

**ENERGY &
ENVIRONMENT**

WE MAKE A DIFFERENCE.



WELCOME TO A PLACE WHERE CHANGE HAPPENS.

We're famous for our iconic river, our wind-swept coastline and international manufacturers. We're known as a global gateway to the Atlantic and beyond, where passengers and products arrive and depart from our great port. Always ready for a challenge, we're harnessing our natural assets and creating energy solutions that are making a significant difference to the fight against climate change.

And we've got some new tools in our workshop: Supercomputing; Robotics; Virtual Reality; Internet of Things; Sensors; Big Data and Big Science. We've got the largest supercomputing facility for industrial applications in the UK and the highest concentration of robotics for materials science in the world. But there's nothing artificial about our intelligence. And there's nothing robotic about our people.

"Liverpool City Region is 80% blue/green space – more than any other city."

- Nature Connected

ENERGY & ENVIRONMENT



INVESTORS INCLUDE ØRSTED, LEGO GROUP, RWE, CAMMELL LAIRD



OVER 1,200 SUPPLY CHAIN COMPANIES

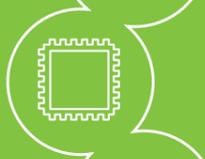


CENTRE FOR OFFSHORE RENEWABLE ENGINEERING



OVER £4BN INVESTED IN ENERGY SYSTEMS IN THE PAST 5 YEARS

CENTRES OF EXCELLENCE FOR MARITIME ENGINEERING & INNOVATION, INDUSTRY 4.0 AND BIG DATA



SIGNIFICANT EXPERTISE AND OPPORTUNITIES IN MARINE ENERGY, HYDROGEN AND WASTE TRANSFORMATION

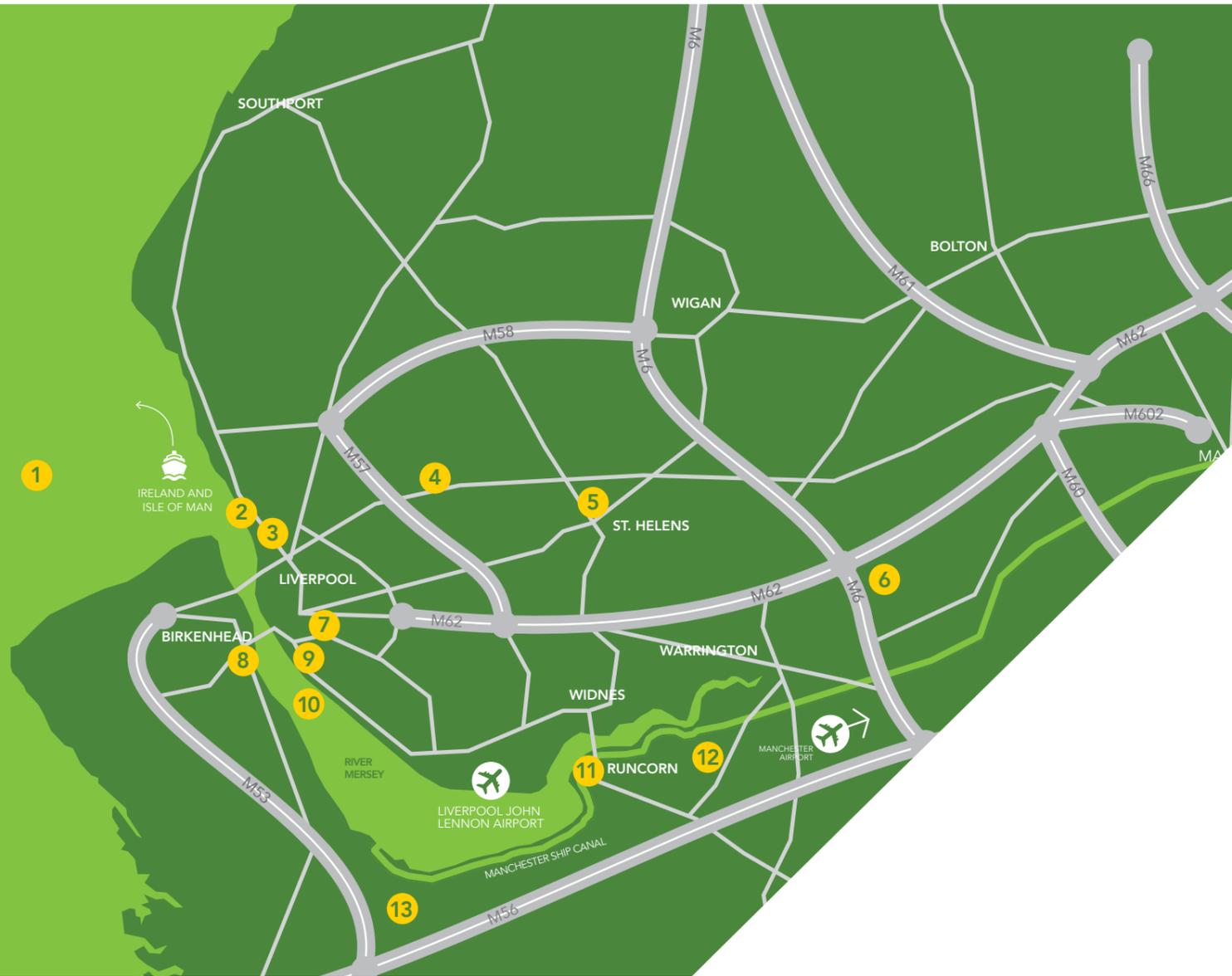
QUAYSIDE, SHIP BUILDING AND COMAH TOP TIER SITES



