Bristol City Region

Gateway for ocean energy technology

A gateway for ocean energy technology

The Bristol City Region is home to world-leading marine energy technology developers, excellent universities and supply chain companies at the forefront of an emerging offshore renewable energy sector. With strengths in the low carbon, aerospace and advanced engineering, microelectronics and business and financial sectors, the Bristol City Region has become a natural place for innovators and investors and is well placed to act as a gateway for the commercialisation of the marine energy industry. Developers and investors can take advantage of the following unique opportunities:

- Access to excellent resources in the Bristol Channel through Bristol Port
- A vibrant finance and business sector, attractive to international investors
- A pre-established hub for tidal and marine energy technology development
- Strong collaborative links between industry and academia
- A supply chain of over 120 companies led by large industrial companies, environmental technologies, advanced engineering, hi-tech and offshore service industries
- Port infrastructure and space to support industrial growth
- Integration with the wider South West marine energy infrastructure and South West Marine Energy Park (South West MEP)
- Commitment from the four Local Authorities and the West of England Local Enterprise Partnership, driving to attract investment and grow the sector
- Recognition of the regions commitment to sustainability through being the first UK city to be crowned the European Green Capital for 2015

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Bristol is proud to host and support one of the most important global clusters of tidal energy technology developers, including Siemens Marine Current Turbines, Alstom Tidal Generation, and IT Power. Key to its continued growth is the expansion of the regional supply chain in partnership with the South West Marine Energy Park.

George Ferguson
Mayor of Bristol

It's great to see Bristol at the forefront of the marine power revolution, providing a real boost to the local economy and accelerating growth in marine energy.

Edward Davey
Secretary of State for Energy and Climate Change

BRISTOL winner 2015 EUROPEAN GREEN CAPITAL An initiative of the European Commission

SOUTH WEST MARINE ENERGY PARK

Where industry meets innovation

The Bristol City Region is one of the most vibrant and economically productive city regions in the UK.

The region has an entrepreneurial energy which stems from the diversity of companies in the area, from large scale industrialists to smaller creative media ventures.

- Population of 1.1 million
- 44,300 businesses, including a third of the FTSE top 100 businesses
- The advanced engineering, manufacturing, environmental technologies and service sectors employ around 21,000 people across 2,400 businesses
- Four outstanding universities support the region's knowledge economy, leading to over 40% of the 500,000 potential employees being qualified to degree level and above.

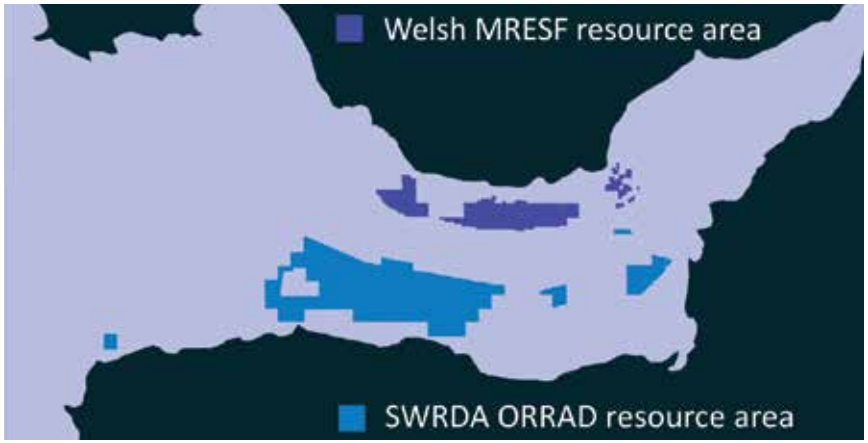
With excellent transport links, land availability and superb portside facilities, Bristol is an ideal location for any business wishing to access the growing wind, wave and tidal opportunities on the western seaboard of the UK and Europe.

