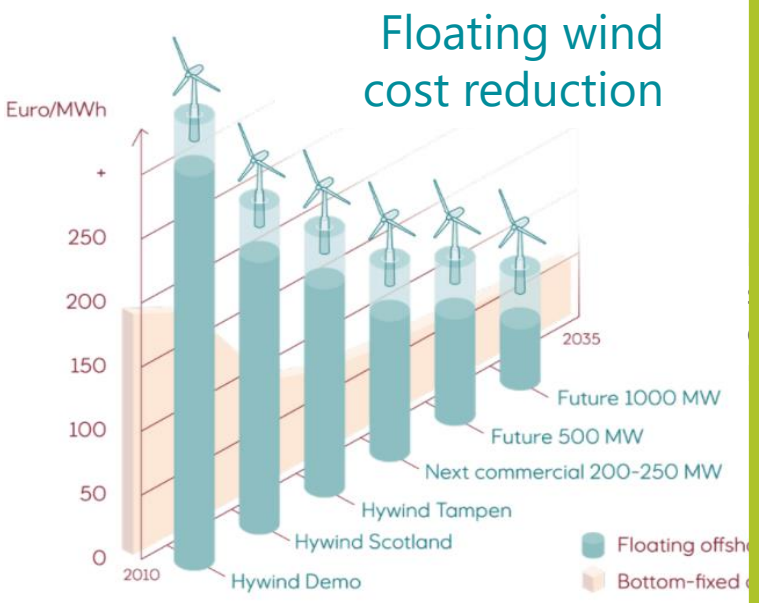


Illustration: Equinor

UK COMMITMENTS TO EXPAND OFFSHORE WIND

The UK Energy Security Strategy, published in April 2022, has confirmed a target of 50 GW of offshore wind by 2030, including a sub-target of 5 GW of FLOW. This is significantly more ambitious than the Net Zero Strategy, which only detailed a target of 1 GW of FLOW by 2030.

With this target in mind, the UK government has provided support measures for floating wind, including:

- A £160m fund dedicated to developing port infrastructure for FLOW, which was announced in October 2021
- A £60m fund for innovation, which has already supported a number of South West based companies.

HotSW winners of funding from the £60m fund for innovation

- The University of Exeter, alongside Reflex Marine, received £882,283 for the development of a novel anchoring system that will secure floating turbine cables to the seabed at a fraction of the weight of some existing anchors.
- The University of Plymouth and London Marine consultants won £264,924 to bring to market a mooring system that will simplify the initial installation of floating turbines and enable simple disconnection when maintenance is required.
- Keynvormorlift, with three other industry partners, received £3,268,058 for developing a trimaran mounting system for wind turbines.

UK OFFSHORE WIND DEVELOPMENT

The development of the offshore wind supply chain in the UK has been broadly successful in terms of capability development, cost reduction and UK content.

There are arguments to consider about the measure of UK content, but broadly it can be said that the earlier offshore windfarms (e.g. London array, a decade ago) generated low levels of UK content at c. 15%, whereas the typical UK content target for the latest offshore windfarms is over 50%. This is despite the fact that the main windfarm component, the turbine, is still manufactured abroad. Part of the increase in UK content has been driven by the requirement for project developers to include a Supply Chain Plan as part of the CfD qualification process.

One of the earliest offshore wind assembly ports, the Port of Mostyn in North Wales continues to support offshore wind developments and O&M in Liverpool Bay and the Irish Sea.

Lowestoft has become a centre of offshore wind operations and maintenance. Investments include port development, new O&M bases for Scottish Power Renewables and the Orbis Energy centre.

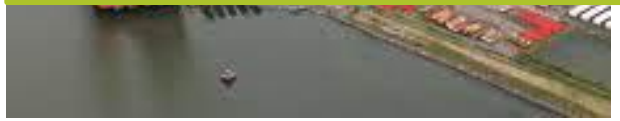
Supply Chain Plans

As part of the CfD qualification process, offshore wind developers are required to produce a comprehensive Supply Chain Plan. The plan must meet a number of criteria for sustainability and carbon etc. There is also an expectation, although not a requirement, that SCPs will include high levels of UK content.

BEIS is currently consulting on proposals to increase the SCP requirements and to extend them to all projects obtaining a CfD.

Regen has responded to the consultation, highlighting the need for SCP requirements to be tailored to the technology readiness level of projects and for an increased level of regional and local input.

There is an opportunity for HotSW LEP and local partners, such as SWMAS, to work with developers, and their tier 1 partners, to highlight the capabilities of HotSW-based companies and to support them in the production of their Supply Chain Plans.



shipbuilding and engineering facility at Appledore in northern Devon.

FLOW IN THE CELTIC SEA

regen transforming energy

CONTENTS

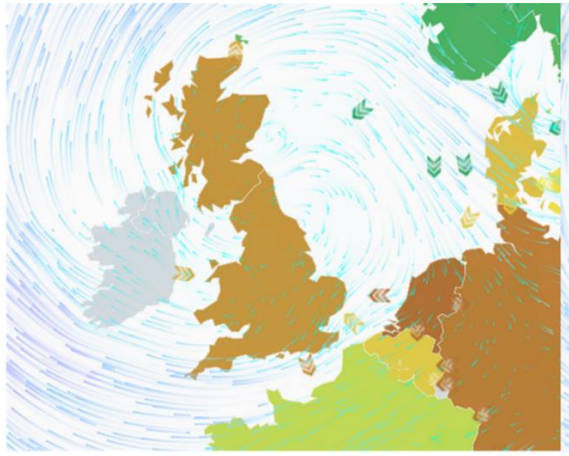
THE CASE FOR FLOATING OFFSHORE WIND IN THE CELTIC SEA

A strong argument has been made that floating wind on the western side of the UK is needed, along with greater interconnection with Ireland and Europe. Westward expansion of renewable generation would result in:

- Access to new areas of seabed and wind resource
- Reduced cumulative impacts affecting the east coast and North Sea
- Better system balancing and reduced whole system costs
- Opportunities for regional economic development and 'levelling up'
- Export and commercial opportunities from new technology development

The energy system benefits of a more diverse wind portfolio have become especially powerful given the high wholesale price volatility currently being experienced, alongside high system balancing costs.

Wind conditions 7 am, 17 December 2021



Wind conditions 8 pm December 2021

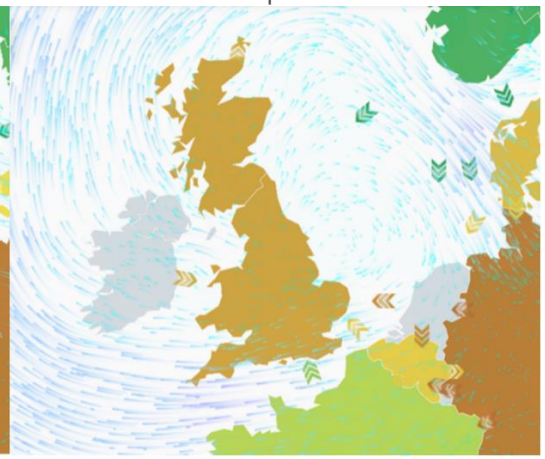


Image from Regen's Go West blog

DEVELOPER INTEREST

There are at least 20 development organisations that have declared an interest in the develop
includes a number of r
experience in offshore
unfamiliar with the sup
West.

As an example, French
developer Simply Blue
(300 MW). Shell has als
project off the coast
acquired majority stake
of the business respor
Ireland.

IRISH CONNECTION

When thinking of the
Sea, and indeed pr
across the western seab
it is important to co
projects that will be
Irish and Northern
waters. In terms of
energy integration (via
purpose interconne
and supply chain integr
there are opportuniti
leverage infrastructure
capabilities across
region.

Celtic Sea Cluster

Lead developer	Project name	CE Lease granted - subject to assessments
DP Energy	Gwynt Glas	No
SSE Renewables	Celtic Sea Array	No
Offshore Wind Ltd.	White Cross	Yes
Blue Gem Wind	Erebus	Yes
Hexicon	TwinHub	Yes
Floventis Energy Ltd.	Llyr 1	Yes
Floventis Energy Ltd.	Llyr 2	Yes
Energia Renewables	North Celtic Sea Project	No
Offshore Wind Ltd.	Blackwater	No
BlueFloat Energy	Petroc	No
DP Energy	Inis Ealga	No
Falck Renewables	Llywelyn	No
Blue Gem Wind	Valorous	No
Simply Blue Energy	Emerald	No
Celtic Sea Power Ltd.	Pembrokeshire demonstration zone	Yes
Hiraeth Energy	Mor Glas	No
Hiraeth Energy	Mor Gwyrdd	No
Simply Blue Energy	Aurora	No
Offshore Wind Ltd.	Merlin Offshore Wind Farm	No
Morwind Ltd.	Morwind 300	No

FLOW IN THE CELTIC SEA

THE CASE FOR FLOATING OFFSHORE WIND IN THE CELTIC SEA

A strong argument has been made that floating wind on the western side of the UK is needed, along with greater interconnection with Ireland and Europe. Westward expansion of renewable generation would result in:

- Access to new areas of seabed and wind resource
- Reduced cumulative impacts affecting the east coast and North Sea
- Better system balancing and reduced whole system costs
- Opportunities for regional economic development and 'levelling up'
- Export and commercial opportunities from new technology development

The energy system benefits of a more diverse wind portfolio have become especially powerful given the high wholesale price volatility currently being experienced, alongside high system balancing costs.

