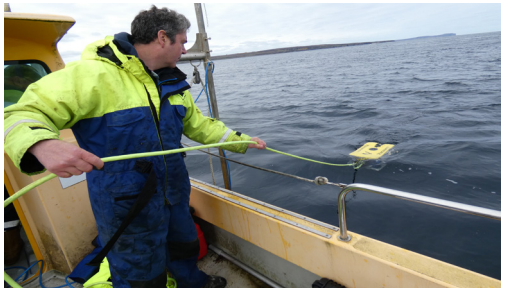
RENEWABLE ENERGY

UHI and Tidal, Wave and Future Energy

Engineers, environmental and social scientists at UHI are working with multiple stakeholders to facilitate wave and tidal energy development in Scotland, the UK and internationally, together with techniques transferable to other marine energy (e.g., floating photovoltaic). These research activities ensure that project developers, regulators and other stakeholders have access to the necessary technologies, baseline data, predictive models, and evaluation methods to understand the significance and potential impacts of marine renewable developments on the surrounding environment. UHI's goals include early identification of data gaps to reduce risks and resource requirements, as well as developing and demonstrating novel technology for environmental characterisation, impact prediction and efficient long-term environmental monitoring across a range of scales.

Resource assessment & characterisation

UHI has expertise in oceanographic and hydrodynamic measurements in challenging high-energy environments through in situ and remote sensing, including robotic and autonomous technology. Novel techniques for metocean surveying and monitoring also provide validation for UHI-developed and client's numerical models across scales, including wave and hydrodynamic modelling. UHI has a track record in monitoring wave-current interactions and wave forecasting in energetic environments, essential for marine renewable energy installations to characterise turbulence and wave spectra, understand device/array effects, and calculate tidal and wave resource.



Environmental monitoring using multiple technologies, sensors & methodologies

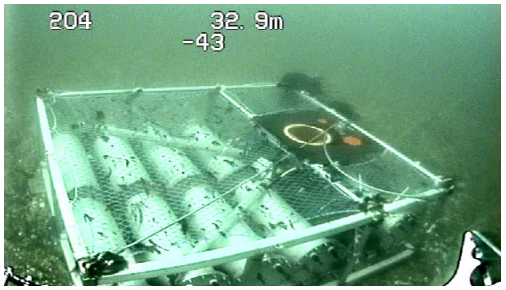
UHI develops and deploys novel yet proven multi-sensory platforms and conventional techniques for environmental monitoring of animal distribution and behaviour. This includes uncrewed aerial and underwater vehicles, specialised technology platforms (such as 'drifting ears' or seabed mounted active acoustic platforms), conventional vessel or vantage point surveys, and seabird GPS tracking and bio-logging. Applications range from baseline studies of animal distribution to inform EIA (fish, fish as prey, diving seabirds, marine mammals) through to cumulative impacts and post-consent monitoring of changes, device-animal interaction (e.g., disturbance, displacement, collision risk) and population consequences of predators targeting marine structures for foraging.

Marine faunal interactions with tidal, wave & future energy

Understanding interactions of marine fauna with wave and tidal energy is a significant research theme at UHI given the scale of marine renewable development planned over the next decade, the wide-ranging nature of many marine fauna species and the conservation status of many of their populations. Primary areas of expertise include the characterisation of fish behaviour and distribution in relation to flow conditions and devices, as well as quantification of marine mammal and seabird usage of high flow environments to understand environmental impacts like collision risk and habitat displacement. UHI also has a track record in understanding the acoustic footprint of marine devices and noise, and the impact of biofouling throughout operational deployment.

Marine governance, planning & decision-support tools

Expansion of tidal and wave energy relies on understanding key risks and opportunities at different scales and developing approaches to working with stakeholders to address legislative requirements effectively and efficiently. Uncertainty of impacts in the planning and consenting processes is a key challenge in expanding marine renewable energy developments, particularly given novel technology and consideration of cumulative impacts associated with the rapid expansion of the sector. Integration of UHI policy and governance expertise with cutting-edge research on key interactions (such as with marine mammals and birds) within UHI provides comprehensive decision-support capacity for wave, tidal and future energy. UHI also has expertise in developing GIS multi-criteria decision-support tools which bring together disparate data sets and consider data uncertainty to guide siting.



Socio-economic impact, community energy & carbon foot-printing

Integrating assessment of socio-economic impacts into planning and decision-making for tidal, wave and future energy is needed at all development stages of planning, leasing, consenting and for all project developments, including to establish 'social licence'. In addition, predicting and managing potential conflicts with other marine space users (e.g., with fisheries) and the potential benefits of co-location of wave, tidal and other sectors and activities such as aquaculture, other renewables, such as offshore wind/PV, into the marine renewable footprint are required. Lifecycle sustainability assessment and carbon foot-printing including social aspects is increasingly required to fully understand the socio-economic consequences of developing new projects.

Case Studies

FLOWBEC

The FLOWBEC project developed field-proven integrated marine instrumentation platforms and analysis techniques for concurrent bio-physical measurement across physical and trophic levels (fish, seabirds, marine mammals) with a focus on marine (wave and tidal) and offshore renewable energy sites. Six successful deployments across a variety of locations have resulted in several publications on changes to animal distribution and behaviour around renewable energy sites and devices.

V-SCORES

Marine current measurements are vital for tidal resource estimation and resilient design criteria for all Offshore Renewable Energies (ORE). In-situ measurements are costly, and retrieval of seabed mounted equipment is not guaranteed. Moreover, in many potential ORE locations globally, suitable field survey campaigns may not be viable. The aim of V-SCORES was comprehensive validation of unmanned aerial vehicle (UAV) techniques for surface current spatial mapping, demonstrated at tidal stream sites. Field campaigns were conducted at contrasting commercial sites (Pentland Firth, Scotland & Ramsey Sound, Wales) under different environmental conditions (wave exposure, operational turbines installed, etc.).

THE BRYDEN CENTRE

The Bryden Centre was a €9.4 million cross-border, renewable energy research centre funded by the EU under the Interreg VA programme covering Northern Ireland, Western Scotland and the Irish border regions. Bryden Centre research was aimed at harnessing the potential for Scotland, Northern Ireland and Ireland to become leaders in marine renewable energy.

Curriculum & CPD opportunities

UHI works with industry stakeholders and employers to create tailored sectoral provision across the supply chain, including Foundation, Modern and Graduate Apprenticeships, HNC/Ds, Undergraduate and Masters provision, Professional Development Awards and industry-specific CPD programmes.

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