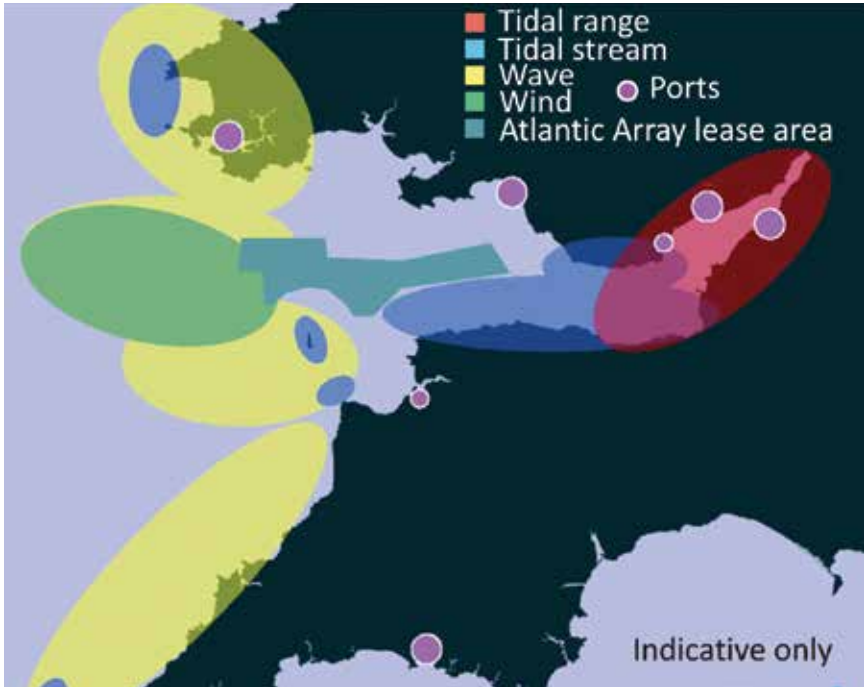
We have the expertise, the natural resources and the ambitions to make Bristol and the South West the hub for offshore renewable energy in the UK.

Stephen Hilton,
Director of Futures Group
Bristol City Council

The West of England has a powerful and vibrant economy with an innovative and highly-skilled workforce.

Colin Skellett,
Executive Chairman, Wessex Water Plc. and Chair of West of England LEP





Supplied by Marine Energy Matters

Balancing energy, environment and economy

The South West of England offers project investors and technology developers a portfolio of tidal, wind and wave energy resource areas.

Energy Potential

At 14m, the Bristol Channel has one of the highest tidal ranges in the world. It also has significant tidal stream potential with flow rates of up to 2.5 m/s in the areas of sea off north Devon/Somerset and South Wales. This great tidal surge through the Bristol Channel and the Severn Estuary has the raw energy potential to provide a significant share of the UK's energy requirements.

In the past, proponents of schemes hoping to harness the energy of the channel have focused on the building of large scale barrages. These projects have failed to come to fruition due to the enormous financial and environmental challenges they face. However, as technologies have developed, Bristol and its partners in the South West and Wales are supporting an alternative approach, using new technologies to generate energy in a manner which is in balance with the environment while providing sustainable jobs and economic benefits across the region.

Tidal lagoons

Bristol City Council is now working closely with Cardiff City Council and other partners to support and accelerate the deployment of tidal lagoon projects. Tidal lagoons employ a similar technology to tidal barrages but harness the tidal range by impounding large areas of water with a lower environmental impact and without blocking the main estuary channel.

Projects such as the Swansea Bay Lagoon are already in planning and further potential sites have been identified on both English and Welsh sides of the channel. With new designs for lower cost concrete embankments, and improved low head turbine technology, a series of lagoons could be now be built in the Severn Estuary providing the region with long term sustainable energy.

Balanced technology approach

Tidal Stream

Previous studies such as the Offshore Renewable Resource and Development (ORRAD) report and the Welsh Government's Marine Renewable Energy Strategic Framework (MRESF) have identified significant areas of tidal stream resource off the coast of Devon and Somerset, South Wales and Pembrokeshire. Although the tidal flow is not as extreme as the highest energy sites, the proximity to the grid and areas of high energy demand will make these areas attractive for future project development and could provide an additional 1GW of renewable energy capacity.

Invest Bristol & Bath are very interested to support tidal technology developers working on new technologies such as cross flow devices, tidal fences and innovative turbines which are designed to harness tidal flows of 1.5-2.5m/s in depths of 20-30m.