Wind conditions 7 am, 17 December 2021 Wind conditions 8 pm December 2021

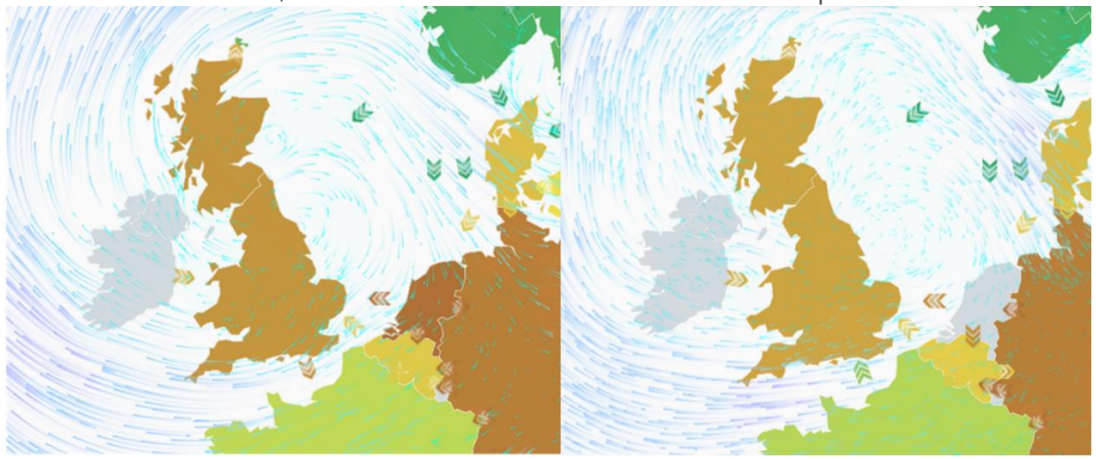


Image from Regen's Go West blog

DEVELOPER INTEREST

There are at least 16 development organisations that have declared an interest in the development of FLOW in the Celtic sea. Significantly, this includes a number of new partnerships, including major oil companies with experience in offshore energy production. Many of these companies will be unfamiliar with the supply chain and R&D capabilities available in the South West.

Multi-purpose interconnectors

As a result of the Offshore Transmission Network Review (OTNR), and Holistic Network Design (HND) initiatives, there is interest in the development of Multi-purpose Interconnectors.

These are High Voltage DC cables that could link windfarms to different energy markets, acting as both a transmission line for the wind farm and an interconnector between energy systems. This would provide greater energy resilience and open up further commercial opportunities.

energy integration (via multi-purpose interconnectors) and supply chain integration, there are opportunities to leverage infrastructure and capabilities across the region.

Current FLOW projects announced for the Celtic Sea

BIG CHALLENGES REQUIRE A DIFFERENT APPROACH

While there is no lack of appetite from both industry and regional and national governments for FLOW in the Celtic Sea, there are a number of challenges facing this burgeoning sector:

- **Grid connectivity** – providing the necessary offshore and onshore electricity network infrastructure, whilst minimizing costs, project risks and impacts on marine and coastal communities and the environment.
- **Ports and logistics infrastructure** – ensuring that there is the space, suitable quaysides and adequate water depths needed to manufacture, assemble and operate FLOW projects.
- **Supply chain development** – ensuring there are the qualified companies and the skilled workforce needed for the scale of the FLOW opportunity.
- **Innovation** – the challenges of FLOW in deeper waters require a high degree of innovation in construction, logistics, mooring and operations.
- **Data and spatial planning** – enabling actions to reduce cost and risk by sharing data and conducting an integrated spatial design and Habitats Regulations Assessment (HRA).

The government is attempting to address many of these challenges through its Offshore Transmission Network Review and National Grid's Holistic Network Design. Many developers are currently looking to connect at Alverdiscott. If multiple FLOW farms were to connect either onshore or offshore near Alverdiscott, this could result in significant inward investment looking to utilise the amount of low-cost renewable energy coming into North Devon and Torridge.

X

Offshore Transmission Network Review

BEIS, OFGEM, ESO and The Crown Estate are currently conducting a review of the offshore transmission network to support the deployment of renewable energy. The review could signal a transition away from the 'developer-led' approach, which until now has helped secure investment in early offshore projects, towards a more centralised process. It is hoped that increased collaboration between developers and cross-project solutions to deliver a considered build out will reduce cumulative impacts and deliver a more efficient network.

The OTNR is exploring how to accommodate all planned new capacity, potentially through an offshore substation.

Holistic Network Design

As part of the OTNR, National Grid ESO is in the process of producing the Holistic Network Design (HND), a map of the onshore and offshore electricity grid of 2030. UK government want to provide certainty to developers as soon as possible with the release of the design, however, this has been delayed and is now expected in July 2022. Though the connection of FLOW in the Celtic Sea will be considered in the HND, it is currently unclear how, and the HND will be responsive to the results of the Crown Estate's 2023 leasing round.

For the Celtic Sea, the HND is likely to feature offshore transmission hubs (consolidation substations), multi-purpose interconnectors and far greater integration between the South West, south Wales, Ireland, Western Europe and even, potentially, Northern Africa.

BIG CHALLENGES REQUIRE A DIFFERENT APPROACH

While there is no lack of appetite from both industry and regional and national governments for FLOW in the Celtic Sea, there are a number of challenges facing this burgeoning sector:

- **Grid connectivity** – providing the necessary offshore and onshore electricity network infrastructure, whilst minimizing costs, project risks and impacts on marine and coastal communities and the environment.
- **Ports and logistics infrastructure** – ensuring that there is the space, suitable quaysides and adequate water depths needed to manufacture, assemble and operate FLOW projects.
- **Supply chain development** – ensuring there are the qualified companies and the skilled workforce needed for the scale of the FLOW opportunity.
- **Innovation** – the challenges of FLOW in deeper waters require a high degree of innovation in construction, logistics, mooring and operations.
- **Data and spatial planning** – enabling actions to reduce cost and risk by sharing data and conducting an integrated spatial design and Habitats Regulations Assessment (HRA).

The government is attempting to address many of these challenges through its Offshore Transmission Network Review and National Grid's Holistic Network Design. Many developers are currently looking to connect at Alverdiscott. If multiple FLOW farms were to connect either onshore or offshore near Alverdiscott, this could result in significant inward investment looking to utilise the amount of low-cost renewable energy coming into North Devon and Torridge.

FOCUSING ON REGIONAL STRENGTHS

To maximise the economic benefits of offshore wind in the Celtic Sea region, it will be crucial for HotSW LEP and local authority partners to focus on and invest in existing areas of strength:

1. **There will be significant opportunities for marine industries, especially at Appledore and Plymouth.** Owing to limitations of space and access, HotSW is unlikely to host the main manufacturing and operational port for the Celtic Sea projects in the way that, for example, Lowestoft and Hull have developed. However, the Celtic Sea will very likely

Tier 1 contractors

On a straight-forward 'conventional' building project, design consultants and the main contractor, sometimes referred to as tier 1 suppliers, work for the employer, and the main contractor may have a limited chain of their own suppliers.

3. **Alongside support for existing businesses, the development of FLOW will provide new opportunities for inward investment, including:**
   - Working with developers, and their tier 1 partners, that are looking for partnerships in the region, especially in technology development.
   - Targeting companies that could form part of the South West's marine industry and blue tech cluster.
   - Targeting industries that will be attracted to the abundance of low carbon/low-cost electricity provided by offshore wind, nuclear and other renewables.

APPLEDORE SHIPYARD

With its existing facilities and links with industry, Appledore is well placed to capitalise on high demands for new vessels.

Appledore is a port with an extensive history in shipbuilding, having built over 30

X

Appledore

Appledore has been a thriving maritime village since the 14th century, with a tradition of fishing, trading and boat building. The Richmond Dry Dock was built in 1856 by William Yeo. The yard was bought in 1964 by shipping and charter holiday airline company Court Line before being taken into public ownership by the Labour government to form part of British Shipbuilders. In 1989 it was acquired by Langham Industries, and flourished during the 1990s due to its specialist work in survey vessels. The yard went into administration in 2003, but was then bought by DML, operator of Plymouth-based Devonport Royal Dockyard, in 2004 which was later acquired by Babcock. Babcock operated the shipyard until 2019, at which point it ended its lease and closed the shipyard.

Harland & Wolff

Harland & Wolff was founded in 1861 and has worked on some iconic ships, including the RMS Titanic, RMS Olympic and HMHS Britannic. It is a multisite fabrication company operating in the maritime and offshore industry across four sites. In Belfast, they operate one of the largest drydocks in Europe. With the acquisition of Appledore in August 2020, they are now able to take on work at both ends of the ship-repair and shipbuilding markets, where there is anticipated to be significant demand.

Collaboration with Petroc College

Harland & Wolff are focused on skills development and training, as the shipyard tends to be a generational employer and is well placed to train up the next generation of workers. This is focused on construction and engineering skills, as well as highly skilled jobs in ship design and clean propulsion systems. In September 2021 Harland & Wolff took on five apprentices from Petroc College, and is hoping to take on a further twenty in September 2022.

