# Research, education, and innovation for offshore wind

# Introduction

**The North East of England has a long and rich industrial heritage in the maritime sector. Today, the region we call home is a global centre of excellence for offshore wind research, innovation, and operations.**

For almost 200 years, Newcastle University has worked at the forefront of engineering, science and innovation. Through our research, facilities, education, and skills programmes, we play a key role in accelerating progress in the offshore wind sector and supporting the transition to net-zero.

# How we work with partners

We collaborate with developers, OEMs (original equipment manufacturers), the supply chain, and regulators through:

• collaborative and contract research
• consultancy and technical problem-solving
• PhD and postdoctoral partnerships
• access to specialist laboratories, modelling tools, and test facilities
• technology commercialisation and innovation programmes
• education and skills initiatives

Our work is boosted by the world-class offshore wind ecosystem of businesses, ports, and partnerships in the North East of England.

We're proud to be working with the Offshore Renewable Energy Catapult, local businesses, and Durham University to develop the Energy Central Institute in Blyth, a new higher level skills and innovation facility.

Additionally, a new Memorandum of Understanding between Newcastle University and Port of Tyne is aligning research, innovation, and skills to decarbonise port operations.

# Advancing offshore wind through engineering, data, and marine science

**Our interdisciplinary teams work across engineering, naval architecture, marine science, computing, and environmental studies to deliver high-impact research that improves the performance, reliability, and sustainability of offshore wind systems.**

Newcastle University's Dove Marine Laboratory at Cullercoats, North Tyneside
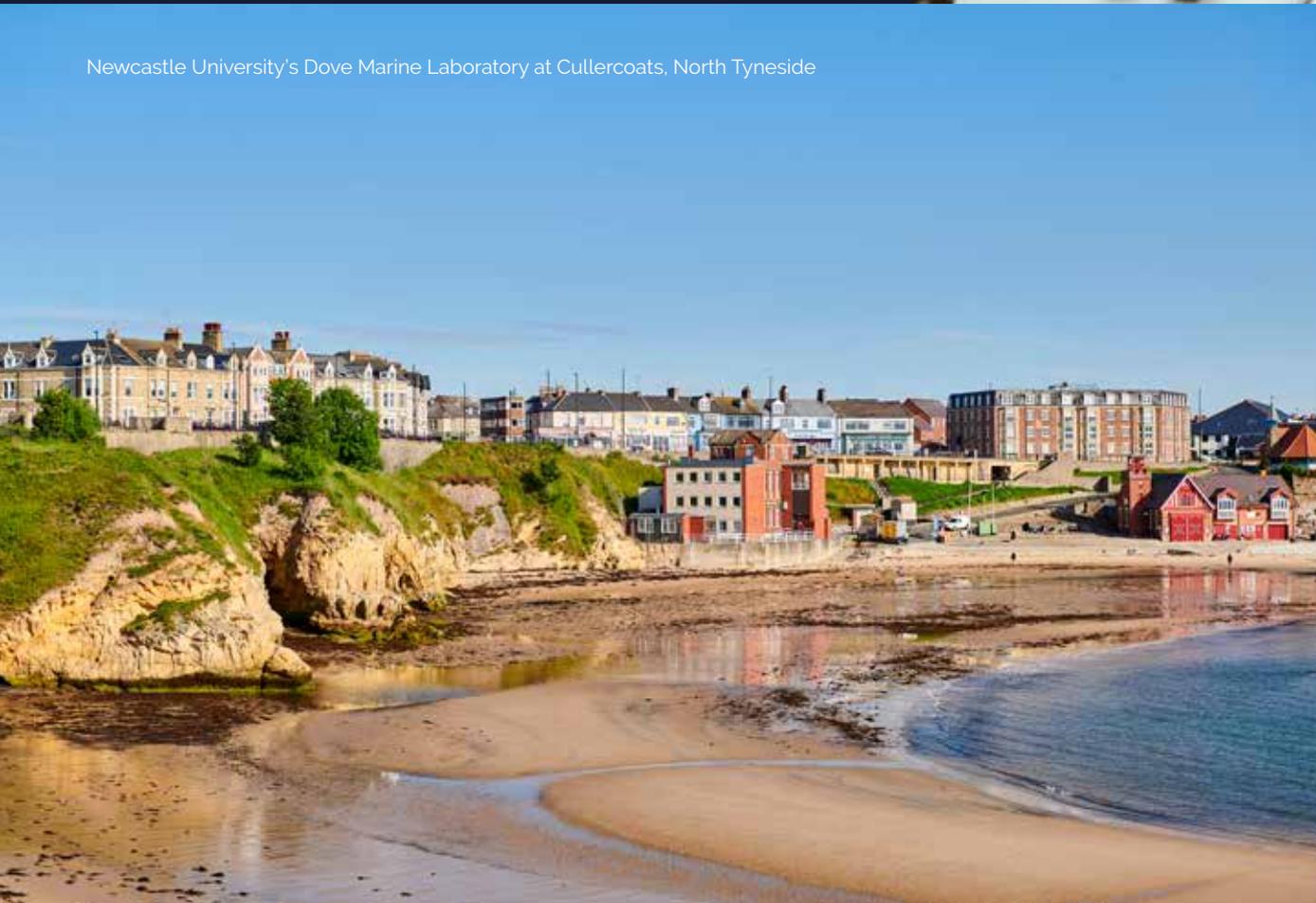
## Applied biomimetics, hydrodynamics, and floating offshore wind