HOME TO THE WORLD'S LARGEST WIND TURBINES



OVER 270 OFFSHORE WIND TURBINES IN LIVERPOOL BAY



KEY:

- | | |
|---|---|
| 1. Liverpool Bay – Burbo Bank and Burbo Bank Extension Offshore Wind Farm. | 8. Wirral – Renewables, Marine and Civil Nuclear Engineering. |
| 2. Peel Ports Liverpool – Liverpool2 and Biomass Terminal. | 9. Liverpool – Sustainable Transport. |
| 3. Bootle – Civil Nuclear Regulation and Marine Engineering. | 10. River Mersey – Proposed Tidal Energy Scheme. |
| 4. Knowsley – Waste to Energy, General Engineering. | 11. Halton – Waste to Energy, Chemicals, Hydrogen Network and Transport. |
| 5. St Helens – Low Carbon, General Engineering and R&D. | 12. Daresbury – Innovation, Modelling & Data Analytics. |
| 6. Warrington – Civil Nuclear. | 13. Ellesmere Port – Energy Innovation. |
| 7. Liverpool Knowledge Quarter – R&D and Energy Innovation. | |

GLOBAL REACH.

Liverpool has always been a gateway. Our geography and natural assets have shaped commercial and cultural life here for centuries. Our role in the national and global economy has never been more relevant as international manufacturers make the most of our global links to reach customers and suppliers all over the world.

One of the biggest opportunities for manufacturing firms in Liverpool City Region is the access to national and international markets enabled by Liverpool's excellent ports and logistics infrastructure. £1 billion has recently been invested in an integrated cluster of logistics assets and expertise that will deliver faster, greener global market access.

For international connections there is a choice of both Liverpool and Manchester airports which are within a 45 minute drive. Liverpool John Lennon Airport has flights to all major European business centres and Manchester Airport has direct flights to 200 destinations and extensive freight and logistics facilities to support the import and export of goods to and from all major global markets.

For the UK market, the region is well-connected. Wherever your customers, Liverpool is within easy reach. London is just two hours away by train – with services every hour. Direct rail services to Manchester, Birmingham, Leeds, Sheffield, Nottingham and others. And our motorway connections put the vast majority of UK cities from Glasgow to Southampton within 4 hours' drive time.

CASE STUDY ØRSTED

Operating out of Liverpool Bay for a decade, global offshore wind energy giant Ørsted, is a leading energy supplier to the industrial and commercial market. The UK is the Danish company's primary market for offshore wind and Ørsted's Burbo Bank windfarm in Liverpool Bay was inaugurated in 2007, the first to employ the 3.6MW wind turbines now used widely across the industry. Construction of the Burbo Bank Extension, managed from Ørsted's facilities at Cammell Laird, on the banks of the Mersey, was inaugurated in May 2017.

Its development and construction was founded on strong relationships with UK businesses, which played key roles in the supply chain and in the delivery of the project. The world's first deployment of a new 8MW turbine, producing more than double the power of the existing Burbo Bank turbines, highlights Liverpool City Region's role in pioneering the future of the offshore wind energy industry.