Key opportunity areas

APPLEDORE SHIPYARD

With its existing facilities and links with industry, Appledore is well placed to capitalise on high demands for new vessels.

Appledore is a port with an extensive history in shipbuilding, having built over 300 vessels over its lifetime. At the end of 2020, Harland & Wolff, a multisite fabrication company operating in maritime and offshore industry, bought Appledore shipyard, which had closed in March 2019. Since then, the workforce has expanded and they now have a catalogue of existing and future work, having received high demand for vessel building, conversion and repair from various clients, including the RNLI.

While Harland & Wolff's Scottish ports in Arnish and Methil have been involved in renewable offshore wind through the fabrication of jackets, Appledore is more suited to supplying and servicing the fleet of clean propulsion vessels that will be needed in future offshore wind developments. They may also be able to manufacture some components needed in the FLOW supply chain including, for example, anchoring systems and offshore substation topsides.

There is also significant brownfield space adjacent to main Appledore site, including Harland & Wolff's New Quay site and the Middle Dock site, which is owned by Torridge District Council. With Harland & Wolff's expanding workload, there could be development across these two sites to support their work in vessels and offshore energy, while Middle Dock could be used for R&D and skills development and training to support the clean maritime sector, with strong opportunities to engage with both higher education and the private sector.

Appledore shipyard has deep roots within the community at Appledore, and many previous employees remained in the local area and have now been re-employed by Harland & Wolff. However, looking to the future, a key constraint for the port's growth will be the availability of housing in and around Appledore, as well as providing a prospering environment to attract and retain a highly skilled workforce.

Petroc College

Petroc College of Further and Higher Education has three campuses across beautiful North and Mid Devon, offering facilities across A levels, vocational courses, apprenticeships, higher education and T levels.

Collaboration with Petroc College

Harland & Wolff are focused on skills development and training, as the shipyard tends to be a generational employer and is well placed to train up the next generation of workers. This is focused on construction and engineering skills, as well as highly skilled jobs in ship design and clean propulsion systems. In September 2021 Harland & Wolff took on five apprentices from Petroc College, and is hoping to take on a further twenty in September 2022.

LEVERAGING HINKLEY C'S SUPPLY CHAIN

As a large-scale infrastructure project, Hinkley C demonstrates that the HotSW area has the necessary skills and supply chain to construct a high-integrity, mission-critical development. Learnings from Hinkley C can be applied directly to FLOW and can aid the development of its supply chain.

Prior to the initial development of Hinkley C, a significant amount of research and investment was put in place to maximise local supply chain content. Knowledge-based and financial contributions from the developer, lo

Local
The developer (EDF) determined 'local' as within a 90-minute commute time radius of the large infrastructure project.

A key outcome for local companies was the creation of a bespoke supply chain programme which provided SME companies with the tools and resources to bid for and win large agreements with tier 1 contractors. The programme is funded by HotSW LEP, West of England Combined Authority and Welsh Government and, as of March 2021, was successful in providing business support for approximately 800 companies and has resulted in approximately £23 million of contract wins. In addition to direct supply chain support, the Hinkley C supply chain programme offered support for foreign companies to relocate to the region, providing inward investment opportunities. HotSW could look to fund a supply chain programme for FLOW, as has been done for Hinkley C, or could support and feed into existing schemes such as Fit 4 Offshore Renewables. Either way, the region can greatly benefit from the experiences gained by companies that have progressed through the supply chain programme.

Timing and communication are key for collaboration between Hinkley C and FLOW in the Celtic Sea. The development and construction of Hinkley C are projected to finish towards the end of the decade, and EDF and HotSW LEP are starting to focus on their legacy. This coincides well with the projected development of the first FLOW farms in the Celtic Sea, and coordination between the two developments is recommended. Local companies are already well-equipped with a variety of high-level transferrable skills that can help across a large proportion of the FLOW supply chain; however, the opportunity that FLOW offers needs to be communicated as early as possible to engage these individual companies and provide them with tangible work opportunities that encourage them to stay in the HotSW area.


Image credit: EDF

LEVERAGING HINKLEY C'S SUPPLY CHAIN

As a large-scale infrastructure project, Hinkley C demonstrates that the HotSW area has the necessary skills and supply chain to construct a high-integrity, mission-critical development. Learnings from Hinkley C can be applied directly to FLOW and can aid the development of its supply chain.

Prior to the initial development of Hinkley C, a significant amount of research and investment was put in place to maximise local supply chain content. Knowledge-based and financial contributions from the developer, local authorities and other stakeholders were incorporated within supply chain plans that were formulated across the ten years prior to the construction of Hinkley C. This ensured that service and manufacturing opportunities were available to local organisations, providing the region with socio-economic benefits and coining a sense of legacy. According to EDF, approximately 600 suppliers based in the HotSW area have been used in the Hinkley C supply chain and can greatly benefit from the experiences gained by companies that have progressed through the supply chain programme.

Timing and communication are key for collaboration between Hinkley C and FLOW in the Celtic Sea. The development and construction of Hinkley C are projected to finish towards the end of the decade, and EDF and HotSW LEP are starting to focus on their legacy. This coincides well with the projected development of the first FLOW farms in the Celtic Sea, and coordination between the two developments is recommended. Local companies are already well-equipped with a variety of high-level transferrable skills that can help across a large proportion of the FLOW supply chain; however, the opportunity that FLOW offers needs to be communicated as early as possible to engage these individual companies and provide them with tangible work opportunities that encourage them to stay in the HotSW area.

Example of local suppliers

Several suppliers based in the South West have worked within the Hinkley C supply chain. Below are just a few examples:

- Bridgwater Welding Supplies, Bridgwater
- Keynvor MorLift, Appledore
- MMES, Bridgwater
- Technical Inspection Services, Clevedon
- RK Bell, Bridgwater
- Turquoise thinking, Barnstaple
- Somerset Cyber Group, Yeovil
- Osprey Group, Portishead
- SC Innovation Group

Image credit: EDF

HINKLEY C SKILLS AND TRAINING

As part of the Hinkley C supply chain, EDF worked with local partners and stakeholders to leverage significant investments in upskilling local companies and individuals to work in nuclear. This investment is playing a key role in developing the UK's industrial capability for major infrastructure projects.

In addition, Hinkley C is also helping to overcome the critical skills shortage within the construction industry whilst providing new, sustainable career opportunities for people in the South West. It is doing this by supporting:

- Local employment, by creating a wide range of occupations and careers
- The local community, by minimising local disruption and setting up a community fund
- Students, through aspirational educational programmes and a jobs service
- Suppliers and local businesses, through contracting local companies and setting up training centres, such as the National College for Nuclear.

In most supply chains, approximately 80% of jobs are made up of core skills, such as welding and construction, with only 20% being specific to the infrastructure project itself. Hence, even though Hinkley C and FLOW are very different infrastructure projects, a large proportion of the supply chain is shared.

Skills interventions that have been put in place by Hinkley C can therefore be utilised within the FLOW supply chain, including Centres of Excellence for Welding and Electrical engineering. Skillsets developed in project management, customer communication, site behaviour and health and safety can be used to de-risk projects and save time on construction by offering swift mobilisation. By ensuring individuals are certified to the latest techniques and standards, organisations within HotSW gain a competitive advantage.

Hinkley C has undoubtedly been a success in supporting and upskilling local companies. Now, it is important that offshore renewables are equally placed among opportunities for HotSW.

National College for Nuclear:

As part of Hinkley C's construction, the flagship National College for Nuclear was set up, forming a cornerstone of the government's response to nuclear skills provision. The curriculum and qualifications provided allow people access to the skills needed to work in nuclear, including:

- Virtual reality and computer modelling
- Construction
- Electrical engineering
- Mechanical engineering
- Chemical engineering
- Robotics

The National College for Nuclear South West Hub delivers a bespoke nuclear curriculum of qualifications and progression routes to jobs. Its training programmes and qualifications are designed to meet the standards of the industry, from entry-level programmes for school leavers, apprenticeships to professional development courses and degree-level qualifications. It is also linked to the South West Institute of Technology via Bridgwater & Taunton College, where it has received capital investment for nuclear industrial training facilities. In recognition of the transferrable skills from nuclear to wider energy systems, the National College is transitioning to a wider Clean Energy curriculum, supported by a wider range of qualifications.

PLYMOUTH AS A CENTRE FOR MARINE TECH

Plymouth has a strong existing maritime industry and long-standing skills within the marine sector, including the University of Plymouth, which was ranked 1st in the world for research towards Sustainable Development Goal 14 (Life Below Water). With a city-wide focus on delivering clean growth and decarbonising the marine industry, Plymouth's role in the development of FLOW is a key opportunity for the Heart of the South West region.

Plymouth benefits from being a hub for a wide range of marine organisations and operations. As stakeholders in Maritime UK South West, Plymouth benefits from key connections across regional academic and industrial sectors, including institutions at Falmouth, Southampton and Portsmouth, alongside national government. This diverse array of skills and connections provide a significant strength for HotSW. Opportunities for Plymouth in the FLOW supply chain range across:

- Construction and design engineering
- Port capabilities
- Research and development
- Skills and training

ENGINEERING AND PORT CAPABILITIES

The city has a long history of supporting marine and naval operations, which has made it a major centre for shipbuilding and marine engineering, with an estimated 300 marine-related businesses (employing over 13,000 people) operating in and around Plymouth's four port sites. This provides a clear opportunity for Plymouth to be involved within design and engineering aspects across the FLOW supply chain, such as component design and vessel refabrication. With the inclusion of the Freeport, this could give the opportunity to attract national and international investment as the FLOW sector expands.

