

EMEC

PIONEERING THE TRANSITION TO A CLEAN ENERGY FUTURE

Innovation catalyst reducing the time,
cost and risk to progress low carbon
technology to market



CONTENTS

Where you'll find us	1
20 years of clean energy innovation	2 • 5
Test with us	6 • 7
Ocean energy test sites	8 • 9
Floating and offshore wind	10 • 11
Green hydrogen R&D	12 • 13
Islands of innovation	14
Islands Centre for Net Zero	15
R&D support packages	16 • 17
EMEC impact	18 • 19
International collaboration	20
Join our team	21

WHERE YOU'LL FIND US



Ocean energy demonstration sites

- 1 **Fall of Warness**
Grid-connected tidal test site
- 2 **Billia Croo**
Grid-connected wave test site
- 3 **Shapinsay Sound**
Scale tidal test site
- 4 **Scapa Flow**
Scale wave test site
- 5 **Floating Wind**
Grid-connected floating wind test site (planned)

Hydrogen demonstration sites

- 6 **Caldale**
Hydrogen production and storage plant
Vanadium flow batteries
- 7 **Kirkwall Pier**
Fuel cell
- 8 **Kirkwall Airport**
Combined heat and power unit (CHP)

EMEC offices

- 9 **Stromness**
Headquarters
- 10 **Kirkwall**
Satellite office

Orkney decarbonisation projects

- 11 **Kirkwall Airport**
Sustainable Aviation Test Environment (SATE)
- 12 **Hatston**
ReFLEX Orkney – Experience Centre
- 13 **ICNZ**
Islands Centre for Net Zero
- 14 **West of Orkney Windfarm**
- 15 **Flotta Hydrogen Hub**



20 YEARS OF CLEAN ENERGY INNOVATION

EMEC is a not-for-profit innovation catalyst pioneering the transition to a clean energy future.

Based in Orkney, Scotland, we are the world's leading centre for demonstrating wave and tidal energy converters in the sea.

As a plug-and-play facility EMEC helps reduce the time, cost and risk of testing and demonstrating ocean energy and associated low carbon technologies.

REDUCING THE TIME, COST AND RISK OF TESTING OCEAN ENERGY TECHNOLOGIES

EMEC was established in 2003 to kick start the development of the ocean energy industry. The centre provides pre-consented, grid-connected test sites in harsh wave and tidal regimes as well as scale test sites in gentler conditions for testing smaller scale technologies, subsystems and components.

EMEC is the world's only accredited ocean energy test laboratory (ISO/IEC 17025) and inspection body (ISO/IEC 17020) offering internationally recognised performance assessments of technologies.

To date, EMEC has hosted more ocean energy devices than at any other site, providing operational, technical and business support to help clients commercialise.

22
WAVE AND TIDAL CLIENTS

11
COUNTRIES

35
MARINE ENERGY DEVICES

2001

Recommendation by House of Commons Science and Technology Committee to set up a wave and tidal energy test facility to kick start a marine energy industry in the UK...

EMEC ESTABLISHED

2003

WORLD'S FIRST test centre for demonstrating ocean energy technologies in the sea

2004

WORLD'S FIRST offshore wave energy generated into national grid by Pelamis Wave Power

2005

WORLD'S FIRST AND ONLY ISO/IEC 17025 accredited test laboratory

2006

2008

UK'S FIRST tidal stream power generated into grid by OpenHydro

2009

2010

2011

WORLD LEADER
MORE MARINE ENERGY DEVICES TESTED AT EMEC THAN ANY OTHER SITE IN THE WORLD

2012

2013



INTEGRATING RENEWABLES WITH NEW ENERGY VECTORS AND STORAGE SOLUTIONS

EMEC is also leading innovation projects exploring floating wind, the integration of renewables, green hydrogen, storage and e-fuels.

EMEC has established an R&D hydrogen ecosystem, featuring electrolysers, fuel cells, storage and refuelling, for first-of-a-kind and pilot scale projects aiming to decarbonise power, heat and transport applications.

Projects range from renewables integration, storage and logistics, through to e-fuels and end-use case demonstrations, particularly within the maritime and aviation sectors.

DEMONSTRATING THE CLEAN ENERGY SYSTEM OF THE FUTURE

Building on its experience in developing the ocean energy sector, EMEC is exploring options for developing a national floating wind test site to the west of Orkney and has launched a research and innovation programme to help develop novel solutions for offshore wind.

EMEC's infrastructure and experience is increasingly being used in wider energy systems and decarbonisation innovation. For example Microsoft demonstrated a subsea data centre at Billia Croo and EMEC is leading the Islands Centre for Net Zero to support Orkney, Shetland and the Outer Hebrides on their path to net zero emissions.