Wave Energy

The outer Bristol Channel and Celtic Sea area has significant wave energy potential and there is now a growing wave energy research and technology development capability with centres in Bristol, Plymouth, Cornwall and Pembrokeshire. This capability is already attracting worldwide technology developers to work with the regions universities and specialist consultancy firms and to access test facilities such as Wave Hub, FaBTest and the Peninsula Research Institute for Marine Renewable Energy (PRIMaRE).

Offshore Wind and Floating Offshore Wind

Two major offshore wind farms are now in development in the South West, the 1.2GW Atlantic Array in the Bristol Channel and the 0.9GW Navitus wind farm off the south coast. These mega-projects could herald the start of a major expansion of offshore wind on the western seaboard of the UK. This expansion will be supported by the development of floating wind technology which has the potential to significantly reduce deployment costs and open up new areas for energy generation.

Balanced Technology Approach

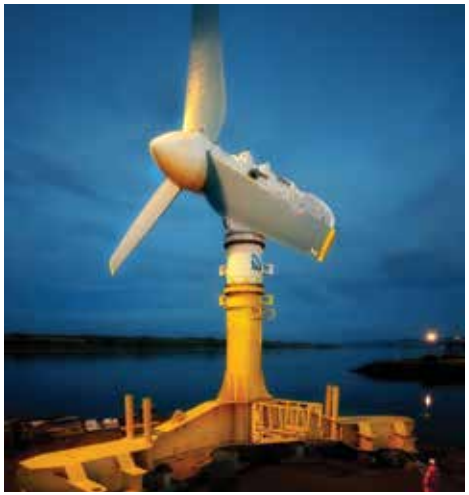
The Balanced Technology Approach paper published in 2012 by Regen SW and Marine Energy Matters and supported by the South West Marine Energy Park, proposes an incremental multi-technology approach to develop renewable energy projects in the Bristol Channel. Such an approach could provide up to 6 GW of tidal energy capacity and a further 5-7 GW of wind and wave energy.

A centre for technology development

Bristol is proud to be a centre of technology development and research in the growing marine renewable energy sector. Through the work of universities and local technical consultancy firms such as DNV GL (Garrad Hassan) and IT Power, Bristol has supported the development of some of the earliest and most innovative offshore renewable energy technologies. As the industry has grown these companies are increasingly working internationally, exporting Bristol's expertise to a global market.

The city is home to three of the world's leading technology developers including market leaders Siemens Marine Current Turbines (MCT), Alstom Tidal Generation Ltd (TGL), and Atlantis Resources Corporation (ARC).

- Marine Current Turbines, now wholly owned by Siemens, was the UK's first developer to deploy a large scale tidal energy prototype with the installation of the Seaflow device in the Bristol Channel. The company continues to be at the forefront of tidal technology development and has achieved nearly 10million kilowatt hours from its 1.2 MW Seagen S device since it's installation in Strangford Lough in 2008. In April 2013, MCT opened its Assembly and Integration facility to build, test and commission the 1.0MW powertrains for their next generation, 2.0 MW Seagen S machine (2 x 1.0 MW powertrains).
- Tidal Generation Ltd is now wholly owned by Alstom providing the company with investment and enhanced engineering capability. In 2012, TGL deployed a 1.0MW pre-commercial device at the European Marine Energy Centre in Orkney. The device is currently undergoing rigorous testing, including acting as a test bed for the Energy Technology Institutes ReDAPT project.
- Singapore based Atlantis Resource Ltd are currently developing the 1.5 MW AR1500 and have projects under development in the UK, Canada, China and India and are set to deploy as part of the Meygen project in 2014. The Atlantis design team is now established in Bristol and is a welcome addition to Bristol's portfolio of technology developers.



Bristol Tidal Energy Forum

The Bristol Tidal Energy Forum is an open, industry led forum dedicated to the development of the tidal energy sector.

The biannual forum provides a meeting place for technology developers, industry and supply chain companies, project developers and research institutions.

The forum has over 100 members and welcomes international and UK based companies who wish to engage with technology developers, companies and consultancies based in the South West of England.