Research and development

Plymouth is an internationally recognised centre of excellence for marine science and provides world-leading research facilities from institutions such as the University of Plymouth, Plymouth Marine Laboratory, Marine Biological Association and the Sir Alister Hardy Foundation for Ocean Science. Plymouth-based organisations have substantial involvement within world-renowned marine renewables research groups such as PRIMaRE and Supergen ORE Hub, and test facilities such as the COAST lab and the recent FLOW simulator at the Marine Navigation Centre offer world-class services for FLOW research and development.

The University of Plymouth is also currently investing in the design of marine autonomous systems which could be used for the collection of environmental and operations and maintenance data. These pioneering devices can deliver significant socio-economic benefits when compared to conventional vessels used for offshore wind projects, providing R&D opportunities for HotSW and the greater FLOW sector.

Freeport

In March 2021, Plymouth was awarded 'Freeport' status, unlocking millions of pounds of funding for the area – both within the city's boundaries and across wider South Devon area. The Plymouth and South Devon Freeport aims to create space for businesses to import goods and materials, add value and export them, and to leverage Plymouth's marine innovation strengths to attract big marine sector tech companies. It is one of eight Freeports across the UK.

CASE STUDY: OCEANSGATE

The progressive advancement of FLOW will require a collaborative approach between a variety of industries. As the first marine Enterprise Zone in the country, Plymouth City Council's Oceansgate stands as a world-class hub for marine organisations, boasting facilities that have already attracted significant investment from reputable companies.

Plymouth City Council's Oceansgate is an ongoing development that aims to provide a collaborative hub for marine-based industries with innovation at its core. Built in three phases, the total area spans 35 hectares and provides commercial use of industrial buildings and office suites, alongside docks and jetties that will provide direct deep-water access to the English Channel. This unique complex of terrestrial and marine industrial space means that Oceansgate is a world-class hub for marine-based businesses, and has

Three phases:

Phases 1 and 2 of Oceansgate provide over 2500 sqm of light industrial space and over 2250 sqm of flexible office space which can be subdivided to suit individual needs. Both phases are fully constructed, with the most recent completion of Phase 2 in March 2021.

Phase 3 will introduce additional office and industrial spaces and will see the development of docks and jetties to provide direct deep-water access to Plymouth Sound. The construction start date of Phase 3 is currently unknown, but with Phases 1 and 2 fully let, it is likely that development will begin soon.

Oceansgate, coupled with Plymouth's reputation for maritime innovation, has already demonstrated itself as a significant attraction for marine-based organisations and is a key motive for internal investment. Attracting prospective internal investment opportunities that could feed into the FLOW supply chain would benefit from a collaborative approach between Oceansgate and other facilities around the HotSW area. For example, Brixham Laboratory, owned by the University of Plymouth, offers similar office space and laboratory facilities and already hosts over 200 employees across a wide range of innovative organisations including Applied Genomics, Arc Marine and Tides Marine. From a geographical perspective, ports such as Appledore and Falmouth can massively benefit from being within two hours of Oceansgate.

Situated within Plymouth's proposed Freeport, Oceansgate is the UK's first marine Enterprise Zone, offering significant socio-economic benefits for the local economy. Incentives such as tax breaks, enhanced capital allowance and a 25-year investment period encourage employers to invest in Plymouth.

Oceansgate has already attracted numerous institutions to the city, safeguarding and creating new high-skilled jobs across the marine, defence and technology sectors and playing an important role within Plymouth's local economy.

By offering collaboration opportunities across a larger pool of organisations, all within relatively close-proximity and within different aspects of the FLOW supply chain, the case for internal investment within the HotSW area has been significantly strengthened.

MARINE TECHNOLOGIES AND 'BLUE TECH'

The development and advancement of marine technologies and 'blue tech' are becoming ever-more prominent for FLOW. Reductions in costs and carbon emissions, alongside improvements in efficiency and data granularity, make a strong case for the uptake of marine technologies, which should be at the heart of the FLOW supply chain to retain a competitive advantage.

Marine technologies, or 'blue tech', encompass the wide range of devices and systems that are used to ensure safe use, protection and development of the marine environment, and are becoming an increasingly integral part of FLOW. Blue tech is incorporated within the majority of supply chain elements, including:

- Environmental monitoring
- Development of materials
- Installation and operation of components
- Data collection and storage
- Personnel training, through the use of virtual reality

Specific tools and equipment used for FLOW are rapidly developing as technology advances and systems improve. 3D modelling of the sea floor has become a standard approach across the past decade due to advancements in sonar devices, with companies such as Sonardyne championing developments. Recent advancements in autonomous vessels and cle

Blue Economy

The Blue Economy refers to ocean-related activities that benefit socio-economic growth, all whilst preserving the health of the ocean ecosystem.

By design, the nature of FLOW and the technologies involved in the assembly, installation and maintenance of the supply chain play a key role in the Blue Economy. At present, 80% of capital expenditure in the Blue Economy is invested in offshore oil and gas, but that is expected to shift, with offshore wind projected to provide over 50% of capital expenditure by 2050, according to the 2021 DNV Ocean's Future to 2050 report.

The UK Government published the ambitious Maritime 2050 strategy in 2019 and identified innovation in maritime technology as a critical element to maintaining the UK's leading reputation in the sector. In January 2022, BEIS reinforced this ambition and awarded £31.6 million to 11 companies developing marine technologies for FLOW, including a novel anchoring approach by Reflex Marine, based in Truro. Current funding opportunities include Horizon Europe (2021-2027), which includes €95.5 billion to boost growth, trade and investment in maritime innovation; the programme is open to UK organisations. The Maritime UK South West Ocean Technology Cluster has driven career events and funding opportunities for technology companies looking to move to the South West, while the Ocean Futures Programme is currently underway to reinforce the marine industry in the South West, with a focus on the innovation and use of marine technologies for autonomy, digitilisation and decarbonisation.

Marine Navigation Centre

Situated within the University of Plymouth, the Marine Navigation Centre provides world-class facilities that support research and training programmes for work within the maritime industry. As of March 2022, the University of Plymouth has announced the proposed installation of a Dynamic Positioning (DP) simulator, provided by Kongsberg Digital. This facility will be used to simulate marine operations, allowing project teams to test and optimise installation and maintenance procedures to increase safety, efficiency and cost-effectiveness. The simulator also provides a safe environment to train industry professionals, filling the gap in national and international demand for expertise.

MARINE TECHNOLOGIES AND 'BLUE TECH'

The development and advancement of marine technologies and 'blue tech' are becoming ever-more prominent for FLOW. Reductions in costs and carbon emissions, alongside improvements in efficiency and data granularity, make a strong case for the uptake of marine technologies, which should be at the heart of the FLOW supply chain to retain a competitive advantage.

Marine technologies, or 'blue tech', encompass the wide range of devices and systems that are used to ensure safe use, protection and development of the marine environment, and are becoming an increasingly integral part of FLOW. Blue tech is incorporated within the majority of supply chain elements, including:

- Environmental monitoring
- Development of materials
- Installation and operation of components
- Data collection and storage
- Personnel training, through the use of virtual reality

Specific tools and equipment used for FLOW are rapidly developing as technology advances and systems improve. 3D modelling of the sea floor has become a standard approach across the past decade due to advancements in sonar devices, with companies such as Sonardyne championing developments. Recent advancements in autonomous vessels and clean propulsion systems also demonstrate a shift in the industry towards decarbonisation and digitalisation. While FLOW benefits from the learnings of fixed-bottom offshore wind, the industry is still in the process of developing a standardised approach to some key operations.

By design, the nature of FLOW and the technologies involved in the assembly, installation and maintenance of the supply chain play a key role in the Blue Economy. At present, 80% of capital expenditure in the Blue Economy is invested in offshore oil and gas, but that is expected to shift, with offshore wind projected to provide over 50% of capital expenditure by 2050, according to the 2021 DNV Ocean's Future to 2050 report.

The UK Government published the ambitious Maritime 2050 strategy in 2019 and identified innovation in maritime technology as a critical element to maintaining the UK's leading reputation in the sector. In January 2022, BEIS reinforced this ambition and awarded £31.6 million to 11 companies developing marine technologies for FLOW, including a novel anchoring approach by Reflex Marine, based in Truro. Current funding opportunities include Horizon Europe (2021-2027), which includes €95.5 billion to boost growth, trade and investment in maritime innovation; the programme is open to UK organisations. The Maritime UK South West Ocean Technology Cluster has driven career events and funding opportunities for technology companies

Maritime UK South West Ocean Technology Cluster

This cluster brings together academia, government and industry and provides collaboration opportunities which aim to promote regional excellence and drive strategic development and investment in the South West's marine sector. The cluster already accounts for £2.54 billion in gross value added per year to the regional economy, encompassing almost 4,000 businesses and 25,000 jobs.