EMEC was set up to spark the development of an ocean energy sector and boost economic development in the Highlands and Islands. Over the years we have grown and diversified and the unprecedented activity that has taken place in Orkney has been a catalyst for economic development, creating jobs and a world-leading supply chain now exporting skills and knowledge around the globe.



2014 >>> 2015 >>> 2016 >>> 2017 >>> 2018 >>> 2019 >>> 2020 >>> 2021 >>> 2022 >>> 2023 >>> 2024 >>>

WORLD'S FIRST
tidal-powered
hydrogen
generation

WORLD'S FIRST
and only ocean
energy facility
designated
with RETL
status by
IECRE

WORLD'S FIRST
international power
performance
assessment
delivered to
Verdant Power
in New York

WORLD'S FIRST
flight powered
by synthetic fuel
(made at EMEC)
achieved by
Royal Air Force

**WORLD'S MOST POWERFUL
TIDAL TURBINE**
Orbital O2 being
demonstrated at EMEC

TEST WITH US

We can support your technology development from early stage technology readiness levels through to deployment at EMEC and beyond.

With two decades of experience, EMEC is attracting developers from around the globe to prove what is achievable in some of the harshest of marine environments.

Whilst initially designed for ocean energy testing, our sites have been sought out by other industries looking to demonstrate clean energy and sustainable technologies in the sea, including offshore components and a subsea data centre.

Please get in touch for a chat about how EMEC can help your development programme.

CONTACT US:

Dernis Mediavilla • Commercial Manager
 E: Dernis.Mediavilla@emec.org.uk
 T: +44 (0)1856 852218



TEST SITES FOR CLEAN ENERGY DEMONSTRATIONS

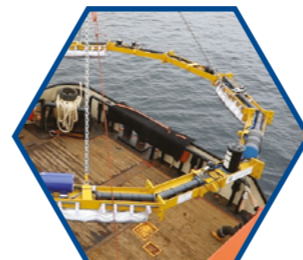


Our sites are used by technology developers, supply chain companies, equipment manufacturers and academics for a wide range of activities.

DEVICE DEMONSTRATIONS



TOOLS DEVELOPMENT



MATERIALS TESTS



COMPONENTS AND SUB-SYSTEMS



RESEARCH PROJECTS



ENVIRONMENTAL MONITORING



STORAGE AND LOGISTICS



TRAINING



H&S PROCEDURES



MOORINGS, CABLING AND CONNECTIONS



MARINE OPERATIONS TRIALS



INSTALLATION AND DECOMMISSIONING



OCEAN ENERGY TEST SITES

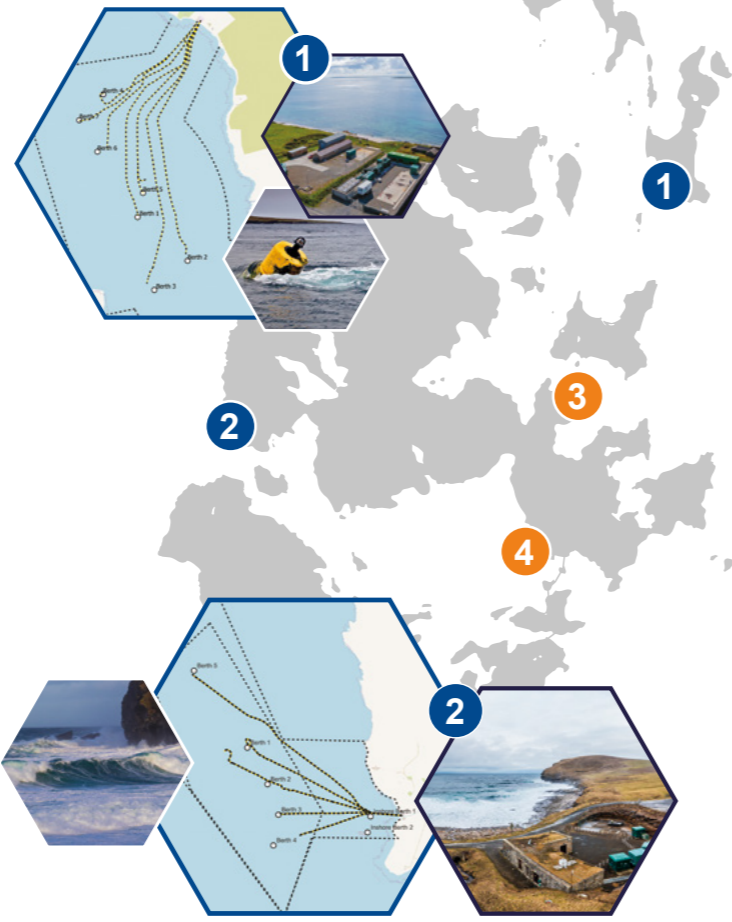


GRID CONNECTED TESTING

Increase investor confidence by proving real sea performance.