Become part of the forum

- Knowledge sharing
- Identifying opportunities in the sector
- Addressing barriers and challenges
- Building relationships and collaborations
- Developing the Bristol Channel and Severn Estuary
- Supporting new tidal technologies for the Bristol Channel and Severn Estuary

Become part of the forum

The forum is open to any business or organisation working in the development of the tidal energy sector.

A LinkedIn group accompanies the event to allow continued discussion and is open to both members and potential members.

Find out more about previous forums here:
http://www.regensw.co.uk/projects/offshore-renewables/tidal-energy

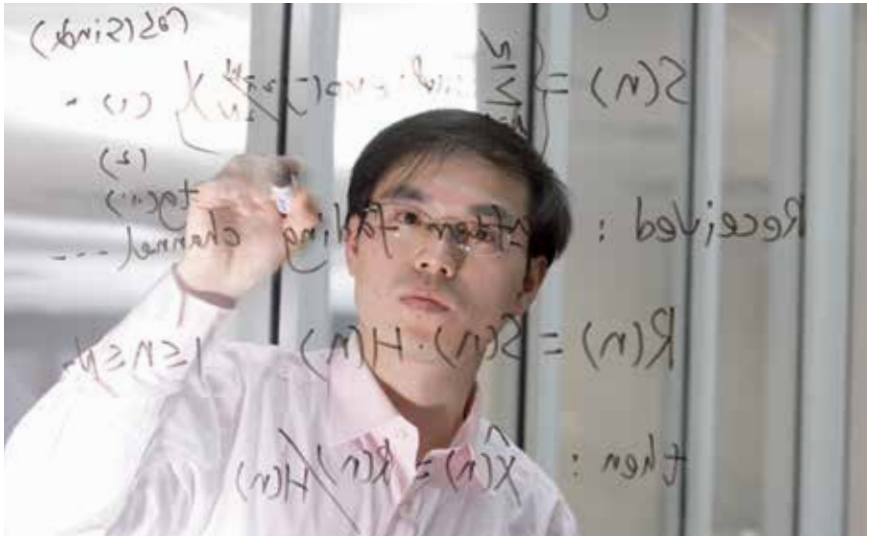
To find out more please contact:
khayes@regensw.co.uk

Open Ocean is building ties with the South West region, and I know that this is happening because of the Bristol Tidal Forum.

Hence, I wanted to thank you again for having invited me to join on the previous Tidal Forum events.

I really enjoy this event and I hope I will be able to attend the next one in 2014.

Jerome Cuny, Business Development Manager
Open Ocean SAS, France



Superb facilities for applied research

The Bristol City Region hosts four prestigious universities, representing the third most powerful academic research cluster in the UK, producing over 10,000 graduates per year with a significant proportion of these qualified in engineering and aerospace related fields.

A key strength of the region's universities is the high level of research and collaboration with industry which includes core areas in composite materials, power transmission systems and turbine blade designs, extending to knowledge transfer partnerships and incubation services that enables start-up companies and technology developers to bring new products to market.

The University of Bristol's Faculty of Engineering has a strong focus on collaborative research between academia, government and industry and is actively involved in research in:

- tidal flow modeling
- offshore foundation design
- advanced generator technologies
- design of wind/tidal turbine blades
- development of structural health monitoring systems to streamline maintenance scheduling for remote structures.

The University of Bath's Department of Mechanical Engineering, which is consistently ranked as one of the top 10 mechanical engineering departments in the country, is affiliated with the Centre for Power Transmission and Motion Control (PTMC) which works with industry across areas such as magnetic bearing systems and fluid systems.

The Department of Electronic and Electrical Engineering at the University of Bath includes the Centre for Sustainable Power Distribution which studies all aspects of renewable power generation, transmission and distribution. It is uniquely positioned at the forefront of research into smart grids and network charging methodologies.

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University of BRISTOL

UWE BRISTOL University of the West of England

UNIVERSITY OF BATH

Centre of excellence for composites and advanced materials

The application of composites and advanced materials technology will be critical to the success of the marine energy and offshore wind sectors.