RESEARCH AND DEVELOPMENT

Examples of test facilities in the HotSW area

- University of Exeter Dynamic Marine Component (DMaC) test facility
- University of Exeter South West Mooring Test facility
- University of Plymouth COAST test facility (replicating wave, wind and tidal technologies)
- University of Plymouth Electron Microscopy Centre (materials analysis)
- SMART Sound
- Marine Business Technology Centre in Plymouth
- Brixham Laboratory

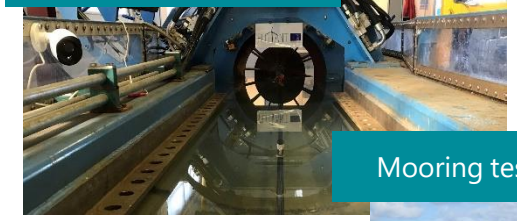
The HotSW is renowned for its academic and research capabilities, including the University of Exeter and the University of Plymouth. The HotSW also benefits from hosting world-renowned marine test facilities, which attract international investment, and key connections with several test facilities across the South West through associations with the Universities and the Marine-i programme, such as the Falmouth Bay test site (FaBTest) and the National Composites Centre.

According to the UK government, research and development will help maintain UK's position as a world leader in offshore wind. This was reflected through £31m in government funding, matched by more than £30m from industry, to develop new technologies that will further FLOW development.

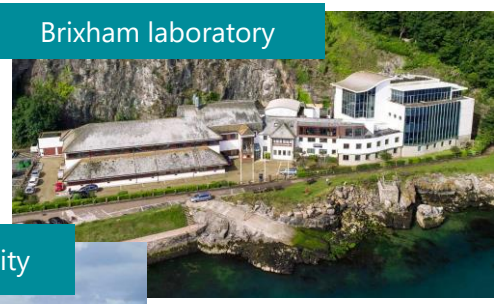
Funding opportunity

In 2021, the Department for Transport and Innovate UK launched the Clean Maritime Demonstration Competition, a competition for feasibility studies and technology trials to accelerate maritime decarbonisation in the UK. The first round allocated £33.5m to 55 projects across the UK, including the University of Plymouth's Marine e-Charging Living Lab project, installing a port-side charger for small electric maritime vessels. There are now talks of a second round of funding under the same competition, with potentially over £100m of funding for large-scale demonstrator projects available.

Dynamic Marine Component test facility

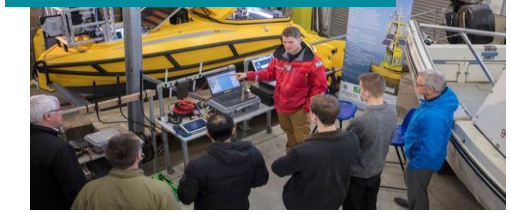


Brixham laboratory



Mooring test facility

Marine Business Technology Centre



COAST test facility

RESEARCH AND DEVELOPMENT

Marine e-Charging Living Lab

Plymouth's Marine e-Charging Living Lab (MeLL) will provide pivotal infrastructure to allow Plymouth to host the UK's first charging network for electric maritime vessels. The project received more than £570,000 funding as part of the Clean Maritime Demonstration Competition. The Project is being led by the University of Plymouth in partnership with Plymouth City Council, Princess Yachts Limited and Aqua SuperPower.

- Mooring and anchoring systems
- Engineering, fabrication and assembly
- Materials and components
- Blade design and optimization
- Propulsion systems
- Autonomous vessels

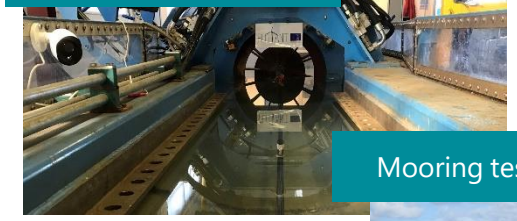
The HotSW is renowned for its academic and research capabilities, including the University of Exeter and the University of Plymouth. The HotSW also benefits from hosting world-renowned marine test facilities, which attract international investment, and key connections with several test facilities across the South West through associations with the Universities and the Marine-i programme, such as the Falmouth Bay test site (FaBTest) and the National Composites Centre.

According to the UK government, research and development will help maintain UK's position as a world leader in offshore wind. This was reflected through £31m in government funding, matched by more than £30m from industry, to develop new technologies that will further FLOW development.

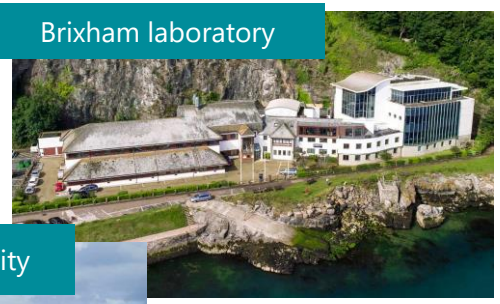
Funding opportunity

In 2021, the Department for Transport and Innovate UK launched the Clean Maritime Demonstration Competition, a competition for feasibility studies and technology trials to accelerate maritime decarbonisation in the UK. The first round allocated £33.5m to 55 projects across the UK, including the University of Plymouth's Marine e-Charging Living Lab project, installing a port-side charger for small electric maritime vessels. There are now talks of a second round of funding under the same competition, with potentially over £100m of funding for large-scale demonstrator projects available.

Dynamic Marine Component test facility

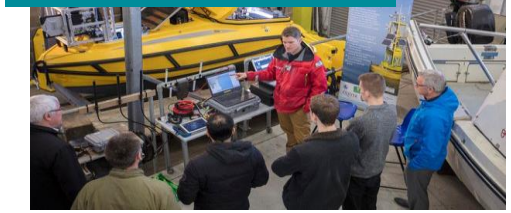


Brixham laboratory



Mooring test facility

Marine Business Technology Centre



COAST test facility

The FLOW supply chain requir
expertise. By investing in the d
HotSW can ensure that the nece
FLOW supply chain.

The supply chain of a FLOW farr
variety of sectors, which can supp

- Environmental Science
- Engineering
- Construction
- Business and Economics
- Politics

The HotSW already has several sp
to FLOW, particularly around
services. There is also significant
existing expertise, particularly a
aspect of the FLOW supply ch
skillsets needed for offshore win
skills that are often used across
only a quarter directly related to

The transferability of these 'c
demonstrates that companies ar
lot of the necessary skills requi
Additional support to develop skills that are directly applicable to FLOW can put HotSW companies in good stead to feed into the supply chain, allowing them to diversify their revenue and secure future income as an ever-increasing number of FLOW projects are developed to meet net zero targets.

Example careers supported by FLOW development:

Environmental Science
- Marine biologist
- Oceanographer
- Geophysicist
- Consents coordinator

Engineering
- Mechanical engineer
- Electrical engineer
- Design engineer
- Installation managers
- Controls system engineer
- Operations personnel

Construction
- Welder/plater
- Crane operator
- Scaffolder
- Health and safety role
- Training personnel
- Electrical technician

Business and economics
- Investment analyst
- Project economist
- Sales manager
- Project planner
- Offshore coordinator

Politics
- Public affair officer
- Policy manager
- Stakeholder advisor

X

created to help get the UK supply chain
newables work. These include supply chain
grant funding and business support to
anding into offshore wind. Such schemes
Growth Partnership (OWGP) and the Fit 4

ewables (F4OR)

es scheme is a business support activity co-
cal Enterprise Partnership and the Offshore
offers businesses the chance to assess and
rtake in the offshore renewables supply chain
engagement, market awareness, profile and
ore renewables work.

an industry-recognised 'Granted' status after
me, meaning they are better equipped to
takeholders and potential future clients. The
5 companies across the UK achieve 'Granted'
es winning major contracts with offshore
s Total and Steisdal Offshore; over 40 more
supported by F4OR programmes nationwide.

to businesses ranging from those with no
e to established suppliers, and companies can
register interest for the scheme on a nation-wide or regional basis at any time. At present, there is no South West application programme; however, with the growth of FLOW in the Celtic Sea, the prospect of a regional programme may be on the cards.

SKILLS DEVELOPMENT AND TRAINING

The FLOW supply chain requires a wide range of high-level skills and expertise. By investing in the development of relevant transferable skills, HotSW can ensure that the necessary expertise is available across the entire FLOW supply chain.

The supply chain of a FLOW farm demands a diverse range of skills from a variety of sectors, which can support careers in:

- Environmental Science
- Engineering
- Construction
- Business and Economics
- Politics



The HotSW already has several specialist skillsets that can be directly applied to FLOW, particularly around environmental surveys and consultancy services. There is also significant opportunity to expand upon and develop existing expertise, particularly around the engineering and manufacturing aspect of the FLOW supply chain. Approximately three-quarters of the skillsets needed for offshore wind supply chains are classed as 'core' skills - skills that are often used across all large-scale infrastructure projects - with only a quarter directly related to offshore wind itself.

The transferability of these 'core' skillsets to the FLOW supply chain demonstrates that companies and individuals in the HotSW already have a lot of the necessary skills required to engage within FLOW opportunities. Additional support to develop skills that are directly applicable to FLOW can put HotSW companies in good stead to feed into the supply chain, allowing them to diversify their revenue and secure future income as an ever-increasing number of FLOW projects are developed to meet net zero targets.