EMEC is the only accredited test centre in the world. Our clients benefit from pre-consented, grid-connected test and demonstration facilities, suitable for testing various wave and tidal energy converters, sub-systems and tools simultaneously.

EMEC's facilities are located in major wave and tidal resources, helping to prove what is achievable in some of the harshest marine environments while in close proximity to sheltered waters and harbours.

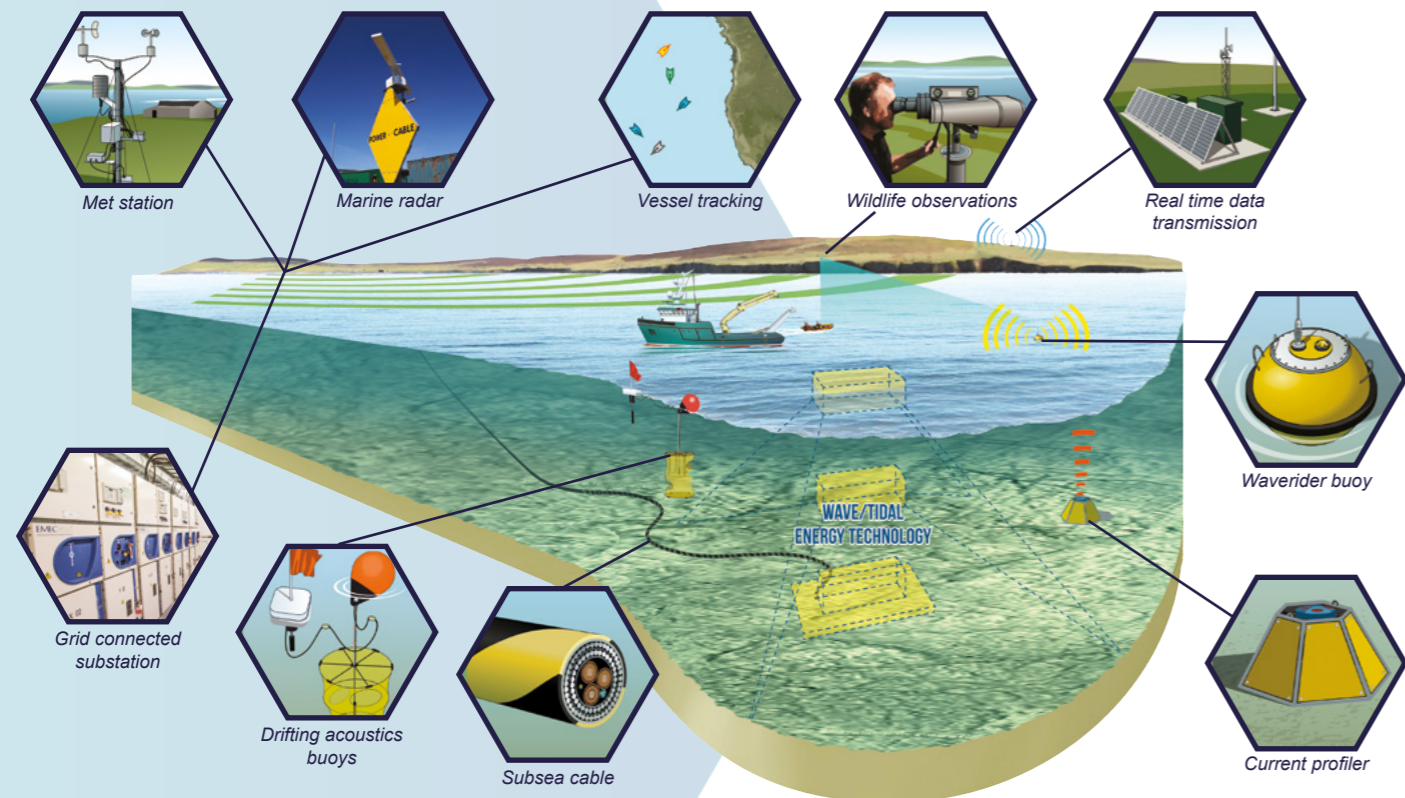


1 Tidal test site at Fall of Warness

Grid-connected: **Yes**
 Berths: **7**
 Depth: **12-50 m**
 Typical spring tides: **3-4 m/s**
 Typical neap tides: **1-2 m/s**

2 Wave test site at Billia Croo

Grid-connected: **Yes**
 Berths: **5 cabled (+1 near shore)**
 Depth: **50-70 m (20 m near shore)**
 Significant wave height: **2-3 m (annual mean)**
 Significant wave height: **8-10 m (typical winter peaks)**



SCALE TEST SITES

Learn lessons at scale, reducing costs and minimising risks before scaling up.

Based in less challenging conditions than our grid-connected test sites, our scale test sites provide accessible in-sea testing options, acting as a stepping stone between tank testing and demonstrating larger projects.

