EPSRC
Pioneering research and skills

energy technologies institute

IDCORE CASE STUDIES

ETI10 TEN YEARS OF INNOVATION 2007 – 2017

Contents

IDCORE - WHAT IS IT?

The Industrial Doctorate Centre for Offshore Renewable Energy (idcore) trains research engineers whose work in conjunction with sponsoring companies aims to accelerate the deployment of offshore wind, wave and tidal-current technologies. This is to help meet the UK's ambitious renewable energy targets.

Students undertake a four year full time course including time with a sponsoring company working on "real world" applications and research initiatives to obtain their doctorates.

IDCORE - THE PARTNERS

Funders – The centre is funded by the Energy Technologies Institute (an industry and UK Government partnership into low carbon energy) and the Engineering and Physical Sciences Research Council (the UK's primary agency for funding research in engineering and the physical sciences).

Academic partners / research facilities:

- University of Edinburgh
- University of Exeter
- University of Strathclyde

Programme partners – HR Wallingford (an independent research and consultancy in civil engineering, environmental hydraulics and the management of water and the water environment) & the Scottish Association for Marine Science (an independent marine science organisation delivering research and education to improve understanding and sustainable use of the marine environment).

Industrial partners / sponsoring companies

- Cefas
- EDF Energy
- E.ON
- GE & Alstom Energy
- Narec
- FloWave TT
- Tidal Energy Ltd
- Siemens/MCT
- Lloyd's Registrar
- TWI
- DNV GL
- Sgurr Energy
- Alba Turn

OFFSHORE WIND CASE STUDIES

Client: Offshore Renewable Energy Catapult

Idcore student: Michael Smailes

Project purpose: the design of a new hybrid high-voltage direct current transformer to be used in offshore wind farms

This project is focused on the design of a new hybrid high-voltage direct current transformer that can be located within the wind turbine blades themselves thereby eliminating the requirement of an offshore platform which in turn reduces production costs for offshore wind generation. It has been modelled that a new design of transformer has the potential to reduce the capital installation costs of a wind farm by 10-11%.

The project will test novel topologies (the arrangements of a network) before building a large scale prototype.

Client: EON

Idcore student: Gabriel Marsh

Project purpose: to undertake a structural load monitoring programme

This research project has developed the tools and methodologies necessary to conduct a structural load monitoring programme on turbines used in an existing offshore wind farm.

It has identified fatigue life extension capabilities for specific structural components on existing turbines. These are expected to have a significant and positive impact on the operations and maintenance costs for the remaining life of the turbine structures.

OFFSHORE WIND CASE STUDIES
Continued

Client: EDF Energy

Idcore student: Rebecca Martin

Project purpose : to conduct a sensitivity analysis of offshore wind operations and maintenance to identify their effects on both the cost and availability of offshore wind farms

This project is demonstrating how sensitivity analysis can be incorporated into software models to help easily identify which particular factors impact the operations and maintenance of a particular wind farm.

This information can then be used to reduce costs and/or improve availability for wind farms, helping to maximise profit margin for offshore wind operators.

Client: EDF Energy

Idcore student: Ajit C Pillai

Project purpose: integrating energy yield assessments and wake methodologies to both assess and optimise offshore wind farm layouts.

This project has developed a software tool to improve the design of offshore wind farm layouts. It has explored the sensitivity of the levelised cost of energy to the constraints of offshore wind farm design and established a methodology by which the value of some of the more subjective constraints can be better understood.

Its findings are being applied to real offshore wind farms currently being developed by EDF Energy and its parent company, helping to realise savings of over €10million through the optimisation of a farm's electrical infrastructure.

MARINE ENERGY CASE STUDIES

Client: European Marine Energy Centre & FloWave Ocean Energy Research Facility

Idcore student: Sam Draycott

Project purpose: to develop an enhanced menu of representative sea waters and full wave characterisation for use in wave tank test facilities

Using existing facilities from both the European Marine Energy Centre and the FloWave Ocean Energy Research Facility this project is helping increase operational understanding for tidal device developers by improving the understanding of how to generate more realistic directional complex sea states for testing purposes.

It is hoped that with advanced testing this will increase the confidence in the generation and validation of directional sea states in tank testing.