Our work involves high-fidelity computational fluid dynamics and coupled aero-hydro-elastic-mooring-servo models to optimise offshore structure design, analysis, and maintenance.

## Digital twins and AI-enabled system modelling

We are advancing digital twins for offshore wind assets, integrating physics-informed neural networks with aero-hydro-structure numerical models.

## Autonomous systems

Low-energy autonomous marine vehicles and robotic platforms can support environmental monitoring, inspection, and long-duration data collection. These systems enhance survey capabilities whilst reducing cost and risk of offshore operations.

## Subsea communications, acoustics, and sensor networks

Research is advancing low-power subsea communication systems, acoustic sensing and the Internet of Underwater Things (IoUT).

## Environmental science, ecology, and consenting

Our marine scientists contribute expertise to evidence-based consenting and long-term environmental monitoring frameworks for offshore wind development.

## Offshore geotechnics and structural engineering

We investigate soil–structure interaction, seabed mobility, installation processes, and long-term structural integrity of offshore wind foundations and mooring systems.

## Energy materials, power electronics, and electrification

Our research includes battery technologies, materials for extreme environments, and power electronics, drives, and controls for offshore systems and grid integration.

# Developing talent for a changing offshore wind industry

**The rapid expansion of offshore wind demands a workforce skilled in engineering, data, marine science, advanced manufacturing, operations management, and leadership.**

We develop talent across these areas through undergraduate and postgraduate degrees, apprenticeships, and professional training.

## Working with our students

We connect developers, OEMs, contractors, infrastructure operators, and regulators with students across engineering, environmental sciences, computing, and leadership disciplines.

Working with students can include research dissertations, technical projects, site-based work, workshops, guest lectures, and early-careers activities, all shaped so students encounter the leading edge of the offshore wind sector. We are also partnering with Durham University and the Northern Net Zero Accelerator to make more experiential learning and careers guidance related to offshore wind available to all students.

## Postgraduate study

We offer a broad suite of advanced programmes in topics that complement offshore wind, including marine technology, marine science, electrical and mechanical engineering, data science, leadership, and management.

These programmes integrate the latest research from our academics and industry partners, preparing graduates for technical, operational, and strategic roles across the offshore wind lifecycle.

## Higher and degree apprenticeships

Our apprenticeships combine advanced technical training with workplace learning, enabling companies to grow talent tailored to operational needs. Two key programmes for the offshore wind sector are:

### Level 5 Operations Manager Apprenticeship

Delivered over 24 months, this programme upskills early-stage managers, providing the skills and knowledge to lead teams and projects effectively.