- Overarching site licence simplifies the consents process within an agreed envelope of activity.
- Test support buoys* enable dissipation of electricity, as well as remote monitoring and control.
- Microgrid* can be set up to simulate grid connection.
- Pre-installed anchor points provide mooring options.
- An area of seabed is available for rehearsal or deployment of tools and techniques.

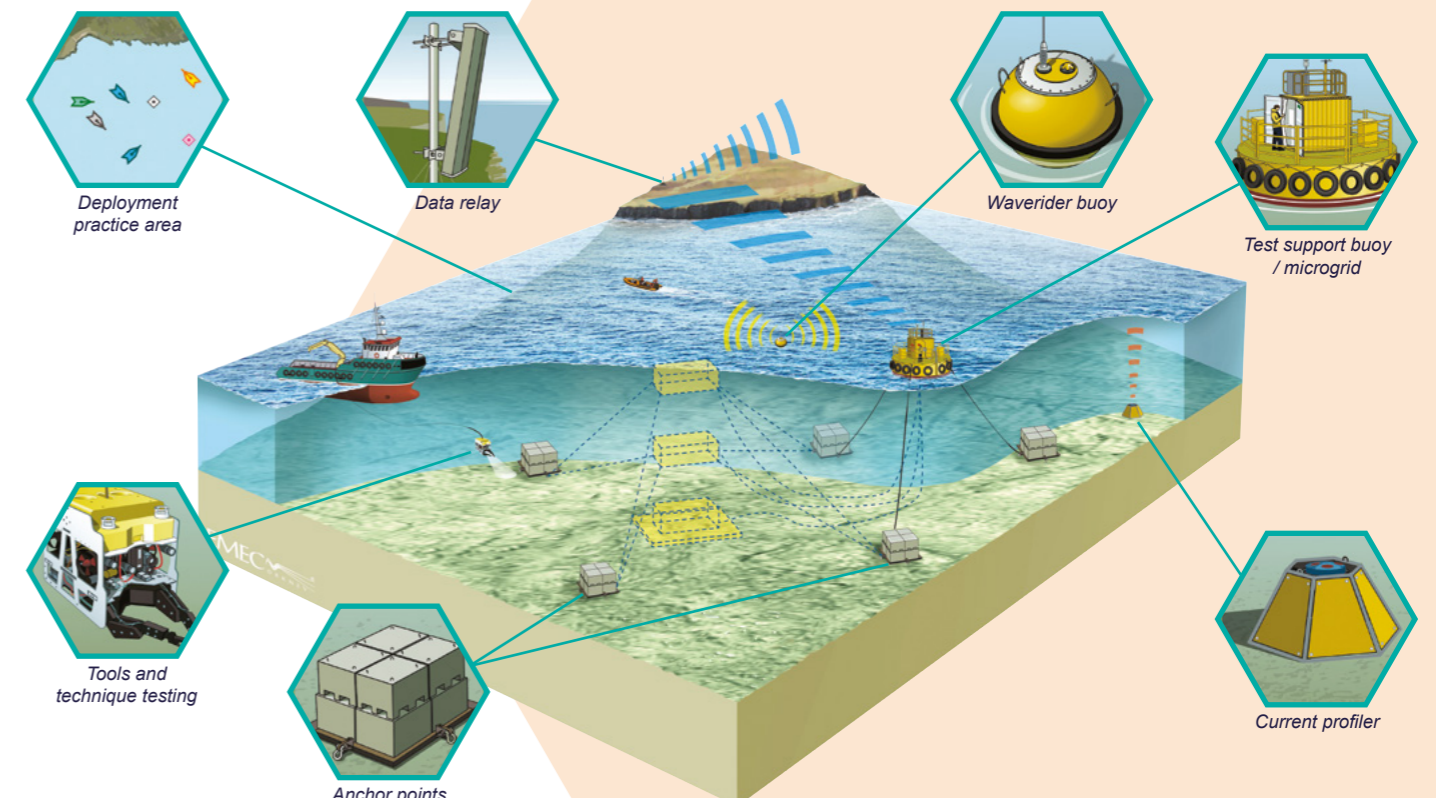


3 Scale tidal test site at Shapinsay Sound

Grid-connected: **No***
 Berths: **2**
 Depth: **21-25 m**
 Typical spring tides: **1.1 m/s**
 Typical neap tides: **0.4 m/s**

