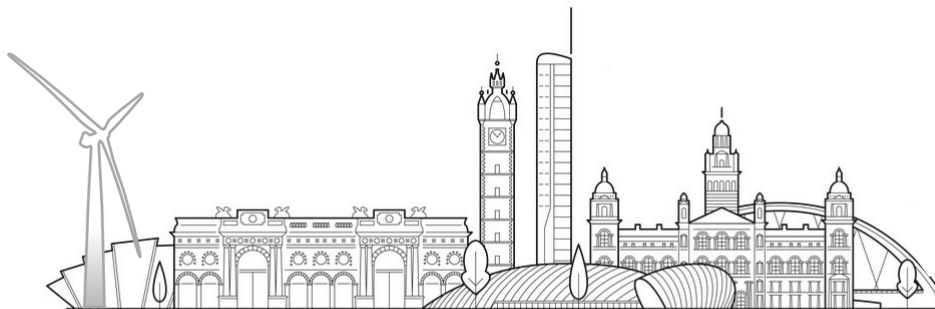


futureWind ²⁰¹⁹ & Marine



7th March 2019
University of Strathclyde,
Glasgow

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Welcome

“I’d like to extend you a warm welcome to futureWind&Marine 2019, the seventh annual conference of the Wind and Marine Energy Systems Centre of Doctoral Training (CDT). The conference committee have put in a lot of effort to ensure that today will be a success.

I hope that you find the variety of research discussed today interesting and enjoyable. Please talk to as many students as possible about their current research, future research interests and the activities that they are involved in outside their PhD work. For example the display from the CDT’s newly formed wind powered car team StrathWind Racing. I’d also like to draw attention to the back page of this brochure which has information on how to go about proposing mini-projects and PhD topics for the new cohort of CDT students.

Thanks go to our event sponsors today: Wood, Scottish Power Renewables, Atkins, Frazer-Nash and the Energy Technology Partnership for making today possible.”

George Elderfield, futureWind&Marine 2019 Committee Chair

Title Sponsor

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Additional Sponsors



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Programme

9:00	Registration	
9:30	Conference Open	
	◇	Welcome
	◇	Keynote address: Alan Mortimer, Wood
	◇	CDT Alumni perspective: Magnus Currie, EDPR
10:50	◇	Early research elevator pitches
	Coffee Break	
	Parallel session1	
11:10	Modelling	
	◇	Una Brosnan, Atkins
	◇	Oliver Tulloch, CDT
	◇	Alfred Cotton, CDT
	Market Analysis	
	◇	Matthew Hannon, University of Strathclyde
	◇	Alfred Alsop, CDT
	◇	Calum Edmunds, CDT
12:20	Lunch	
	Parallel session 2	
	Operation & Maintenance	
	◇	Robert Jones, Scottish Power Renewables
13:30	◇	Ciaran Gilbert, CDT
	◇	Sofia Koukoura, CDT
	Control	
	◇	Jonathan Samson, Frazer-Nash
	◇	Lindsey Amos, CDT
	◇	Gabriele Amico, CDT
14:40	Coffee Break	
	Final Session	
	◇	ETP poster award
	◇	Debate: “What will the energy landscape look like in 2030?”
15:00	◇	Closing remarks

Keynote Presentation

Alan Mortimer
Director of Innovation



Wind and marine priorities for industry-academia collaboration

Alan's presentation will cover the main challenging areas for wind and marine technologies where further development is essential to reducing cost, increasing reliability and in some cases environmental acceptability. The role of academia in addressing these challenges and identifying solutions will be discussed, and optimal means of collaboration between industrial and academic organisations.

Wood's clean energy business specialises in renewable energy and grid integration, providing engineering and technical advisory services that support the delivery of projects around the world. Our market-leading services and technologies provide engineering know-how to onshore and offshore wind, solar, wave and tidal and hydro projects.

Bio: Alan graduated from Glasgow University in 1987 with an Honours degree in aeronautical engineering. After four years at James Howden & Co. Ltd. in Glasgow he joined ScottishPower, working in renewables development. The company expanded to become the leading player in the UK wind market. His roles included Head of Wind Development where he developed the strategy for, and then delivered a wind portfolio including Whitelee Windfarm – which at 539MW is Europe's largest onshore windfarm.