### Level 6 BEng Product Design & Development Engineer Apprenticeship

This 48 month programme has been designed specifically to produce the skills and expertise needed to drive engineering innovation in electrification and advanced manufacturing. A new offshore wind stream is being developed for the programme.

## Short courses (CPD)

We offer technical continuing professional development (CPD) courses designed to upskill teams. Short courses are delivered both online and on campus enabling flexible professional development for engineers, analysts, and operational staff.

## Growing the offshore wind workforce

We're working with the Sofia Offshore Wind Farm and others to inspire and inform our students about opportunities in offshore wind.

For several years, our partnership has engaged students across engineering, marine science, data science, climate change, and leadership with research, projects, workshops, site visits, careers events, and guest lectures.

We also host two networking events each year where students and industry partners connect to explore career and progression opportunities.

SOFIA
OFFSHORE WIND FARM

RWE

# Technical expertise and high-end equipment to create new insights

**You can access a wide portfolio of advanced laboratories, testing environments and specialist equipment to advance research, innovation, and problem-solving across the offshore wind lifecycle.**

Our facilities are operated by expert technical teams and are available for collaborative projects, contract research, and commercial testing.

Working together can support detailed investigation of materials, hydrodynamics, subsea performance, environmental interactions, and power systems.

Laboratory and technical expertise includes:

## Chemical and surface analysis

Analytical capabilities for evaluating material composition, corrosion behaviour, and surface treatments used in offshore environments.

## Gear technology and mechanical power transmission

Our Gear Technology Design Unit hosts expertise in mechanical power transmission systems and is home to the National Gear Metrology Laboratory. Services include gear stress analysis, specification, transmission design, mechanical testing, and failure investigation.

## Hydrostatic and hyperbaric pressure testing

High-pressure testing capability can replicate deep-water conditions, enabling assessment of subsea components, connectors and materials for structural performance, safety, and long-term durability.

## Hydrodynamics, marine propulsion, and coatings

Our marine technology laboratories enable testing of ship and offshore structures, hydrodynamic performance, cavitation and noise, hull/structure interaction, propulsion efficiency, and protective coatings, all critical for offshore vessels and platforms, cables and supporting structures.

## Marine science and consenting

Our laboratories can support ecological, sediment, habitat, and environmental impact assessment work required for offshore wind consenting, development, and monitoring.

# RV Princess Royal

Our seagoing 18-metre research vessel is available to charter and offers a flexible marine platform for offshore wind-related operations, including:

- marine mammal and bird surveys
- deployment, testing, and servicing of oceanographic and autonomous equipment
- environmental sampling, benthic trawling, and habitat mapping

# Accelerating technology development and adoption

**By working together, we help organisations discover, validate, and deploy new technologies that strengthen offshore wind performance, reliability, and sustainability**

We work with SMEs, large companies, OEMs, and public-sector partners to advance new products, services, and processes for the offshore renewable energy sector.

Through targeted innovation support, applied research and strong regional partnerships, we help organisations move from concept to validated solution, strengthening the North East of England's position as a global offshore wind hub.
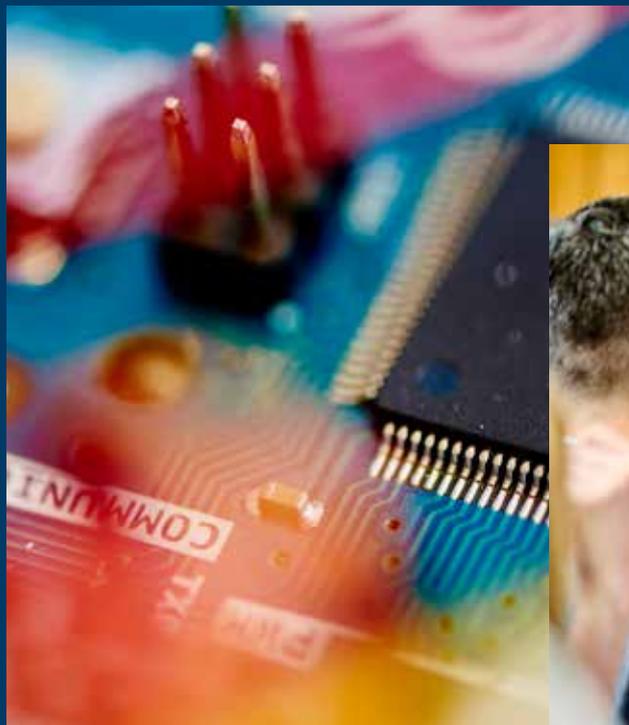
## Arrow – innovation support for North East companies