4 Scale wave test site at Scapa Flow

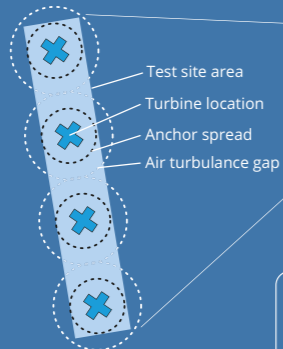
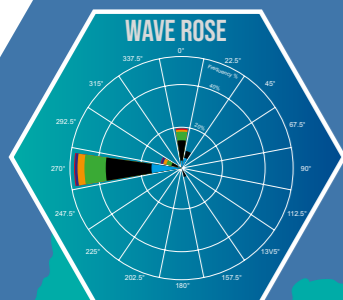
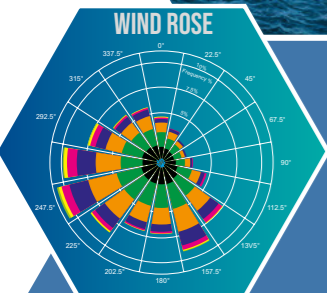
Grid-connected: **No***
 Berths: **2**
 Depth: **21-25 m**
 Significant wave height: **0.4 m (annual mean)**



NATIONAL FLOATING WIND TEST CENTRE



Based in Orkney, EMEC is ideally located at the heart of 40 GW of ScotWind offshore wind developments.



Key:
 National Floating Wind Test Centre area
 Subsea cable hub
 Subsea cable
 Subsea cable (TBC)

With over 23 GW of floating wind due to be deployed in Scottish waters over the next 20 years, EMEC is pursuing the development of a National Floating Wind Test Centre in the UK.

The proposed test site will comprise four grid-connected berths for floating offshore wind turbines of up to 20 MW rated capacity, extending up to 8 berths if there proves to be sufficient demand.

With water depths of 80-100 meters, large waves and a mean windspeed of 10.7 m/s, the site will offer floating wind developers representative metocean conditions to those in ScotWind, Celtic Seas and future leasing rounds.

The site has been designed specifically for floating wind developers to de-risk technologies, putting turbines, floating structures, moorings and other components to the test in an energetic offshore environment. This will enable performance to be refined on a wide range of technologies prior to commercial scale-up and build-out.

A dedicated test site will also help ensure that the UK captures and retains the innovation benefits and cements its leading position in the floating wind sector.

CONTACT US:
Matthew Finn - Commercial Director
E: matthew.finn@emec.org.uk
T: +44 (0)1856 852064

OFFSHORE WIND TESTING AND INNOVATION



COMPONENT AND SUBSYSTEM TESTING

EMEC's existing ocean energy test sites can accommodate demonstrations of offshore wind related components, sub-systems and tools, for example floating platforms, anchoring solutions and installation methodologies.

Previous trials have included high-performance coatings, offshore mooring demonstrations and solutions to minimise the impacts of biofouling.



RESEARCH AND INNOVATION PROGRAMME

EMEC launched its Offshore Wind Research and Innovation (R&I) Programme in 2023.

The £1 million programme is searching for novel solutions to help deliver offshore wind faster, cheaper and at lower risk.

The programme aims to accelerate innovation, supporting companies to explore ways to overcome specific technical challenges in offshore wind development in high energy environments, while embedding economic benefits in the North of Scotland.

A series of innovation calls will address challenge areas facing Scottish offshore windfarms, spanning metocean, installation, logistics, and operations and maintenance (O&M).

Innovative projects will be sponsored to help the supply chain bring new solutions to market, build operational capacity and scale up activities. Successful applicants can also get support with developing a robust project proposal, accessing alternative grant funding and opportunities to test at EMEC's world-leading demonstration sites.



The programme is sponsored by the West of Orkney Windfarm which is developing an offshore wind farm 30 km west of the Orkney Mainland, 25 km north of the Sutherland coast.

BECOME A SPONSOR:

We're looking to bring additional industry sponsors into the programme to broaden its remit and impact.

- Sponsor funding calls to address site specific and sector wide challenges
- Improve non-price factor project capacity around supply chain development, skills provision, innovation and sustainability for future Contracts for Difference rounds.
- Build up expertise close to site and maximise local supply chain impact.

offshoreinnovation.scot
emec@offshoreinnovation.scot



GREEN HYDROGEN R&D

EMEC's R&D ecosystem covers the green hydrogen value chain, integrating renewables with hydrogen production, storage and transport, and trialling end use applications including feedstock for e-fuel production.

Our sites and infrastructure are used for first of a kind projects exploring how to decarbonise power, heat and transport applications to support the transition to a clean energy future.



HYDROGEN PRODUCTION

EMEC own and operate fixed and re-deployable hydrogen production assets for use in R&D projects.

ELECTROLYSER AND STATIC STORAGE

EMEC's hydrogen production plant is located onshore in Eday neighbouring EMEC's grid-connected tidal test site at the Fall of Warness. It comprises a 670 kW rapid response PEM (Proton Exchange Membrane) electrolyser, compressor and static storage with capacity to hold up to 500 kg of hydrogen. Based on the electrolyser running at full power for 24 hours, up to 260 kg of high purity, fuel cell grade hydrogen can be generated.



The production plant is integrated with renewable energy input, either tidal energy converters testing at the Fall of Warness or from the Eday 900 kW community wind turbine.