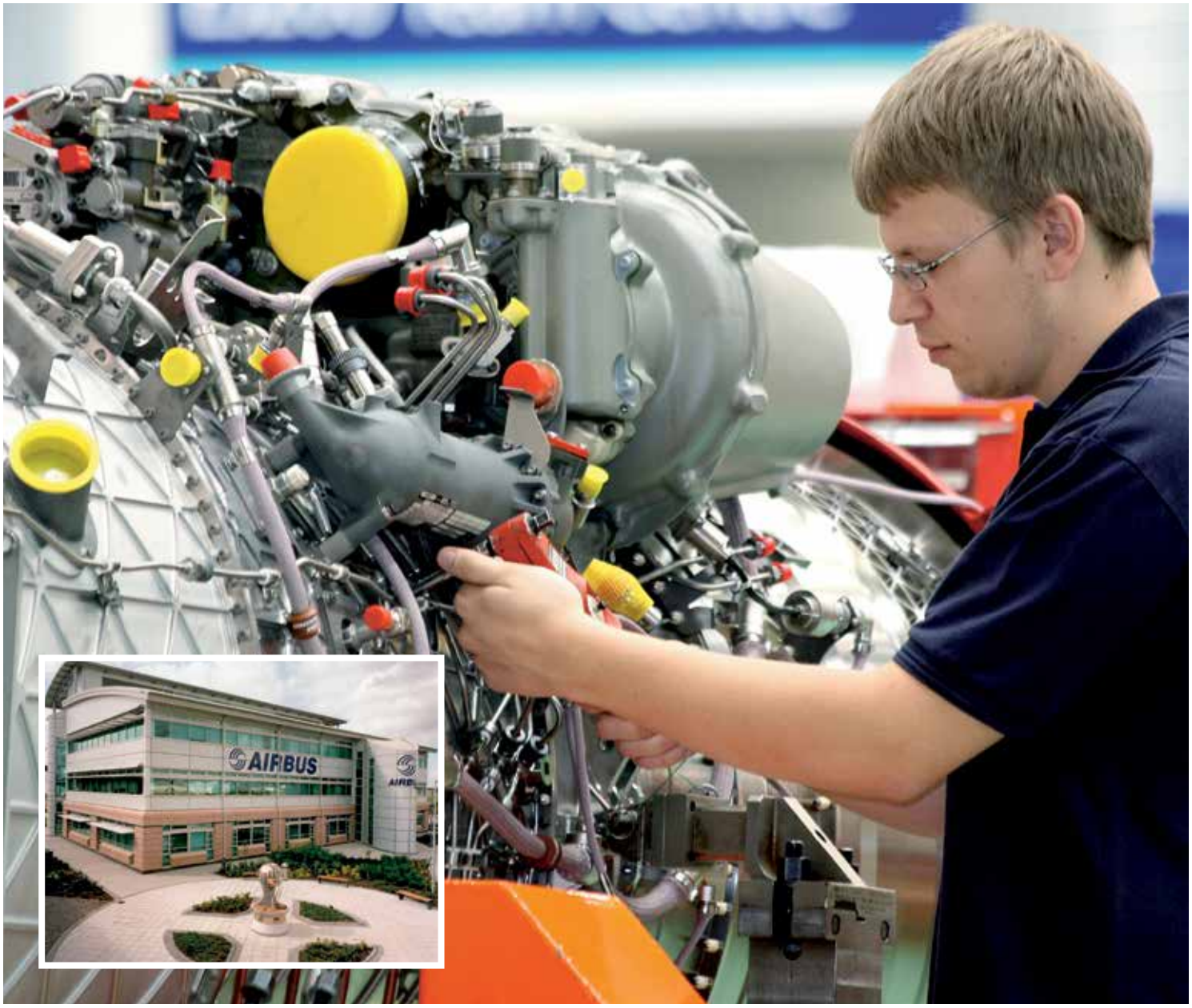
The Advanced Composites Centre for Innovation and Science (ACCIS) based in the Faculty of Engineering at University of Bristol is a leading edge centre of composites research which promotes strong links with industry for exploitation and technology transfer. ACCIS has collaborated with a number of industry partners including Airbus and the National Composites Centre and has collaborated with leading tidal energy companies in developing improved materials and design techniques for tidal turbine blades.