Arrow is a multi-university programme that provides specialist innovation support to businesses across the region. The scheme can help with applied research and feasibility studies, direct time with academic and technical experts, and access to specialist facilities across four universities.

# Driving the Electric Revolution Industrialisation Centre (DER-IC) Newcastle University

The centre provides open access to advanced manufacturing, testing, and validation facilities for power electronics, machines, and drives (PEMD), all critical components for offshore wind turbines, vessels, and supporting infrastructure.



# National Innovation Centre for Data (NICD)

Based at Newcastle University, the National Innovation Centre for Data helps businesses to explore data to gain a competitive edge, build and embed data analytics skills, and create new products and services.

# Acoustics, sensing, and high-pressure performance

**Our discovery and applied research delivers advanced subsea engineering. Sensing and communication technologies can promote safer, more efficient, and more environmentally responsible offshore wind operations. Our work integrates underwater acoustics, low-power communications, autonomous sensing, and high-pressure testing.**

## Underwater acoustics and environmental monitoring

We have developed passive acoustic tools that automatically detect, classify, and interpret underwater noise and marine mammal activity. These systems enable continuous monitoring, reduce reliance on vessel-based surveys, and support evidence-based consenting for both fixed-bottom and floating offshore wind.

Our research combines:

• signal processing and machine learning
• noise source classification
• species-specific acoustic identification
• distributed sensing
• real-time reporting and automated alerts

## Low-power subsea communications

We are advancing reliable, low-energy communication systems for complex underwater environments. These technologies enable the emerging Internet of Underwater Things (IoUT) and support:

• large-scale sensor data collection
• diver and autonomous underwater vehicle (AUV) tracking
• rapid recovery of lost equipment
• persistent environmental or operational data feeds

## Hyperbaric testing

To validate components for extreme environments, we offer high-pressure testing (630 bar / 9,267 psi) through our vertical hyperbaric chamber. This capability is used to verify the performance and safety of subsea connectors, housings, buoyancy modules, cable protection systems, and novel materials for extreme environments.
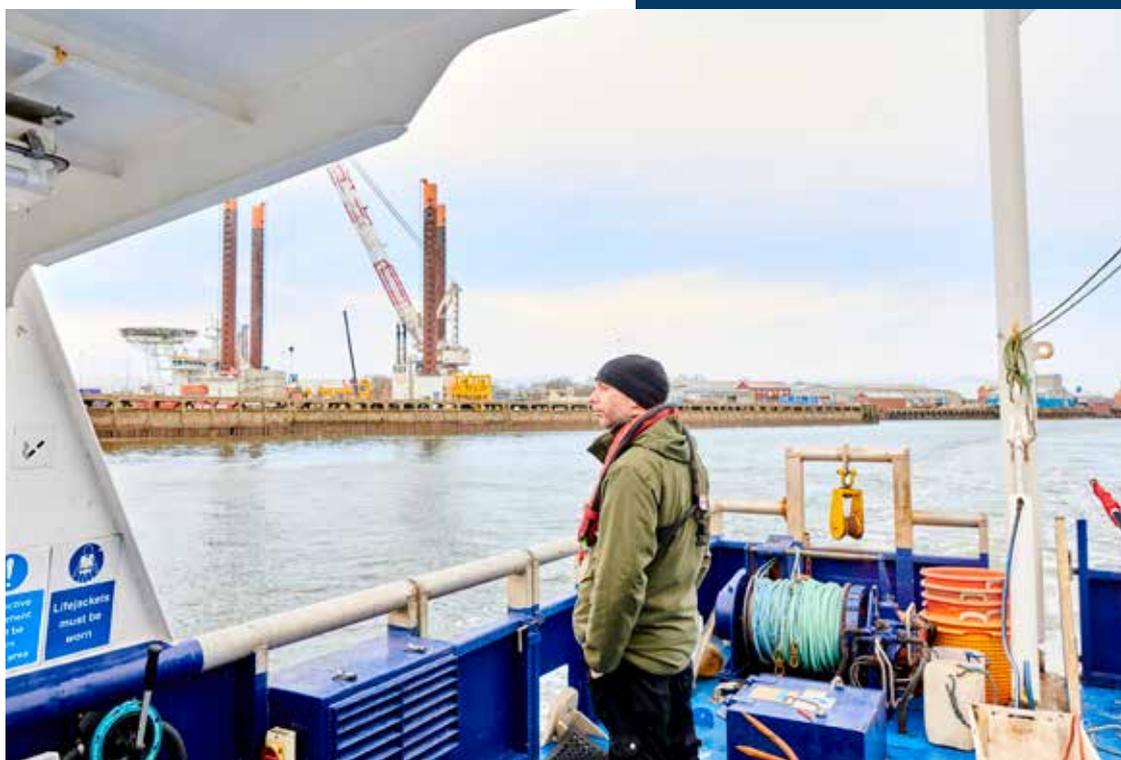
# Introducing ECHO, a next-generation platform engineered to transform environmental monitoring and operational intelligence