Ørsted continues to lead supply chain events, developed in partnership with Liverpool City Region and now rolled out, worldwide, as its exemplar model, to strengthen local partnerships. It has also built a £multi-million operations and maintenance facility on the banks of the Mersey in Wirral, to serve the existing Burbo Bank offshore windfarm and the new Burbo Bank Extension.

Around 45 people are based at the site, providing offshore access and flexibility.

A report ¹ published in June 2016 estimated that Ørsted will have invested £5.4 billion in developing offshore windfarms off the North West of England by 2019, which opens up potential opportunities to Liverpool City Region-based partners.

Lee Rollason, Head of Burbo Bank Operations, said "I think working closely with Wirral Council (part of the Invest Liverpool team) has proven very beneficial to us, particularly being involved with its 'Clean Energy Coast' initiative, that's something we're proud to be a part of.

"Wirral Council is very forthcoming as a partner. It helped us pick out the Kings Wharf spot.

"There were a couple of other locations we were looking into and working with the team enabled us to find the best solution for Ørsted and the local residents. We have a great relationship with them."

¹ Regeneris Consulting, 2016 - The Economic Impact of DONG Energy Investments in the East Irish Sea



Image courtesy of Ørsted

WE ARE CREATORS.

From the creative sparks making smarter solar panels, the marine biologists and oceanographers mapping our seas; to those installing the world's biggest offshore wind turbines. In specialist factories and huge dockside facilities, universities laboratories and power stations; in every corner of this innovative region; we are creating a more sustainable future.

Thanks to our great schools, colleges and universities, Liverpool City Region has a rich seam of future engineering talent that will join an existing workforce. Our famous cultural, sporting and lifestyle attractions make it easier to attract and retain the skills required by energy and environmental businesses.

Our city region has produced innovative Skills for Growth agreements for our key sectors which reflect a unique and innovative joint working between public, private and academic organisations to address current and future skills needs. A great example of this skills partnership in action can be seen at Wirral Met College, where more than 1,000 employers are engaged in ensuring that the curriculum portfolio matches the demands of local businesses.

CREATING NEW ENERGY

Liverpool is leading the way in developing new energy technologies, and significant advances in environmental research.

- **Offshore Wind** - Liverpool City Region is a designated Centre for Offshore Renewable Engineering, home to one of the world's largest concentration of offshore wind farms and the first commercial deployment of the world's largest wind turbines is set to boost our offshore wind supply-chain opportunities for years to come. In particular there are significant opportunities for O&M, offshore innovations, modular assembly, global supply chain and future rounds of offshore wind development.

- **Solar** – researchers at University of Liverpool have developed a new manufacturing method which could bring down the cost of making a type of solar cell. And with Pilkington, one of the world's biggest glass manufacturers here, there's no shortage of solar expertise in the city region.

- **Tidal** – Development projects underway to harness the tidal range of the River Mersey and Liverpool Bay to produce Gigawatt scale power.

- **Energy from Waste** – we've got some serious credentials and capabilities when it comes to the generation of energy from food and animal waste. The region has been a leading player in initiatives such as the generation of power from biogas coming from organic waste and the recycling of chip fat from fast-food restaurants into biofuel for lorries.

- **Combined heat and power** – The efficient use of the energy in fuel is essential to reducing carbon emissions, Liverpool companies are at the forefront of this globally important technology, and many key buildings such as University of Liverpool have put the technology into action.

- **Hydrogen** - Liverpool City Region is at the centre of the recently announced HyNet North West project - a major hydrogen energy and carbon capture, usage and storage (CCUS) project. The goal of HyNet is to reduce carbon emissions from industry, homes and transport and support economic growth in the North West of England. It has the potential to save over one million tonnes of carbon dioxide emissions every year. It is anticipated that HyNet Northwest will create 5,000 jobs by 2025, provide opportunities for inward investment and position the North West as the leaders in hydrogen technologies and skills for export



CASE STUDY CLARKE ENERGY (A KOHLER COMPANY)

Liverpool City Region success story Clarke Energy was founded in 1989 and today employs more than 1,000 people in 17 countries from Algeria to New Zealand.

It supplies, installs and maintains high efficiency embedded power plants, with over 5,000MW of reference plants globally which can generate enough electricity to supply the equivalent of 13 million UK homes.

Leading on low carbon and renewable power, with Liverpool City Region plants including Broadgreen Hospital and the University of Liverpool and a range of international projects, Clarke Energy is a key player in the low carbon economy.