The Bristol City Region is home to the National Composites Centre (NCC), the UK's centre of excellence for composites and advanced materials applied research. Backed by leading industrial partners including Airbus UK, Rolls-Royce, GE, MBDA, AgustaWestland, Cytec (Umeco) and GKN, the NCC is located at the Bristol and Bath Science Park on the north east fringe of Bristol, close to the M4, and provides an independent open access facility including 5,500 m² of dedicated research workshop space, open plan offices and meeting/ teaching rooms that supports design innovation leading to rapid manufacturing and commercial exploitation of advanced materials for the aerospace, automotive, marine and alternative energy sectors.

The NCC is now a member of the High Value Manufacturing Catapult which brings together seven national centres of excellence to accelerate the commercialisation of new manufacturing technologies. It is extending its facilities to incorporate a second phase, making it one of the largest research and development centres of its type in the world. Phase two, currently under development, will allow for increased training and skills development and provide a dedicated composite material manufacturing facility.

There is no doubt that composites will form a vital part of the UK's manufacturing renaissance. This key part of the UK economy will be driven by closer collaboration between industry and the very best of academia and we are proud that the University of Bristol and the NCC's initiating partners are playing such a significant role in this important part of the UK's economy.

Guy Orpen, *Pro Vice-Chancellor for Research and Enterprise at The University of Bristol*



Advanced engineering and aerospace

The concentration of aerospace and advanced engineering companies located in and around the Bristol City Region represents a superb opportunity for companies wishing to partner with large scale industrialists, develop their supply chain or access cutting-edge engineering capabilities.

The region's proud aerospace history spans from the earliest days of flight with the Bristol Boxkite, through Concorde and to the latest development of wings for Airbus airliners and Rolls-Royce jet engines.

Since Rolls-Royce was founded in Filton on Bristol's north fringe in 1910, the Bristol City Region has grown to become the largest cluster of aerospace and related industries in the UK. The region has over 700 advanced engineering organisations, including world leading aerospace businesses such as Airbus UK, GKN and BAE Systems.

Bristol has a leading position in the world's aerospace industry. Nick Durham, President Customer Business UK and International Defence – Rolls-Royce

Port facilities and industrial land space

The Bristol Port Company operates one of the UK's most technically advanced and fastest growing commercial ports. No other UK port has such good access to both a freight railhead and a motorway network providing access, within two hours, to the largest UK markets and the heartland of the UKs manufacturing industry.

With deep water berths at Avonmouth and Royal Portbury docks sitting in a 2,600 acre estate, the port offers extensive land space which could be utilised as a logistics hub and an assembly/ construction port for offshore wind and marine renewable energy projects.

The port itself has become a beacon for renewable energy with three on site wind turbines generating more than 15 million kilowatt hours of electricity per year and providing 75% of the port's electricity needs. Five further 3 MW wind turbines have been constructed on sites owned by Bristol City Council and Wessex Water to the north of the port, ensuring that renewable energy is an increasing and iconic feature of the skyline in this important industrial part of the city.

Looking ahead, the port has expansion plans for new key side areas and facilities, including planning permission to create a deep-water container terminal with capacity to service the new generation of ultra large container ships up to 18,000 TEU and 16 metres draught.

Adjacent to the port is the Avonmouth and Severnside Enterprise Area.