VANADIUM FLOW BATTERIES | ENERGY STORAGE

EMEC is exploring the integration of the hydrogen plant with flow battery technology to optimise hydrogen production, 'smoothing' tidal generation to create continuous, on-demand electricity to power EMEC's electrolyser.



Located adjacent to the hydrogen production plant, EMEC's energy storage building houses 48 vanadium flow battery modules with a combined storage capacity of 1.8 MWh.

RE-DEPLOYABLE ELECTROLYSER

EMEC's re-deployable modular electrolyser supports demonstration projects by providing on-site hydrogen generation in locations where there is no fixed hydrogen infrastructure.

The unit consists of 10 stack anion exchange membrane (AEM) electrolyser technology and a low-pressure buffer tank. The electrolyser is rated at 24 kW and generates hydrogen at 30 – 35 bar.



GREEN HYDROGEN INTEGRATION



TRANSPORTING AND REFUELLING WITH HYDROGEN

MOBILE STORAGE TRAILERS

Five specially designed mobile storage trailers can transport up to 250 kg of hydrogen from point of production to supply end applications across power, heat and transport in technology demonstration projects.



MOBILE REFUELLING SOLUTION

EMEC's Pioneer is a transportable refuelling system that can provide in-field refuelling in locations with no fixed infrastructure. The Pioneer can store up to 420 kg of hydrogen at 425 bar pressure.



The Pioneer can be coupled with EMEC's 24 kW re-deployable modular electrolyser for on-site hydrogen generation for a full end-to-end system.



CONTACT US:
Matthew Storey - Consultancy Manager
E: matthew.storey@emec.org.uk
T: +44 (0)1856 852067

END USE DEMONSTRATIONS

KIRKWALL PIER FUEL CELL

A 75 kW fuel cell is housed at Kirkwall Pier to convert hydrogen back to electricity.



Designed to resemble the vessel engine room of a ship, the fuel cell can be used as a training rig as part of a first of a kind MCA-approved hydrogen training course. Developed by Orkney College UHI's maritime studies department, in collaboration with EMEC and Orkney Ferries, the course equips mariners with the necessary skills and knowledge to work on-board hydrogen fuelled vessels.

COMBINED HEAT AND POWER

A combined heat and power (CHP) unit is being trialled at Kirkwall Airport to demonstrate the use of hydrogen for heat and power requirements in the airport terminal building.



SAFETY

EMEC's hydrogen R&D facilities are overseen by experienced maintenance and operation technicians with infrastructure regularly checked and tested.



ISLANDS OF INNOVATION

LIGHTHOUSE COMMUNITIES FOR THE ENERGY TRANSITION

The Orkney Islands have been home to, and centre of, renewable energy innovation for more than 60 years.

KEY STATS*:

- 10% of homes on Orkney have microgeneration compared to 2.8% in the UK;
- Orkney has over 3 times as many EVs per home than the UK average;
- Orkney has 2.0 kW of renewable energy capacity per home – 9 times higher than UK average;
- Orkney has 12 times more domestic RHI installations per home than the UK average;

*Dept of Business, Energy and Industrial Strategy, and Dept of Transport: 2020



Since 2013, Orkney has generated over 100% of its electricity demand from renewable power sources.

Orkney has a long-standing heritage as a national location for testing modern wind turbine technology since the first deployment at Costa Head in the 1950s. Over the last 20 years there has been a marked diversification in activity, starting with energy efficiency, then deploying wind turbines to decarbonise electricity, establishing a world leading marine energy test facility, introducing innovative heating, and projects exploring green hydrogen, energy storage and balancing technologies.

Orkney's energy ecosystem is being used as a case study to help other communities and regions across the world. Visitors come to Orkney to learn from the pioneering energy R&D activities taking place, and Orkney-based expertise and equipment has been exported all over the world to help facilitate, encourage, and inspire communities to achieve their own sustainable energy solutions.

Orkney has largely decarbonised its electricity and are working hard to decarbonise heat and transport by 2030. Collaboration is key and EMEC works closely with partner organisations, locally and internationally, to help demonstrate the clean energy system of tomorrow.

ISLANDS CENTRE FOR NET ZERO

DECARBONISING SCOTLAND'S ISLANDS



The Islands Centre for Net Zero (ICNZ) is a ten-year, £16.5 million programme working to support Orkney, Shetland and the Outer Hebrides on their path to net zero emissions.

Part of the Islands Growth Deal, ICNZ is jointly funded by the UK and Scottish governments. It is led by EMEC alongside partners Aquatera, Community Energy Scotland, Heriot-Watt University and the three Islands' Councils.