**The expansion of offshore wind into deeper waters and more complex environments demands monitoring systems that are autonomous, endurant, and capable of collecting high-resolution data at scale.**
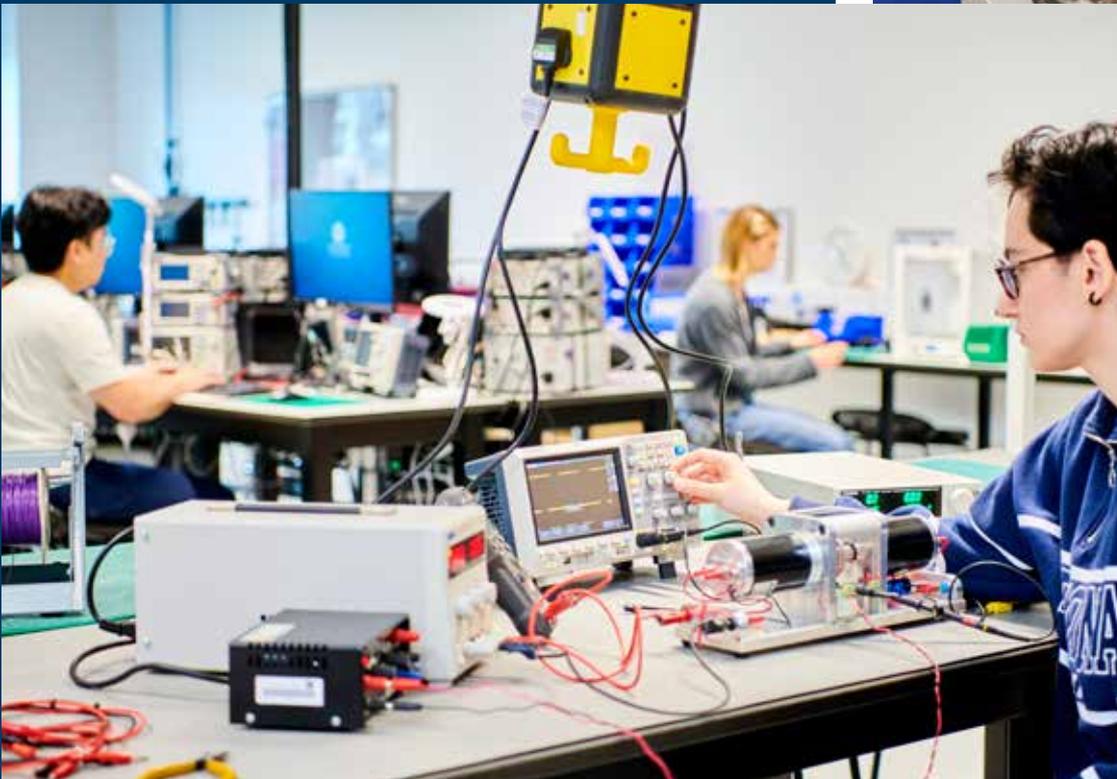




ECHO has been supported by programmes including Innovate UK ICURe, Northern Accelerator, Northern Net Zero Accelerator, and the Royal Academy of Engineering Enterprise Fellowship.