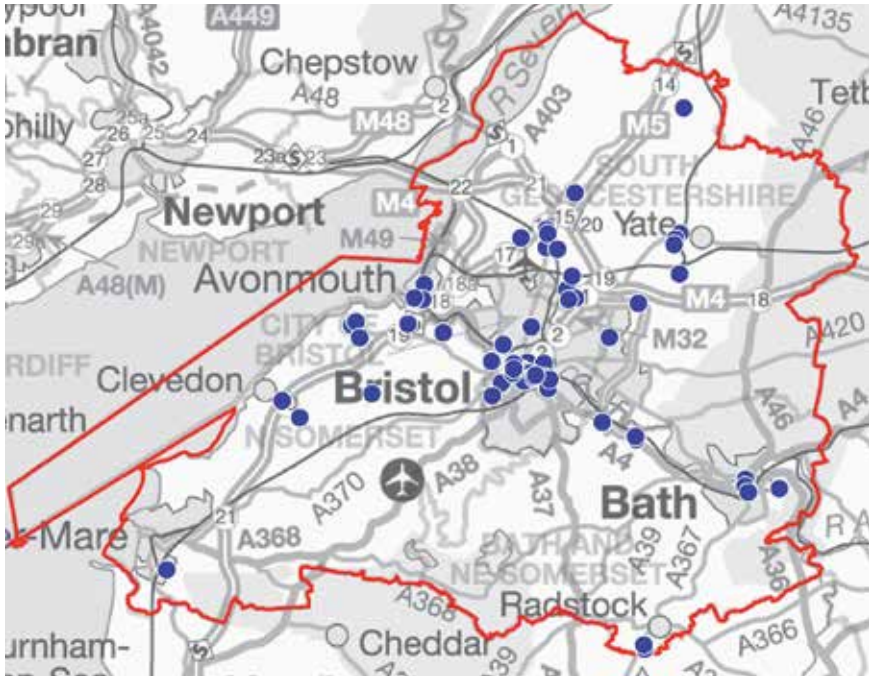
Conveniently located on the major M4/M5 corridor - providing strategic rail, motorway and marine transport links to the midlands, South West England and Wales - the Enterprise Area has been earmarked for significant future infrastructure investment to support new businesses.

- The Avonmouth industrial area comprises 84 hectares including 277,168 m² prime commercial floor space
- The Severnside industrial area covers 462 hectares and over 1million m² commercial floor space

The two sites have huge potential for large-scale industrial, warehouse and distribution, low carbon manufacturing, energy and waste processing sectors and are seeking to attract inward investors and expanding local companies to create in excess of 8,000 new jobs by 2026.

A vibrant supply chain including consultancies, legal and financial services

In addition to companies supporting technology development the region is internationally recognised for its strengths in aerospace and advanced manufacturing, microelectronics and business and financial services. The collaboration between academic research, engineering excellence and large multinational companies underpins the Bristol City Regions offer to the offshore energy industry.



Over 100 companies have been identified in the Bristol and Bath city region that have the potential to diversify into the sector from sectors such as defence, aerospace and engineering sectors.

The Bristol City Region has a vibrant cluster of supply chain companies working in the marine and offshore wind sector. Areas of core capability include:

- Consultancy and professional services
- Engineering and engineering design
- Composites
- Aerospace and advanced manufacturing
- Financial and legal services
- Marine and port operations
- Technology innovation and research

For more information about supply chain companies across the south west please visit: www.regensw.co.uk/projects/offshore-renewables/offshore-supply-chain

For further information about Bristol Tidal Energy Forum, contact khayes@regensw.co.uk

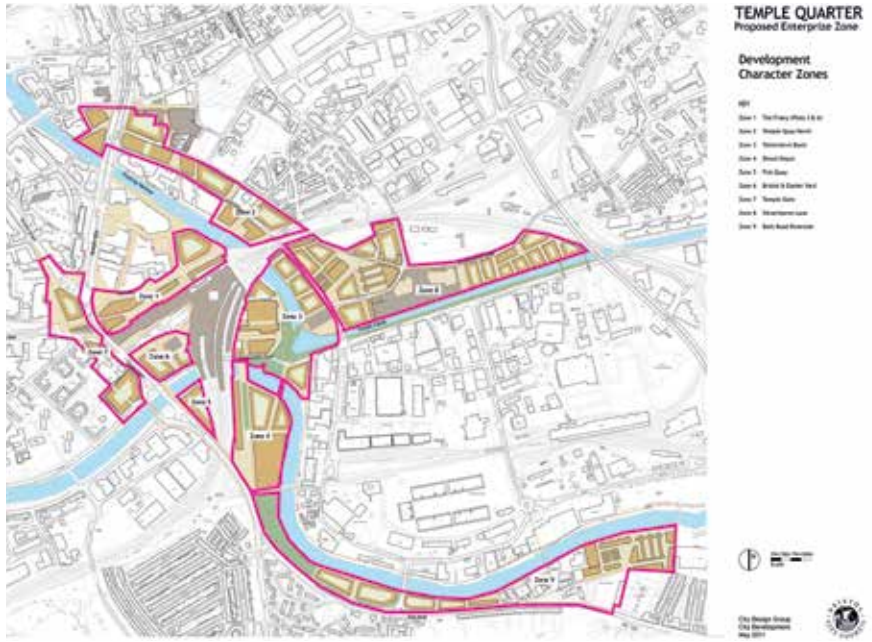
Case study - attracting international investment

LICenergy UK Ltd, a subsidiary of the Danish offshore engineering company LICEngineering AS, has recently moved into offices in the Temple Quarter Enterprise Zone. With plans to expand its engineering and design capability LICenergy UK is a valuable addition to the West of England area as well the wider UK offshore renewables sector.