ICNZ aims to navigate barriers to decarbonisation through applied research, demonstration of innovative technologies and deployment of solutions. The partnership is working with the islands' communities and local businesses, empowering them to identify and implement place-appropriate solutions that could have replicability worldwide.

icnz.org
info@icnz.org

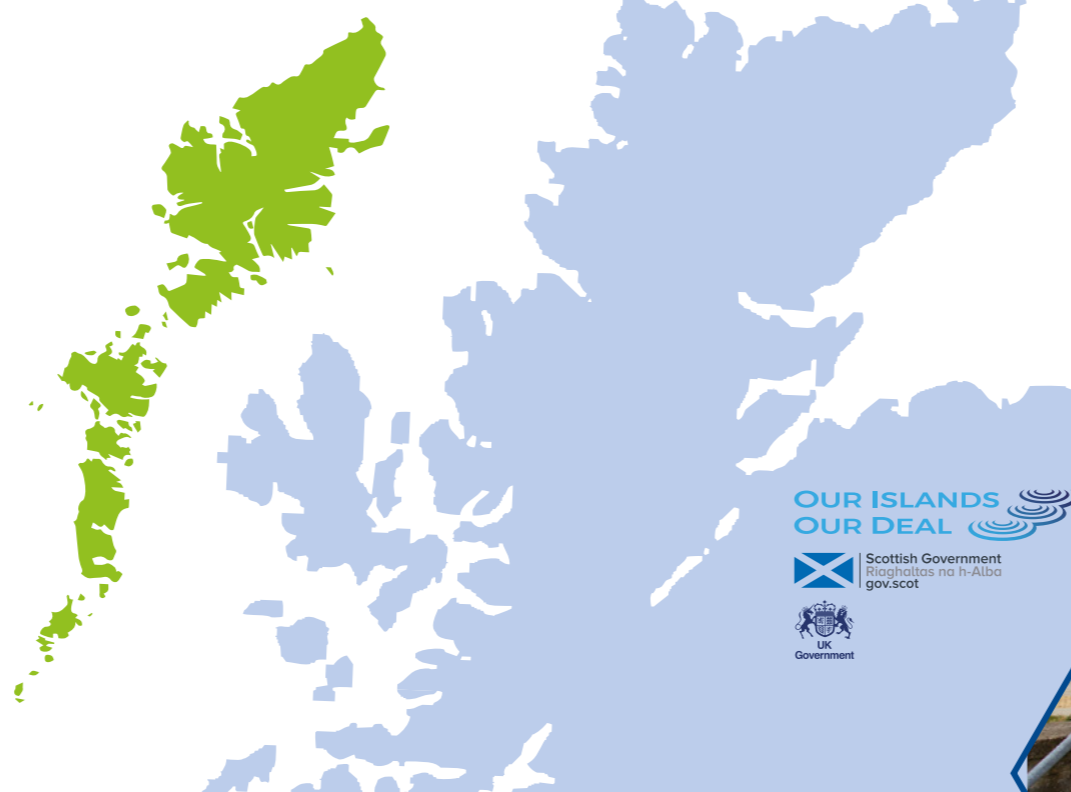


OBJECTIVES:

- Support the islands to become some of the first regions in the UK to reach net zero through a globally recognised innovation centre.
- Create 300 new green jobs within the islands - 100 new jobs plus 200 jobs repurposed from declining industries.
- Generate new enterprise and revenue streams, stimulating growth across the supply chain - adding over £150 million gross value added (GVA) to the islands' economy.
- Embed decarbonisation in the activities of all Islands Deal projects with a central carbon data exchange setup to measure progress and drive change.

CONTACT US:

Laura Hutton • Project Director (ICNZ)
E: laura.hutton@emec.org.uk
T: +44 (0)1856 852001





The development of EMEC and the marine energy supply chain has had a positive effect locally, and across the UK, creating employment and encouraging public and private investment to help service the sector.

EMPLOYMENT

EMEC has created highly skilled, high value jobs and is one of the top 20 employers in Orkney, with salaries higher than the Orkney average.

The creation of high value jobs helps to retain young people in Orkney, attracting back those who had previously moved away for work or study, as well as enticing new people to move to the county. This is particularly important as the working age population of Orkney is projected to decrease by 13% between 2021 and 2043.



ECONOMIC IMPACT IN NUMBERS*



*Economic impact assessment by BiGGAR Economics on total cumulative impacts attributable to EMEC: 2003-2023

LOCAL CONTENT GLOBAL IMPACT

By taking advantage of the resources available in the Highlands and Islands, we are supporting the economic development of rural peripheral areas.

50% (over £30 million) of EMEC spend 2005-2023 has been spent in Orkney.

Further afield, concentrated effort is being made by the ocean energy sector to ensure local content is front and foremost in procurement. For example, Orbital Marine Power's O2 tidal turbine was made with 80% UK supply content, from Scottish steel work and main manufacturing through to anchors from Wales and blades from the south of England. The launch of the O2 marked the first vessel launch from Dundee since ship building ended over forty years ago.