A regular winner of industry awards for its international success Clarke Energy is a holder of the Queen's Award for enterprise and in 2016, it was named Exporter of the Year Award at the North West Business Masters Awards, for a second year running.

WE ARE COLLABORATORS.

This is a friendly and open place. People here work best when they work together. For us, open innovation isn't a management theory, it's a way of life around here. Our sense of community and solidarity runs deep. We attract manufacturers from around the world and bring them together in collaborative environments to build better products and services.

A great example of this approach is The Maritime Knowledge Hub which brings together key maritime assets with businesses, research institutions and skills providers to create a single centre for innovation, research and development and business support to drive growth within the marine and maritime sector.

COLLABORATING ON TRANSPORT SOLUTIONS

This is an area where the collective action of transport players is delivering real change. Local partnerships are working with Merseytravel, the city region's Integrated Transport Authority, to ensure that our transport systems are sustainable.

There is significant investment into the local and regional rail infrastructure with ongoing electrification to deliver capacity improvements and reduced emissions. Bus operators are investing in low emission bus fleets including electric, diesel electric hybrids, compressed natural gas and biofuel buses.

The city region strongly supports the adoption of electric vehicles and partners continue to invest in EV charging infrastructure. New charging points are being installed supported by local companies providing equipment, installation and management services.

We are part of the major, transformational HyNet Northwest project (see page 8) that will present opportunities for future transport developments utilising hydrogen technologies including rail and road transport.

We have a unique set of assets associated with hydrogen production and distribution. Our universities, local authorities and the Local Enterprise Partnership are collaborating with local companies on hydrogen hybrid and fuel cell technologies and the creation of a public hydrogen refuelling station.

As a major European hub for the production of biofuels, we're home to leading refiners producing fuel from sources such as used cooking oils and other recovered materials.

And our port infrastructure is focused on the concept of port-centric logistics, to reduce unnecessary road freight and reduce carbon emissions.

CASE STUDY: ULEMCo

A Liverpool company is pioneering the conversion of commercial vehicles to enable the use of hydrogen as an alternative transport fuel.

In 2016, ULEMCo completed the conversion of refuse lorries to be operated by Fife Council in Scotland. The trucks now have the ability to run as dual fuel (hydrogen diesel) in what is believed to be the first conversion of its kind in the world. The bin lorries can switch from diesel to dual fuel when operating in densely populated areas, where air pollution is a major health risk, with the zero emission hydrogen displacing diesel to help reduce both carbon and improve air quality.

ULEMCo, which was established in 2014, supports a fleet of vehicles across a range of hydrogen hubs in the UK.

"This is a global first for hydrogen vehicles and a really great example of the innovative approach that is needed to deliver the low carbon and low emission vehicles of the future," said Amanda Lyne, Managing Director of ULEMCo.



WE ARE CHALLENGERS.

This is a place with spirit, pride and passion.

We're independent and we never shy from challenging the status quo. When someone says it can't be done; we'll find a way; when things need changing and new models are required, you'll find us right there at the forefront of innovation and change.

Our region is bursting full of innovators and entrepreneurs that are revolutionising their industries. Not only will you find individuals and creators; we also have the right infrastructure to nurture and support them.

The role of government agencies and academic partners in creating the right environment to facilitate and encourage innovation is essential. Across the city region there is a proactive approach to champion change and to harness the benefits of industrial and digital transformation.

CHALLENGING CLIMATE CHANGE

We're taking a leading role in the fight against climate change.

As well as pioneering new environmental technologies and harnessing renewable sources of energy, we're taking up the challenge street by street.

Local authorities across the city region are engaged in a retrofit programme. Social rented housing offers huge opportunities to improve its energy efficiency and there are similar levels of retrofit opportunities to commercial and industrial building stock, centred on insulation, lighting, heating and ventilation, and building controls.

Whether it's on our roads, ports, railways and airports; from houses to factories; and in our schools, colleges and universities – in the greatest of global challenges, Liverpool is making a difference.



CASE STUDY HUGHES SUB SURFACE ENGINEERING (A JAMES FISHER & SON COMPANY)

Specialises in subsea engineering, civil engineering and offshore construction, both above and below the waterline, Hughes Sub Surface Engineering was founded in Liverpool City Region in 2005.

Its expertise in offshore renewables has seen it play a key role in supporting the construction and maintenance of offshore windfarms such as Gwynt y Mor, Walney, Teesside and London Array.

In 2016, the company was appointed by Ørsted to conduct subsea inspections on several of the Danish company's offshore wind farms in Denmark and Germany.