In his current role at Wood, Alan is responsible for identifying new opportunities in renewables including advanced technologies and analytical approaches. This includes supporting the development of the latest generation of wind and tidal turbine technologies, reducing their costs and addressing operational challenges. Alan has also been responsible for establishing the company's industry-leading wind farm optimisation service. The innovation role is also extending Wood's capabilities in renewable heat and energy storage including clean hydrogen.

Presentations & Speakers

Úna Brosnan

Business & Strategy Development Manager



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Floating Wind and Disruptive Technology

In recent years we have seen unprecedented leaps in cost reduction for fixed bottom offshore wind however looking to the future with sights on cost parity and UK 2030 and 2050 targets we explore the emergence of floating wind and the technology disruptors in the offshore wind sector which have potential to shape our future.

Robert Jones

Lead Asset Performance Analysis Engineer



**SCOTTISHPOWER
RENEWABLES**

Data Driven Operation & Maintenance

An overview of how data analytics are key to ScottishPower Renewables' O&M strategy will be presented, including the innovation priorities and challenges currently faced in the industry. Additionally, how SPR is adopting a more data-driven approach to tackling these issues will be discussed.

Jonathan Samson

Senior Engineer



Wind Turbine Performance Analysis and Optimisation

This talk will present Frazer-Nash's capability within the Wind Energy sector, highlighting our underlying approach to work. To illustrate this in more detail a case study is provided on how FNC helped support Kohana Technologies Inc with their active aerodynamic control solution simulated on a 2MW wind turbine.

Presentations & Speakers

Matthew Hannon
Senior Lecturer



Markets for Emerging Technologies in the Energy sector

Matthew's talk will give a markets perspective of emerging technologies in the renewable energy sector; wave, tidal stream and floating wind. He'll also talk about the challenges these technologies face.

Matthew works as Senior Lecturer and Director of Research at the Hunter Centre for Entrepreneurship within the University of Strathclyde's Business School. His research examines the policy and market conditions necessary to accelerate low-carbon energy technology and business model innovation. He is Co-Investigator for the UKRI's £8m *Energy Revolution Research Consortium* on smart, locally led energy systems, and the UK Energy Research Centre's community energy finance project.

Additional speakers:

Welcome: George Elderfield, FutureWind&Marine committee Chair

CDT Alumni: Magnus Currie, EDP Renewables

Final year presenting PhD Students: Sofia Koukoura, Ciaran Gilbert, Oliver Tulloch, Alfred Alsop, Alfred Cotton, Calum Edmunds, Lindsey Amos, Gabriele Amico.

Debate

"Energy landscape by 2030 and the key challenges to overcome in getting there"

Chaired by Iain Dinwoodie - Natural Power and CDT alumni

Panel:

- ⇒ Robert Clayton - Wood
- ⇒ Richard Bellingham - University of Strathclyde
- ⇒ Stephen Salter - University of Edinburgh
- ⇒ Iain Jarvie - Atkins



Sofia Koukoura

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Wind Turbine Gearbox Diagnostics using AI and Condition Monitoring Data

Wind turbine drivetrains tend to fail before the end of the turbine's design life and their replacement increases downtime and maintenance costs. It is therefore important to foresee incipient faults before they become catastrophic failures. Various sources of data, can be used to predict failures and improve maintenance decisions. However, with an increasing amount of wind turbine data, manual interpretation becomes challenging and therefore AI can be used to make the monitoring process more efficient.

During the course of this PhD, condition monitoring data (including SCADA and vibrations) have been utilised to perform anomaly detection and fault diagnosis in wind turbine gearboxes. Domain knowledge and advanced signal processing have been applied to analyse fault signatures and extract appropriate condition indicators. The condition indicators are used in machine learning models which can inform about the health state of gearbox components and give an indication of potential failure modes.

The techniques developed can be used by wind turbine operators in a decision support system which optimises maintenance actions.

Bio: Sofia received her degree in Mechanical Engineering from the National Technical University of Athens in 2015. She then joined the University of Strathclyde Wind and Marine Energy Systems Centre for Doctoral Training. Her PhD focuses on diagnostics and prognostics of wind turbine gearboxes using signal processing and machine learning techniques. Sofia is open to industrial projects, give her data to play with!