Numerous schemes have been created to help get the UK supply chain ready to bid for offshore renewables work. These include supply chain programmes that can offer grant funding and business support to companies interested in expanding into offshore wind. Such schemes include the Offshore Wind Growth Partnership (OWGP) and the Fit 4 Offshore Renewables scheme.

Fit 4 Offshore Renewables (F

The Fit 4 Offshore Renewables scheme is a
funded by the North East Local Enterprise
Wind Growth Partnership. It offers busines
enhance their readiness to partake in the of
by increasing their industry engagement,
confidence in bidding for offshore renewable

Successful businesses obtain an industry-re
completion of the programme, meaning
engage with major industry stakeholders ar
scheme has already helped 15 companies a
status, with some companies winning m
renewable companies such as Total and St
businesses are currently being supported by

The programme is available to businesses
offshore renewables experience to establishe
register interest for the scheme on a nation
time. At present, there is no South West ap
with the growth of FLOW in the Celtic Se
programme may be on the cards.

Companies supported by F4OR to date

- 2H Offshore Engineering Ltd
- Apollo Offshore Engineering
- Balmoral Comtec Ltd
- Birlinn Offshore Ltd
- Carnaud Metal Box Engineering
- EnerMech
- JBA Consulting
- JGC Engineering
- KRG Specialist Engineering Services Ltd
- Leask Marine
- Peritus International
- Proeon Systems
- Rix Renewables
- Stowen Clean Energy Ltd
- TecoSIM Simulation Ltd

ENVIRONMENTAL SERVICES

The ability to undertake environmental and marine surveys as part of the FLOW supply chain is one of the key opportunities for HotSW.

In the development of a FLOW farm, many marine and environmental surveys are required. Previous projects have commissioned surveys into the following three aspects:

The physical environment includes:
- Salinity of water column
- Temperature of water column
- Wave and current regimes
- Wind resource assessments
- Sediment regime
- Geological surveys
- Seabed features and bathymetry

The biological environment includes:
- Ecology and nature conservation
- Habitat surveys, including for birds, fish and marine mammals
- Feeding patterns
- Breeding patterns
- Noise and vibrational analysis

The human environment includes:
- Main shipping routes
- Commercial fishing grounds
- Landscape and seascape
- Navigation
- Archeology
- Military and civil aviation

The completion of marine and environmental surveys requires large amounts of data, which can take several years to collect, but holds immense value and opportunities to learn about the marine environment. At present, environmental data is primarily collected using manned vessels, however, there is a growing opportunity for the use of marine autonomous systems.

The Crown Estate has recently announced that they intend to streamline the deployment of FLOW by carrying out Habitats Regulations Assessment (HRA) ahead of tender. This will identify key environmental impacts as early as possible which will de-risk investment and speed up the leasing process. Developers will still need to carry out site-specific environmental surveys, but this could mean that companies will need to liaise with a range of contractors including developers and The Crown Estate. Floating windfarms Whitecross, Llŷr 1 and Llŷr 2 are the first to be involved in this trial.

Case Study

Partrac is a metocean consultancy that employs c. 20 people. They have a South West office in Heathfield, Devon as well as offices in the North West and Scotland. They have been involved in multiple offshore wind projects since their formation in 2003, including carrying out measurements for NextGen's ScotWind leasing bid. They have also recently been contracted by StatKraft to deliver metocean measurements for the developer's North Irish Sea Array offshore wind site.

PARTRAC

ENVIRONMENTAL SERVICES

The ability to undertake environmental and marine surveys as part of the FLOW supply chain is one of the key opportunities for HotSW.

In the development of a FLOW farm, many marine and environmental surveys are required. Previous projects have commissioned surveys into the following three aspects:

- The physical environment

Some examples of environmental surveyors in the HotSW include:

- CMS GeoScience, Plymouth
- CPR Survey, Plymouth
- GoBe, Buckfastleigh
- Partrac, Heathfield
- Quantum Geotechnic, Exeter
- Ramboll, Exeter
- RPS Energy, Exeter
- Seiche, Holsworthy
- SLR, Exeter

also provides opportunity for inward investment. There are a significant number of specialist companies in the Heart of the South West that currently provide geotechnical site information, habitat surveys and marine mammal monitoring, with several of these companies have previously worked in the offshore wind sector.

The completion of marine and environmental surveys requires large amounts of data, which can take several years to collect, but holds immense value and opportunities to learn about the marine environment. At present, environmental data is primarily collected using manned vessels, however, there is a growing opportunity for the use of marine autonomous systems.

The Crown Estate has recently announced that they intend to streamline the deployment of FLOW by carrying out Habitats Regulations Assessment (HRA) ahead of tender. This will identify key environmental impacts as early as possible which will de-risk investment and speed up the leasing process. Developers will still need to carry out site-specific environmental surveys, but this could mean that companies will need to liaise with a range of contractors including developers and The Crown Estate. Floating windfarms Whitecross, Llŷr 1 and Llŷr 2 are the first to be involved in this trial.

Case Study

Partrac is a metocean consultancy that employs c. 20 people. They have a South West office in Heathfield, Devon as well as offices in the North West and Scotland. They have been involved in multiple offshore wind projects since their formation in 2003, including carrying out measurements for NextGen's ScotWind leasing bid. They have also recently been contracted by StatKraft to deliver metocean measurements for the developer's North Irish Sea Array offshore wind site.

PARTRAC

ENVIRONMENTAL SERVICES

The ability to undertake environmental and marine surveys as part of the FLOW supply chain is one of the key opportunities for HotSW.

In the development of a FLOW farm, many marine and environmental surveys are required. Previous projects have commissioned surveys into the following three aspects:

- The physical environment
- The biological environment
- The human environment

Marine and environmental surveys are the first steps in securing a seabed lease from The Crown Estate. According to The Crown Estate's guide to an offshore wind farm, approximately £4m is spent on environmental surveys per GW developed, which offers a significant economic opportunity for the HotSW. This is key, as many of the developers currently interested in the Celtic Sea have not yet started surveying.

Environmental surveys can benefit from the site-specific knowledge and expertise available from local companies. However, due to the flexibility of survey work, there is also the prospect for companies within the HotSW to work on offshore wind or other surveying projects outside of the region. This also provides opportunity for inward investment. There are a significant number of specialist companies in the Heart of the South West that currently provide geotechnical site information, habitat surveys and marine mammal monitoring, with several of these companies have previously worked in the offshore wind sector.

Habitats Regulation Assessment
A HRA is a compulsory process that ensures that any marine development has limited environmental impact on legally protected areas (Special Areas of Conservation and Special Protection Areas).

The Crown Estate has recently announced that they intend to streamline the deployment of FLOW by carrying out Habitats Regulations Assessment (HRA) ahead of tender. This will identify key environmental impacts as early as possible which will de-risk investment and speed up the leasing process. Developers will still need to carry out site-specific environmental surveys, but this could mean that companies will need to liaise with a range of contractors including developers and The Crown Estate. Floating windfarms Whitecross, Llŷr 1 and Llŷr 2 are the first to be involved in this trial.

Case Study

Partrac is a metocean consultancy that employs c. 20 people. They have a South West office in Heathfield, Devon as well as offices in the North West and Scotland. They have been involved in multiple offshore wind projects since their formation in 2003, including carrying out measurements for NextGen's ScotWind leasing bid. They have also recently been contracted by StatKraft to deliver metocean measurements for the developer's North Irish Sea Array offshore wind site.

PARTRAC

PROFESSIONAL SERVICES

The Heart of the South West region has many companies that work in professional services and consultancy, including many that are focused solely on offshore and marine work. There is scope for many existing companies to diversify to provide these services for FLOW.

Professional services and consultancies are involved in the development, operation and decommissioning stages of a FLOW project. This i

Example services provided by consultancies:

- Initial site selection and feasibility studies
- Support to bids for seabed leases
- Project consenting and permitting
- Environmental Impact Assessments
- Habitat regulation assessments
- Dredging and disposal characterisation
- Transboundary impact assessments
- Environmental survey specification, procurement and management
- Stakeholder consultation and negotiations
- Planning and development advice and strategy
- Management of NSIP projects
- Consent compliance management
- Decommissioning and repowering

development, as they have experience of the supply chain involved in a high-integrity, mission-critical project.

Across the HotSW, there are over 300 companies working in environmental consultancy, employing over 600 people. These are mainly centred around Exeter and have a cumulative annual turnover of c. £95 million.

Case Study

GoBe is one of the leading providers of services to the marine renewable energy sector, having provided support in relation to a number of wave, tidal and offshore wind developments. Based in Devon, they also have offices in Scotland, and could be involved in developments in the Celtic Sea and as part of ScotWind. GoBe has experience in the Celtic Sea, as they provided professional services for the Wave Hub site in 2015.

PROFESSIONAL SERVICES

The Heart of the South West region has many companies that work in professional services and consultancy, including many that are focused solely on offshore and marine work. There is scope for many existing companies to diversify to provide these services for FLOW.

Professional services and consultancies are involved in the development, operation and decommissioning stages of a FLOW project. This is intrinsically linked with the need for environmental and marine surveys, which can often be carried out by the same companies. The development of FLOW in the Celtic Sea provides an opportunity for surveyors to diversify to provide services during the whole supply chain.