Operating in the most challenging environments, its services include commercial diving, UAV, working at heights, confined space entry and remote intervention, including remotely operated vehicle technologies.

Hughes Sub Surface Engineering also has experience in the Oil & Gas Market, recently opening an office in Aberdeen.

BIG SCIENCE BIG ASSETS.

At the heart of this region's attractiveness is a thriving academic scene.

Schools, colleges and universities are involved in some of the world's most important science and engineering projects. The amount of new investment in science, technology and engineering facilities and capabilities is testament to the ambition and vision of an academic cluster that works closely with major businesses.

- **University of Liverpool** – a world-class university ranked in the top 1% globally. The Stephenson Institute for Renewable Energy at Liverpool focuses on the physics and chemistry that will transform the future of energy generation, storage, transmission and energy efficiency.

- **Materials Innovation Factory** – located at University of Liverpool, this £68 million project features the highest concentration of robotics for materials science in the world.

- **Liverpool John Moores University** - is one of the largest, most dynamic and forward-thinking universities in the UK. The Engineering and Technology Research Institute brings together a broad range of disciplines, from astrophysics to bio-engineering and computer games technology to microwave research.

- **Manufacturing Technology Centre** – MTC@LJMU is the first regional offshoot of the national Manufacturing Technology Centre Catapult. This further enhances our links with Innovate UK, the national innovation agency, and other catapult centres for digital technologies. It will provide an innovation hub for local businesses to build and commercialise new products, access new funding streams and point them towards the potential of emerging technologies.

- **Liverpool Hope University** – was ranked fifth in the UK for student satisfaction by The Sunday Times Good University Guide in 2016 and is in the top 20 of all UK universities for the percentage of academic staff with doctorates.

- **Edge Hill University** – voted The Times Higher Education University of the Year in 2014/15, Edge Hill is a hub for research around sports science and health-related issues. The computing department was recently voted as the best for teaching in the country.

- **Sci-Tech Daresbury** - is home to STFC Daresbury Laboratory and The Cockcroft Institute conducting leading-edge research and development, along with 100 technology companies including IBM and Lockheed Martin, and pioneering open innovation working. There are more than 1,200 people on the site, including 500 scientists working on accelerator science, high performance computing, simulation and data analytics and sensors and detectors.

The National Oceanography Centre - a world class oceanographic research facility. With the largest collection of marine modellers in the UK, it contributes expertise on the shelf scale, ocean margin, coastal/ estuarine modelling of hydrodynamics, ecosystems, sediment transport and surface waves, as well as global ocean circulation models.



CASE STUDY: BIBBY HYDROMAP

Bibby HydroMap provides a range of seabed survey services to global businesses, from its Liverpool City Region base.

Hydrography, engineering geophysics, marine geotechnics and oceanography services are delivered by a team of more than 100 specialists and boosted by five purpose-built vessels, with advanced survey and positioning equipment.

The latest addition to the fleet is the custom-built d'ROP (dynamic Remotely Operated Platform), which will revolutionise productivity in shallow water remote survey and inspection.

Working with leaders in offshore renewables, oil and gas, subsea cables, marine aggregates and port/harbour operation, Bibby HydroMap is world-renowned.

In 2013 it was awarded a Regional Growth Fund (RGF) by Wirral Council which allowed it to deliver a growth strategy that included investing in new-build vessels and state-of-the-art equipment.

LCR 4.0

Sensors, big data and robotics are transforming the way we make things. The Industrial Internet of Things, and Industry 4.0, will dramatically alter the processes and possibilities of production. Liverpool City Region is an exemplar region in the UK that is leading this transformation with its 'LCR 4.0' programme to create a new infrastructure that connects physical and digital assets.

By encouraging the convergence between our manufacturing and digital sectors, we are becoming a hardware test bed for sensory technology and data communications systems. Many of the resulting products and services will enable smart homes, smart cities and smart grid applications that will play a major role in energy efficiency and carbon reduction.

Projects that contribute to LCR 4.0 include:

- **Sensor City** - new University Enterprise Zone that includes one of the world's first incubators dedicated to the development and exploitation of sensor technology.

- **Hartree Centre** - leading collaborative research and innovation centre focused on accelerating the adoption of data-centric computing, big data and cognitive technologies into industry to gain competitive advantage.

- **Virtual Engineering Centre** - the UK's leading centre of virtual engineering technology integration for industrial and commercial applications.