LICenergy

After extensive research, LIC felt that Bristol offered the greatest potential for our expansion both as a geographically strategic base but also backed up with the high academic standard of engineers qualifying from the University. Throughout our research to establish a UK base the support we have received from Invest in Bristol has been faultless. The team has been a key element in our final decision to settle here. The vibrancy of the city matches well with our Danish roots and we look forward to becoming a part of this expanding and exciting business community.

Morten Tobias Lind, *MD of LICenergy UK Ltd*



Bristol's Temple Quarter Enterprise Zone

Bristol's Temple Quarter is one of 22 Enterprise Zones that have been created across England. The zone occupies 70 hectares (173 acres) of land in the vicinity of Bristol Temple Meads Railway Station.

The Enterprise Zone attracts world-leading creative, digital and technology companies, providing 2.6 million sq ft of new or refurbished space, high speed digital connectivity, transportation links and a significant business rate discount.

Environmental technology and services companies already located within or near to the Enterprise Zone include DNV GL (Garrad Hassan) and LICenergy UK. The Zone is also host to established clusters of creative and digital, professional business and financial companies including several with close links to the marine energy sector such as Burges Salmon, Osborne Clarke and Bond Dickinson.

The renewal and redevelopment of this area will lead to the creation of almost 17,000 new jobs over a 25 year period, and will attract investment, jobs and businesses to locations across the Bristol City Region including the Avonmouth. Severnside and Filton industrial areas.

Invest Bristol & Bath

The Invest Bristol & Bath team based at The Engine Shed in the Temple Quarter Enterprise Zone provide a 'red carpet' reception for companies wishing to develop or locate in the Bristol and Bath region, with dedicated account managers offering a range of 'soft landing' packages, including access to premises planning and development services, recruitment, training, networking, supply chain and knowledge base needs.

In order to provide tailored advice and support to the offshore and marine energy sectors, Invest Bristol &Bath has partnered with Regen SW, an independent not for profit centre of excellence for the renewable energy sector in the South West of England.

For green technology developers and start-ups, there is a wealth of specialist services accessible including the SW Environmental Technologies iNet, the SW Clean Tech Co-Investment Fund, and the Bristol and Bath Science Park with close links to the National Composites Centre and the Set Squared Incubation Centres run by the Universities of Bristol and Bath.

In addition, Low Carbon South West, a Bristol-based trade association, offers networking and support services to the wider environmental industries sector.

www.bristol.gov.uk

www.lowcarbonsouthwest.co.uk

www.inets-sw.co.uk

www.bristolandbath.com

www.ukti.gov.uk

www.primare.org

www.regensw.co.uk

www.weaf.co.uk

www.regensw.co.uk/projects/offshore-renewables

www.setsquared.co.uk

www.bath.ac.uk

www.mas.bis.gov.uk/south-west

www.uwe.ac.uk

www.bris.ac.uk

www.wavehub.co.uk

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BRISTOL CITY COUNCIL

BRISTOL Winner 2015 EUROPEAN GREEN CAPITAL
An initiative of the European Commission

regensw delivering sustainable energy

SOUTH WEST MARINE ENERGY PARK

Our thanks to the following companies for use of images: Airbus in the UK, Bristol Port Company, GL Garrad Hassan, LJCenergy UK, Siemens Marine Current Turbines, National Composites Centre, Rolls-Royce, Alstom Tidal Generation Ltd, Marine Energy Matters, Toshiba Research Europe Telecommunications.

Designed by Bristol City Council, Bristol Design BD4964 DECEMBER 2013. Stay in touch with your council www.bristol.gov.uk/signup