## Combining biomimetic engineering and AI

ECHO is inspired by the hydrodynamics of whales and remora. The vehicle also uses a buoyancy-driven propulsion system (pictured left) that delivers minimal acoustic noise, very low-energy consumption, and stable, low-drag movement, even in variable currents.

An advanced, machine-learning-driven control framework allows the platform to:

• adapt its trajectory to environmental conditions
• optimise energy use in real time
• identify and respond to obstacles or dynamic features
• maintain survey precision with minimal human intervention

## Modular payload

ECHO can carry a wide range of sensor payloads including:

• CTD (conductivity, temperature, and depth) sensors for oceanographic profiling
• hydrophones for marine mammal monitoring
• backscatter modules for sediment and turbidity assessment
• other environmental and acoustic sensing technologies
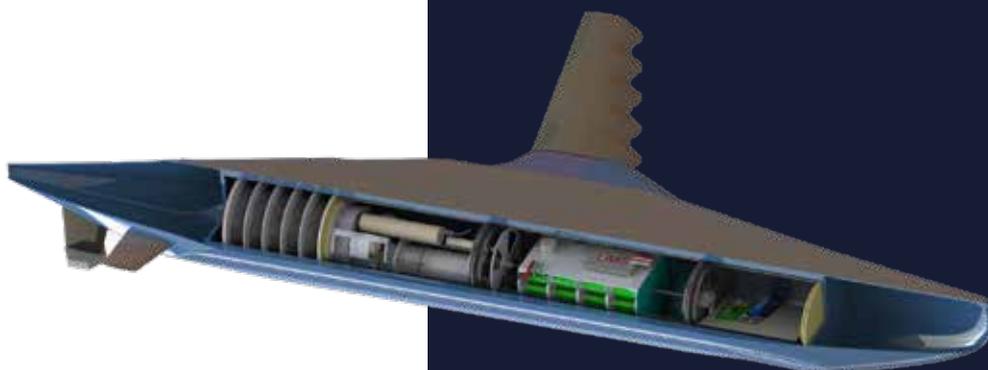
## Driving efficiency in offshore wind

ECHO provides tangible advantages to offshore wind developers:

• 20–30% reduction in environmental survey costs
• continuous, early, high-quality data that improves consenting confidence
• long-duration monitoring without weather downtime

## From prototype to deployment

ECHO is currently at technology readiness level (TRL) 4. A patent is filed and we invite enquiries for commissioning partnerships, field testing and validation, commercialisation and manufacturing collaboration, and development of service-based deployment models.