Client: Wave Energy Scotland

Idcore student: Anthony Gray

Project purpose: to create an operations and maintenance model to provide confidence when analysing the lifetime costs of a wave energy array

This project aims to create a Wave Energy Array operations and maintenance model to provide additional confidence in the analysis of the lifetime costs of a wave energy array.

There are four fundamental research areas as part of the project – reliability data, weather data, maintenance information and expected power output.

MARINE ENERGY CASE STUDIES
Continued

Client: Queens University Belfast

Idcore student: Laurie Wilkinson

Project purpose: assessing the viability of the modular flap concept for use in wave energy convertors

This project is seeking to assess the viability of the design of a modular flap concept as opposed to a rigid flap design in wave energy convertors. This is based around a device made up of individual flap modules that share a common foundation which may improve power capture, reduce foundation loads and ultimately become more cost-effective to install and manufacture.

The assessment of the design is through the use of physical and numerical modelling with the physical modelling being undertaken in wave tanks at Queens University Belfast.

“I have learnt many transferrable skills which have made me a better engineering professional”

Client: Alstom

Idcore student: Alberto Perez Ortiz

Project purpose: to improve the accuracy of a tidal resource assessment at a strait that is between an island and a landmass

This project is seeking to increase the understanding of the effects that energy extraction presents in the availability of tidal resources prior to the development of large tidal arrays.

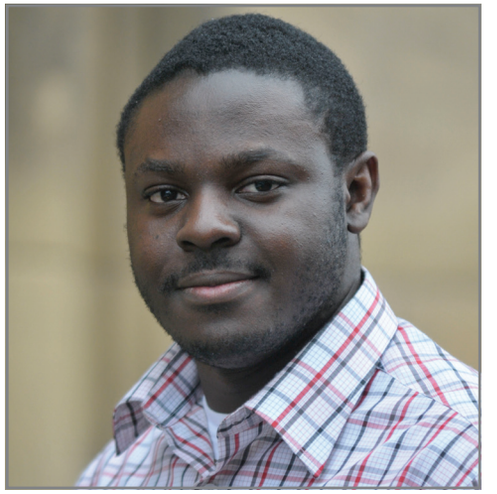
Focusing on straits between islands and landmass, the project is seeking to increase the accuracy in tidal resource assessments. This should improve the understanding of the interaction between energy extraction and the dynamics of the site flow. This will hopefully help tidal developers in their future site selection and array design to generate significant project cost reductions.

“The IDCORE programme has provided me with the skills and confidence to find solutions to a wide range of problems”

MARINE ENERGY CASE STUDIES
Continued

Client: Offshore Renewable Energy Catapult

Idcore student: Kwaku Ampea Karikari-Boateng



Project purpose: to develop and validate an accelerated life test plan for tidal turbine drivetrains

This project aims to develop and validate an accelerated life test plan for tidal turbine drivetrains to compress the 20 year life of a turbine into a testing programme that takes a few weeks to carry out.

It is hoped that by accelerating the testing process then the cost of the testing process can be greatly reduced, making the proposition more attractive.. At the same time, reliability can be demonstrated over the full life span of a turbine. This should ultimately, reduce operation and maintenance costs, increase the availability of turbines, reduce the cost of turbine insurance, help boost investor confidence and increase competition in the market.

“ Such close collaboration would be very difficult in regular PhD programmes ”

Client: Tidal Energy Ltd

Idcore student: Magnus Harrold

Project purpose: the development of a control strategy that allows a user to make predictive corrections to a tidal turbine’s default method of operations

This project seeks to develop knowledge that helps protect the operation of tidal turbines improving their reliability and fatigue life.

The project has developed the in-house engineering capability at Tidal Energy Ltd through the build of mathematical models, improvements in data acquisition, the development of post-processing and visualisation tools together with the formation of test procedures for turbine operations.

It is hoped the knowledge developed and shared will increase investor confidence in tidal stream technology moving forward.

“ The research project has allowed me to be involved in the full process of assessment of a new concept. This has taught me to balance details with achieving the project goals ”

For further information on Idcore:

Professor David Ingram

Institute for Energy Systems
School of Engineering
The University of Edinburgh

0131 6519022

david.ingram@ed.ac.uk

Energy Technologies Institute
Holywell Building
Holywell Way
Loughborough
LE11 3UZ

01509 202020
www.eti.co.uk
info@eti.co.uk
@the_ETI