This also extends beyond offshore-focused companies and services, to more general services, including:

- Planning
- Legal and insurance
- Accountancy and finance
- IT and data services

Examples of HotSW companies providing professional Services to offshore projects:

- AFRY Solutions Ltd, Plymouth
- BMT, Plymouth
- Maritime and Coastguard Agency, Plymouth
- GoBe consultants, Newton Abbot
- Mecal, Plymouth
- Royal HaskoningDHV, Exeter

Across the HotSW, there are over 300 companies working in environmental consultancy, employing over 600 people. These are mainly centred around Exeter and have a cumulative annual turnover of c. £95 million.

Case Study

GoBe is one of the leading providers of services to the marine renewable energy sector, having provided support in relation to a number of wave, tidal and offshore wind developments. Based in Devon, they also have offices in Scotland, and could be involved in developments in the Celtic Sea and as part of ScotWind. GoBe has experience in the Celtic Sea, as they provided professional services for the Wave Hub site in 2015.

FLOW FOUNDATIONS

Floating substructures have widely been constructed from steel, as a handover from previously deployed monopile foundations. However, there may be a strong case for the use of concrete to make FLOW substructures, where the HotSW can greatly benefit.

Due to the infancy of the industry, designs for floating foundations are yet to be standardised. FLOW developers typically use one of three floating substructure designs, based upon conditions such as the resource available, size of the turbines and port and harbour facilities.

Floating substructure design

Tension-leg platform: consists of submerged buoyancy tanks with multiple columns to spread the load. Vertical mooring lines to preclude vertical movement and rotations and provide stability.
Challenges: Unstable assembly process and need for high vertical load moorings and anchors.

Semi-submersible: semi-submerged buoyancy tank consisting of multiple columns to spread the load and provide stability. The most popular concept due to simpler transportation and installation, lower cost of anchoring system and wider range of water depth.
Challenges: a lot of structure above the waterline, high exposure to waves.

Spar: uses weight installed near the bottom of a vertical buoyancy cylinder
Challenges: deep structure limits port access.

Kincardine

Semi-submersible foundations
- 67m wide
- Max. 12m above waterline
- Steel weight ~3,000 tonnes

Hywind

Spar foundations
- 91 m in length
- 14.5 m in diameter
- Steel weight ~2,300 tonnes

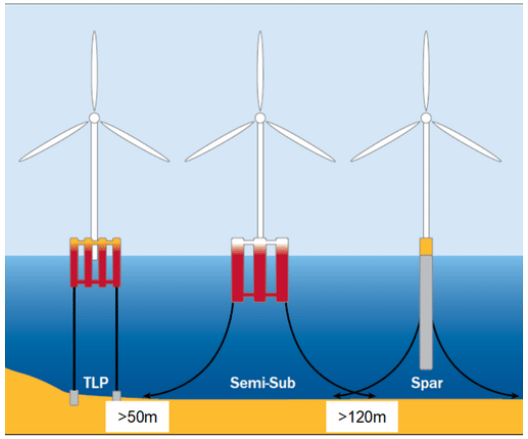
Recent discussions in industry have suggested a shift towards the use of concrete for floating substructures, either fully or as a composite design with steel, due to its lower manufacturing costs and lower carbon footprint; approximately 0.8-2.8 tonnes of CO_2 are emitted per tonne of steel, whereas concrete has a footprint of approximately 0.1 tonnes of CO_2 per tonne. Innovations in low carbon concrete have helped with this potential industry shift. However, there are still concerns over the durability of concrete structures in the extreme conditions that FLOW foundations have to endure. Arc Marine has designed innovative carbon-neutral concrete structures for the sea floor with an expected lifetime of 100 years; however, the durability of concrete at the ocean-air interface is still unknown.

Some FLOW developers have stated that concrete would not be used in their developments due to survivability issues. Although there is still uncertainty as to whether concrete will be used for FLOW foundations, if it was applied, the HotSW would be able to benefit from its use due to companies such as Hanson Ready-mixed Concrete and RGB Building Supplies.

FLOW FOUNDATIONS

Floating substructures have widely been constructed from steel, as a handover from previously deployed monopile foundations. However, there may be a strong case for the use of concrete to make FLOW substructures, where the HotSW can greatly benefit.

Due to the infancy of the industry, designs for floating foundations are yet to be standardised. FLOW developers typically use one of three floating substructure designs, based upon conditions such as the resource available, size of the turbines and port and harbour facilities.



Substructures currently used in floating offshore wind. Floating platforms used in water depths >50m.

Most demonstration projects, such as Hywind (Five 6 MW turbines) and Kincardine (Five 9.5 MW turbines) in Scotland, use floating substructures that have been manufactured from steel. Steel's survivability in the marine environment is well-understood from its use in fixed-foundation offshore wind, and steel manufacturing facilities are already available with materials that are readily obtainable. Companies in the HotSW such as Relay Engineering, Clifford Friend and Blackhill Engineering have experience in structural steel manufacturing and could contribute to the fabrication of large foundations.

Kincardine

Semi-submersible foundations
- 67m wide
- Max. 12m above waterline
- Steel weight ~3,000 tonnes

Hywind

Spar foundations
- 91 m in length
- 14.5 m in diameter
- Steel weight ~2,300 tonnes

Recent discussions in industry have suggested a shift towards the use of concrete for floating substructures, either fully or as a composite design with steel, due to its lower manufacturing costs and lower carbon footprint; approximately 0.8-2.8 tonnes of CO_2 are emitted per tonne of steel, whereas concrete has a footprint of approximately 0.1 tonnes of CO_2 per tonne. Innovations in low carbon concrete have helped with this potential industry

Low Carbon Concrete

Cement (the main component of concrete) has a high carbon content. Although the use of a concrete substructure will have a short carbon payback period when used in FLOW, reducing the carbon content of its constituent parts would be beneficial. Identifying clays suitable for use as in cement, including supplementary cementitious materials (SCM) or alkali-activated cementitious materials (AACM), is a starting point.

ANCHORS AND MOORING SYSTEMS

Unlike fixed-bottom offshore wind, a FLOW turbine is mounted on a platform that is anchored to the seabed using mooring lines. The sector is still in a period of innovation, with no universal method of anchoring and mooring collectively adopted yet.

ANCHORS

The type of anchor used for a particular project is driven by characteristics such as the project size, substructure foundation and seabed properties. There are currently three main types of FLOW anchors:

- Drag-embedded
- Suction
- Driven pile

Drag-embedded
These anchors are dropped and dragged along the seabed to provide deeper embedment; sand or shales are required to embed these anchors into the ground. They are typically the cheapest option, but are unable to share mooring lines and so limit the number of turbines in the farm.

Suction
Suction anchors use a vacuum to hold them in place on the seabed. They are most effective on soft clays yet require ROVs and additional vessels during installation and so can be the most expensive form of anchor.

Driven pile
These anchors are driven in the seafloor typically using a vibratory or impact hammer. They perform best in harder ground.

Drag-embedded anchor


Driven pile anchor

MOORINGS

Typical configurations state that mooring lines are at least four times longer than the water depth of the site; according to OREC, a 300 MW project (the smallest commercial capacity set to develop in the Celtic Sea) requires approximately 51 km, or 23,000 tonnes, of mooring lines. Mooring lines are currently made from large diameter chains and require large factory and laydown areas, and cranes with an excess of 500 tonnes lifting capacity. However, there is a shift towards the use of synthetic rope for future FLOW mooring solutions to minimise costs of the floating wind farms. This period of innovation could support the numerous R&D and testing facilities around the HotSW.

This development means there is a growing need for experienced rope makers. There are several HotSW companies that currently manufacture rope for boat moorings, but expansion would be needed to diversify into synthetic materials. Bristol Rope and Twine currently manufacture, import and distribute synthetic rope to a range of marine industries worldwide; however, the diameter required for FLOW is in excess of 1.5 m, requiring a significant increase in manufacturing facilities. Although not based in the HotSW, FLOW in the Celtic Sea could provide a good basis for Bristol Rope and Twine to invest in such manufacturing facilities within the region.

ANCHORS AND MOORING SYSTEMS

Unlike fixed-bottom offshore wind, a FLOW turbine is mounted on a platform that is anchored to the seabed using mooring lines. The sector is still in a period of innovation, with no universal method of anchoring and mooring collectively adopted yet.

Reflex Marine
Reflex Marine has around 30 years of expertise in designing, manufacturing and tailoring crew transfer equipment and solutions. They successfully led a consortium of partners from the University of Exeter, Bridon-Bekaert Ropes Group and Wood Thilsted Partners to develop the JAVELIN solution, which gained financial investment from UK government.

The manufacture of these anchors typically requires large laydown areas for storage, and is preferably carried out in close proximity to deep water access for transport ease. Access to cranes with approximately 300 tonnes lifting capacity is also needed, though this is significantly less than the 1000 tonnes lifting capacity needed for a turbine's nacelle.

At present, there are no companies located within the HotSW manufacturing anchors; however, there are companies with bases in Cornwall that are exporting anchoring products and drilling services that would be capable of handling a commercial-scale contract, including Fugro and Acteon. As FLOW is an emerging technology, the design of anchoring systems is ever-developing. Cornwall-based Reflex Marine has developed a javelin-like anchor which is capable of being drilled in a wide range of seabed geologies – beneficial for the range of geologies present in the Celtic Sea. If the HotSW can capitalise on this development, then these piled anchors can be manufactured locally and at a competitive price.