SUPPLY CHAIN DEVELOPMENT

EMEC has fostered a cluster of activity in Orkney that is enabling other companies to develop and thrive. The services available locally have developed substantially since EMEC was established with businesses in other sectors, such as fishing, diving and oil and gas, diversifying into the marine renewables sector.

EXPORTS AND INWARD INVESTMENT

EMEC has exported its knowledge across the Americas, Europe, Asia and Oceania to support the development of a global ocean energy sector and facilitate wider clean energy R&D. EMEC has secured £49.5 million R&D funding since 2016, the vast majority of which was inward investment.

A hub of knowledge has been created through the creation of EMEC. Local consultancies, diving companies and vessel operators are now selling knowledge obtained by working on EMEC's sites and with our customers to others around the world.

INFRASTRUCTURE

£23 million has been invested by OIC and HIE in supporting harbour infrastructure for the ocean energy sector in Orkney, which has also benefited the fisheries industry and cruise sector.

A JUST TRANSITION TO A MORE EQUITABLE ENERGY FUTURE

KEEP UPDATED ON LARA'S RESEARCH.



PHD - IN THE SPOTLIGHT

Exploring the justice dimensions of emerging energy technologies

An energy justice and responsible innovation inquiry into marine renewables and green hydrogen in island communities.

This research explores these emerging technologies which are not yet 'locked into' our current systems, to anticipate their potential risks of injustice, and the opportunities they offer for building just energy transitions.



Lara Santos-Ayllon

COLLABORATION TEAMWORK MAKES THE DREAM WORK



20 years of front-line experience in supporting clean energy testing and demonstration has given rise to a range of collaborations generating cross-sectoral innovation and knowledge sharing.

We partner with the local supply chain and wider industry on R&D projects to drive the transition to clean energy future. We also work closely with other ocean energy test centres to support the global development of the ocean energy sector.

INTERNATIONAL WATERS

Test centres help develop the sector in many ways. They help reduce costs and streamline test programmes for technology developers, are often the first to encounter regulatory barriers like permitting and are therefore a key node for knowledge sharing within the sector. They also provide a local/regional focal point encouraging job creation and supply chain growth.

EMEC established the International WaTERS (Wave and Tidal Energy Research Sites) network in 2013. As part of our 10th anniversary, we hosted an International Test Centre Symposium in Orkney, Scotland, inviting operational and planned test sites from around the world to discuss common issues and agree actions for collaborating for the good of the marine energy sector.

Since then, the group has met annually. Today the network includes open-sea test centres from over 20 countries and over 30 test and research centres.



International WaTERS drives collaboration and knowledge transfer between test centres and global regions. Members learn directly from their peers about managing test sites to a high standard and delivering high-quality research and demonstration programmes.

The objectives of the network are to:

- Share updates on progress and challenges;
- Identify common test site challenges and opportunities;
- Discuss key R&D topics;
- Identify actions to forge relationships and knowledge transfer between test sites.

The network has proven to generate collaborative research projects (for example the Interreg NWE OceanDEMO and BlueGIFT projects), and tangible knowledge exchange between test sites.

TEST CENTRE DATABASE

For further information on the network and a database of international ocean energy test centres, visit: www.internationalwaters.info

The network has been supported by:



JOIN OUR TEAM



We are driven to help find solutions to tackle climate change internationally and create a sustainable and more equitable energy system for the future, as well as delivering tangible economic impact for the communities we work in.



PLANET

Leave a positive legacy on the environment.



PEOPLE

Create jobs and development opportunities within a healthy, safe and inclusive culture.



PROSPERITY

Deliver tangible economic impact in the communities we work.

DO YOU SHARE THIS PASSION?

Based in Orkney off the north of Scotland, we're passionate about finding solutions for islands decarbonisation and believe that islands have a key role in becoming lighthouse communities in the energy transition. Orkney has a long-standing history in renewable energy innovation and can be viewed as microcosm demonstrating the energy system of tomorrow, guiding other communities and regions across the world.

The passion and dedication of our team in building a cleaner, fairer world is what makes EMEC what it is today. By choosing to work at EMEC, you will be joining a world-leading company, working on pioneering, innovative projects and helping find the solutions to some of the world's greatest environmental challenges.

We aim to ensure every member of the team has the support needed and is empowered to succeed in the innovative, fast-paced environment in which we work. It's important to us that you are supported in developing your career and we work hard to build a culture that delivers on our core values, supplying each team member with the tools, opportunity and challenge to grow.

If you want to help shape the future of ocean energy and work towards a cleaner energy future, we want to hear from you.

CONTACT US:

Molly Harris • HR Manager
E: HR@emec.org.uk
T: +44 (0)1856 852060



INNOVATE COLLABORATE GENERATE



+44 (0)1856 852060
info@emec.org.uk

emec.org.uk

The Charles Clouston Building, ORIC, Back Road,
Stromness, Orkney, KW16 3AW