# Innovation, demonstration, and delivery

Blyth

Offshore Renewable
Energy Catapult

**Blyth Offshore
Demonstrator
Wind Farm**

Newcastle
International Airport

Newcastle

Newcastle United
Football Club

Newcastle
University

Northumbria
University

**Offshore Wind**
Construction bases
and ORE Catapult

Sunderland
University

Sunderland

Durham
University

Teesside

Teesside
University

ViTAL living lab:
decarbonising defence

**Catalysing an integrated energy system which grows a productive, clean economy for communities across the globe.**

**Sofia Offshore Wind Farm**
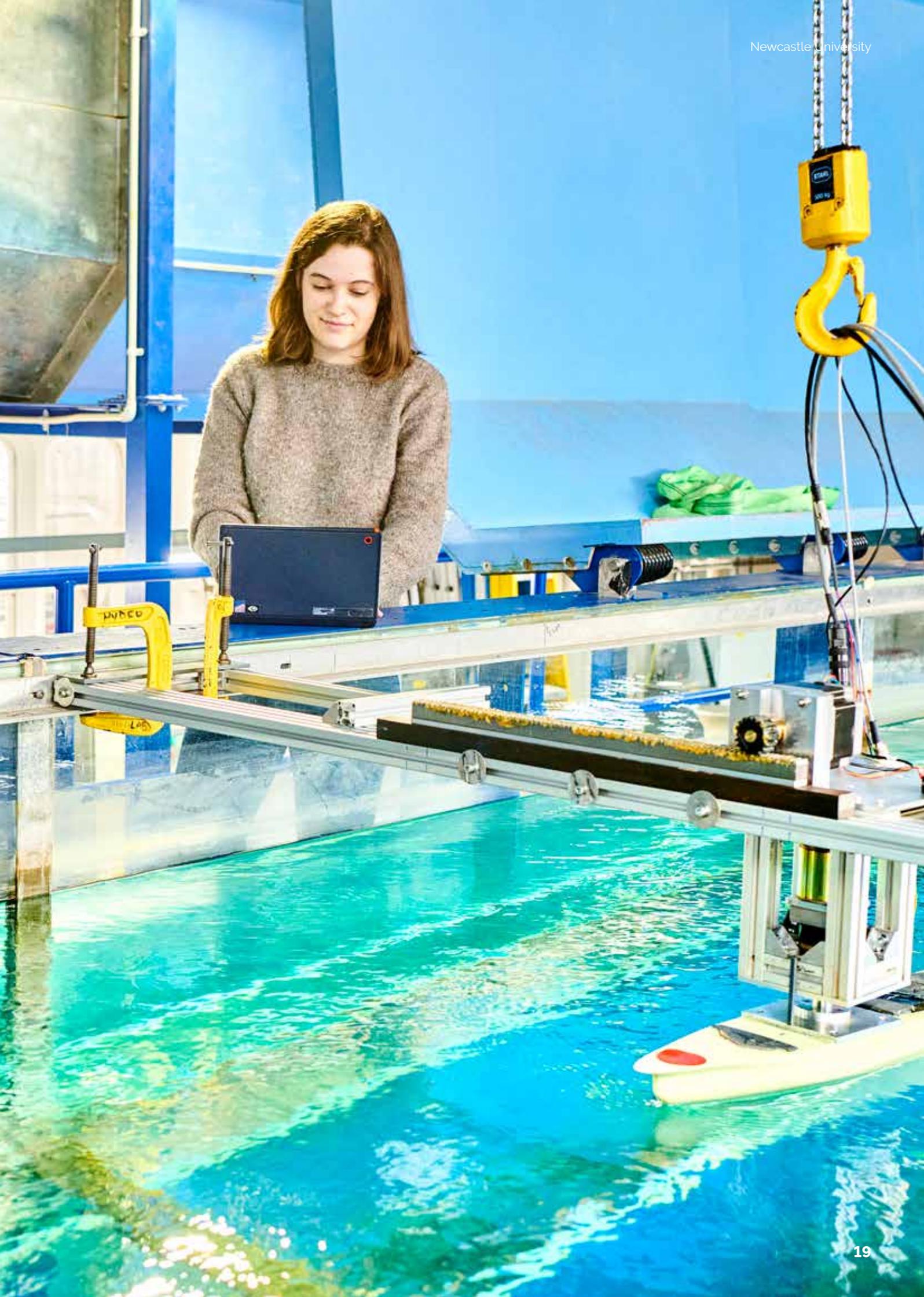
**Dogger Bank**
World's largest offshore wind farm 3.6GW

Newcastle

**Teesside**
Freeport with hydrogen and CCUS projects

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# Research, education, and innovation for offshore wind

Newcastle
University

## Newcastle University

Newcastle University exists for the public benefit
to advance education, learning and research.
Our objective is to build on this core purpose
and, in doing so, provide new knowledge and
creative solutions that make a positive impact.
We aim to work collaboratively with our many
external partners to shape brighter futures, grow
the economy, and champion social justice.

**ncl.ac.uk**

**business@newcastle.ac.uk**

**in** **Business and partnerships
with Newcastle University**