- **Engineering and Technology Research Institute (ETRI)** - world-class research facilities including Advanced Manufacturing Technology Research Laboratory.

Companies in Liverpool City Region will have the opportunity to collaborate and partner with this world-class infrastructure that is at the centre of the industrial internet of things. Other initiatives that have a focus on IoT projects include Fab Lab Liverpool and the maker community at DoES Liverpool.



CASE STUDY: PILKINGTON

Pioneers of manufacturing innovations from self-cleaning glass to solar energy panels, Pilkington is a world leader in the glass industry. Founded in St Helens in 1826 and now a member of the NSG Group, headquartered in Japan, Pilkington has major manufacturing facilities in the region, along with the NSG Group's European Technical Centre situated here.

The business employs around 3,000 people across the UK, producing a range of glass solutions, from the manufacture of float, rolled and coated glass to glass processing. The St Helens sites are capable of producing 300,000 tonnes of glass a year for use in cars, commercial buildings, homes and renewable energy projects.

The European Technology Centre, responsible for the strategic direction and performance of the Group's research and development programme for new products

and processes, and the delivery of Group Engineering solutions are also located in the region.

Pilkington is a major player in sustainable energy, providing specialised glass and coated glass products for use in all of the leading solar energy technologies, including thin film photovoltaics, crystalline silicon photovoltaics, concentrated solar power technology and solar thermal collectors.

Phil Brown, European Regulatory Marketing Manager at Pilkington, said: "We've made a significant investment in both R&D and our manufacturing facilities over the past few years, to enable us to continue to produce high-performing energy-efficient products, using nanotechnology for the commercial and domestic markets."



PRODUCTIVE & COMPETITIVE.

So many major manufacturers and innovative startups choose to locate and invest in Liverpool City Region because of the many cost and productivity advantages when compared to other regions. The cost of land and property is extremely competitive here, with three designated Enterprise Zones offering additional support, making operating costs among the most favourable in the UK.

But it's not just about lower costs though. Our workers are highly productive too. Liverpool led the UK in productivity growth between 2004-2012 with a 34% increase. Economic output per job in advanced manufacturing is £47,305 - this is 7% higher than the UK average. And we're not done growing. The advanced manufacturing sector is set to grow 22% over the next 10 years in Liverpool City Region, compared to 19% nationally.

The area's location and key infrastructure assets make it an ideal base for international manufacturers. Proximity to OEMs in automotive, aerospace, chemicals, energy and construction offer opportunities for strong engineering supply-chains; while access to UK and international customers is made easier thanks our growing ports, road and rail links and airports.

But most importantly of all, we've got the people that your business needs. A tenth of the city region's workforce is aged 16-19, that is above the national average. A fifth of the working age population is in their twenties. You'll find a young and dynamic workforce here, that's developing future engineering skills through apprenticeships, schools, colleges and university programmes.

The bottom line: Liverpool City Region is a profitable and productive place for innovative manufacturers.



CASE STUDY: CAMMELL LAIRD

Cammell Laird has been at the heart of British manufacturing for the last two centuries and major investment in its port infrastructure and facilities are seeing it play a critical role in the region's offshore wind industry.

From its Birkenhead site, on the River Mersey, it handles huge component parts for the construction of the windfarms in the Irish Sea, working with international partners such as RWE and Ørsted.

One of the best and most competitive heavy fabrication facilities in the engineering industry, Cammell Laird has one of the largest modular construction halls in Europe and with world-class facilities and the right engineering skills it provides services to offshore wind energy, maritime, civil nuclear, oil and gas and petrochemicals projects.

Ship-building and refitting capabilities continue to be at the heart of Cammell Laird's work, winning contracts to construct the flight decks for the Royal Navy's new aircraft carrier and beating international competition to build a £200 million polar research ship, which will be equipped with on-board laboratory facilities and robotic technologies.

We have a team of business location experts from across Liverpool City Region that can assist you with your next project.

We can provide detailed research on markets, sectors and workforce demographics. We can put you in touch with the right contacts at industry networks and partner organisations. We're happy to introduce you to potential partners at our world-class universities and our existing businesses. We can help you to identify all the available support to help your expansion and show you a wider range of sites, premises and development opportunities.

Email us at LCR@investliverpool.com or telephone +44 (0)151 600 2930 for help and we look forward to working on your plans with you.

investliverpool.com

INVESTLIVERPOOL

ADVANCING THE CITY REGION