Drag-embedded anchor


Driven pile anchor

MOORINGS

Typical configurations state that mooring lines are at least four times longer than the water depth of the site; according to OREC, a 300 MW project (the smallest commercial capacity set to develop in the Celtic Sea) requires approximately 51 km, or 23,000 tonnes, of mooring lines. Mooring lines are currently made from large diameter chains and require large factory and laydown areas, and cranes with an excess of 500 tonnes lifting capacity. However, there is a shift towards the use of synthetic rope for future FLOW mooring solutions to minimise costs of the floating wind farms. This period of innovation could support the numerous R&D and testing facilities around the HotSW.

This development means there is a growing need for experienced rope makers. There are several HotSW companies that currently manufacture rope for boat moorings, but expansion would be needed to diversify into synthetic materials. Bristol Rope and Twine currently manufacture, import and distribute synthetic rope to a range of marine industries worldwide; however, the diameter required for FLOW is in excess of 1.5 m, requiring a significant increase in manufacturing facilities. Although not based in the HotSW, FLOW in the Celtic Sea could provide a good basis for Bristol Rope and Twine to invest in such manufacturing facilities within the region.

VESSELS AND SUBSEA OPERATIONS

Specialist vessels include:

- Towing vessels for offshore substructure and turbine
- Specialist cable-laying vessels
- Trenching ploughs
- Anchor-handling tugs
- Survey vessels
- Crew transfer vessels
- Barges
- Service operation vessels (SOVs)
- Subsea remotely operated vessels (ROVs)
- Multicats

These operations require access to specialist vessels alongside a support network of experienced personnel, such as divers and engineers. Floating wind farm developers will contract these services out to specialist companies who undertake these operations for the necessary period of time; this can range from 12 - 18 months for the installation of structures, to the entirety of the project lifetime for CTVs and SOVs.

The HotSW already has a variety of specialist companies that have the services and skills suitable for the marine and subsea operations needed for FLOW. These include subsea diving and cable installation, provision of offshore engineers, and vessels capable of towing large structures. Several of these companies have previous experience working in offshore renewable energy, but would need expanding to provide the same services at the scale required for FLOW.

Plymouth Marine Laboratory is also in the process of testing a new fleet of autonomous survey instruments and vessels to deliver high-speed underwater communication and data collection. Autonomous mechanisms minimise restrictions from weather and environmental conditions, providing an extended deployment window, and require skilled personnel to collate and interpret the data, providing employment for data handlers and specialists across the lifetime of the project.

Case Study

Based in Brixham, MTS has a fleet of 23 vessels that can offer towage, engineering support and crew transfer services. Their access to large tugs, shoalbusters and multicats has given them experience in working in the offshore wind sector, having previously provided support vessels for the extension of the Walney fixed-bottom offshore wind farm off the Irish coast.

MTS MARINE & TOWAGE SERVICES

There is a growing opportunity for HotSW companies that specialise in vessel construction and operation, particularly in light of the recent launch of the UK government's new unit, UK SHORE, and the associated £206m in funding for clean propulsion and skilled maritime jobs. The number of vessels needed, and their tonnage requirements, are expected to grow rapidly by the end of the decade as the scale of FLOW farms increase, according to Rystad Energy. Harland & Wolff, based in Appledore, have already acknowledged a gap in the market for the construction of SOVs, and capitalising on this progression before the end of the decade can put the HotSW in a favourable position when contracts are being offered.

OPERATIONS AND MAINTENANCE

The operation and maintenance (O&M) of a FLOW farm can secure work within the FLOW supply chain for decades. Supply chain elements such as continuous monitoring systems, autonomous vessels and experienced personnel can provide HotSW companies with long-term investment and employment opportunities.

The O&M of a FLOW farm comprises the facilities and services which carry out major repairs, routine inspection and proactive maintenance. Across the initial operation period of 5-10 years, a wind farm may be predominantly serviced by the plant owner; however, after this warranty period, contracts for on- and off-site operations are typically handed out to external companies. There is still speculation on how major repairs will be undetaken for FLOW. Primarily, discussions are based on determining whether repairs will be carried out on- or off-site, both of which will require different amenities and services:

- On-site repairs will likely take several days and may require a 'mother-daughter' method, where smaller marine vessels travel to and from the plant from a larger 'base' vessel, acting as a hub for personnel. This requires an extensive understanding of the maritime industry to optimise solutions and provide quick and efficient vessels that can carry out major repairs.
- Off-site repairs will employ a tow-to-port strategy where the turbine and its substructure are towed onshore (either dry dock or inshore) by available vessels and repaired with cranage at a capable port. This strategy is complex and costly, both in terms of operations and downtime, yet is currently the most accessible approach for the present scale of FLOW.
- An increase in helicopter use for routine O&M operations may also be included in the future O&M mix as FLOW farms stretch further out to sea. Companies like Helitune can aid in such operations.

The dimensions of proposed turbines and their substructures, alongside current port facilities, mean that the HotSW will not be the primary basis for major O&M repairs for the Celtic Sea. However, there are multiple supply chain elements that are applicable for the routine inspection and proactive maintenance aspects of operating a floating wind farm. Existing companies that can provide a selection of routine O&M services include:

Routine inspection and proactive maintenance

This comprises scheduled inspection of the main components of a floating wind farm and will include supply chain elements such as:

- Remote condition monitoring - in-built sensors and drone examinations
- Through-water communication support
- Subsea surveys
- Remote and autonomous vessels – subsea cable and mooring inspection
- Data collection and analysis
- Vessels and logistics – marine coordination
- Qualified personnel in health and safety, project management and administration

logistics. As the Celtic Sea provides one of the first opportunities for large scale maintenance of floating wind turbines in the world, the HotSW is well-placed to advance and optimise the O&M process of FLOW.

PORT REQUIREMENTS

The physical scale of FLOW components, as well as the expected number of turbines to be deployed, will place high and wide ranging demands on port infrastructure. These demands will vary across the project lifetime:

Near-term requirements → **Future requirements**

Planning

In project planning, surveying vessels will be active and in need of construction, maintenance and docking space. Port activity will be highest in the construction phase, with demand from installation vessels, tow vessels and crew transfer vessels.

Construction / Assembly and launch

While the manufacture of turbines and towers themselves is highly likely to remain at the OEMs existing sites, fabrication of floating substructures will require ports with both construction facilities and suitable quayside areas, and depths to store and float the structures. High tonnage cranes and/or a floating drydock are needed, with road and rail access also key. Local port capabilities can be considered to an extent in the choice of substructure type; the ORE Catapult has completed work estimating the specific port requirements for each. Mooring chains and anchoring systems can be manufactured and stored separately and will also require portside space, likely strengthened.

Catapult Supply Chain report:

- Laydown Area – ~20 ha
- Water Depth – 8.5-11 m
- Facilities – access to cranes, dry dock
- Nearby supply chain main elements
- Land transport – access to rail (preferred), motorway connection required

O&M

Once operational, an O&M base will be needed for the lifetime of the windfarm. This site must have secure storage and lay down areas, space for offices and workshops and a quay with 24/7 access capable of handling SOVs.

Decommissioning

There is a final role for ports as a decommissioning base.

A "WindFloat" semi-submersible substructure at port. At present, only a few ports globally can handle the scale of these structures.

COMMUNITY BENEFIT

As explored in this report, there are many benefits that can be realised through the development and operational lifetime of renewable energy projects, by creating new jobs, providing education and skills, boosting the local economy, developing local infrastructure and environment, and providing direct community investment.

COMMUNITY BENEFIT SCHEMES

Community benefit schemes are a well-established part of renewable energy developments, and often represent a positive relationship between renewable energy developers and local communities. Community benefit schemes are voluntary arrangements offered by developers to communities located near developments, and are not currently a material consideration in the planning application process.

While the UK, Scottish and Welsh governments do not currently have any formal requirements for community benefits for offshore wind, projects have historically been strongly encouraged to include an element of community benefit in the development. One example of a community benefit scheme is the Tirgwynt Wind Farm, owned by Belltown Power, which donated an upfront grant of £500,000 to support the construction of a brand-new primary school building for Ysgol Carno in Powys, Wales.

Community benefit in Scotland

All onshore energy developments in Scotland are strongly encouraged to include an element of community benefit of the value equivalent to £5,000 per installed MW per annum. This has created a strong community energy presence around these windfarms and has helped to invest in the local communities.

Orsted's Offshore Community Benefit Funds

Developers Orsted have allocated a total of £6 million per year across their Burbo Bank, Walney, and Hornsea offshore wind projects for local and community initiatives.

Each project has a dedicated Community Fund, which funds community interest projects and organisations in grants typically worth £10,000-£20,000. These funds are managed by independent grant-making charity GrantScape. Decision-making in grant allocation is conducted by a local advisory group, made up of stakeholders such as local authority members, campaigners and community councils in the local area.

The structure and purpose of the community funds are agreed through extensive local community engagement, managed again by Grantscape. Through this engagement with local stakeholders across policymakers and civic society, "funding zones" (where the money is to be spent) are also identified, allowing local stakeholders a role in determining the relevant community or area of interest.