Ciaran Gilbert

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Vessel Specific Access Forecasting for Offshore Operations

Access forecasting for offshore operations is critical to ensure safe transfer of maintenance technicians to and from offshore wind turbines and to maximize availability. Typically, scheduling decisions are made on the basis of single-valued (deterministic) forecasts of significant wave height and service contracts where transfers are expected to be attempted below a threshold significant wave height. However there is always uncertainty in a weather prediction which can be accounted for by probabilistic forecasts.

The goal of this work is to provide a vessel-specific access forecasting tool to predict the quality of a transfer accounting for uncertainty in the weather conditions. This is done via creating a data-driven vessel motion model which is supplied with future scenarios of the sea-state derived from Numerical Weather Predictions. Following this a forecast visualisation stage is presented to transform the data into actionable information for the forecast user.

Bio: Ciaran received an MSc in Sustainable Engineering with a speciality in offshore renewable energy in 2015. His research interests are in energy, access, and electricity price forecasting.



Oliver Tulloch

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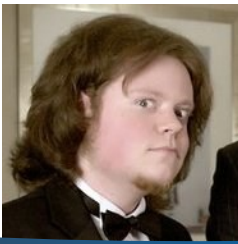
Development of Safe and Efficient Operation of an Airborne Wind Energy System — A Rotary Kite Design

Airborne Wind Energy (AWE) is a form of wind power where energy is harnessed using tethered wings. By using lightweight materials these devices can reach higher altitudes compared to current wind turbines. It is envisaged that AWE will lower the cost of wind energy and increase the number of locations where wind energy is economically feasible.

All AWE systems harness wind power at altitude. This power must be transmitted back down to the ground. This can be done mechanically or electrically. This PhD focuses on rotary AWE systems and their power transmission to ground. Working closely with Windswept and Interested Ltd. tensile rotary power transmission has been investigated.

Tensile rotary power transmission is where torque is transmitted over long distances using tensioned tethers held apart by rigid components. This is crucial to the future success of rotary AWE systems that wish to generate electricity on the ground. Housing the generator on the ground ensures that the airborne components are lightweight, a key advantage of AWE over conventional wind turbines.

Bio: Before starting the Wind and Marine CDT, Oliver received a MEng (Hons) in Mechanical Engineering from the University of Bath. His interest in sailing and wind surfing drew him to a PhD in airborne wind. Being slightly mad also helped.



Alfred Alsop

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Market Assessments for Small Wind Turbines for Rural Electrification in the Developing World

Approximately 1 billion people still have no access to electricity, most of which live in rural areas of the developing world. United Nations Sustainable Development Goal 7 commits the world to universal access to clean and affordable energy by 2030. In order to reach this goal a mix of technologies is required, allowing off-grid systems to benefit from diversity of generation. This talk will cover a three-step Market Assessment methodology developed to assess the potential for small wind to contribute to a country's rural electrification efforts. The developed methodology makes use of techno-economic and spatial modelling, expert elicitation and decision analysis techniques in order to quantify the market for small wind generation, along with recommendations for optimising the enabling environment.

Bio: Alfie graduated from the University of York with a Masters Degree in Astrophysics, joining the CDT in 2015. Since the beginning of his PhD research into small scale wind power he has been closely involved with Wind Empowerment, an international charity dedicated to promoting the use of small wind in the developing world. As a contractor for Wind Empowerment, Alfie conducted a national scale market assessment for small wind in Nepal in March 2018, in partnership with the Kathmandu Alternative Power and Energy Group (KAPEG) and the Alternative Energy Promotion Centre (AEPC). Outside of wind power, Alfie has also used the market assessment methodology to assist in solar micro-grid and electric cooking projects.



Alfred Cotten

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Performance Enhancement of a Jointed, Multibody Wave Energy Converted through Numerical Optimisation

There exist numerous designs for Wave Energy Converters (WECs) of a multibody design. Often entailing a large amount of degrees of freedom, the numerical models thus employed are often impractical for thorough optimisation studies. From an early stage, this can leave a considerable amount of uncertainty clouding the potential of these concepts, which can ultimately result in an underestimation of the merit of these types of concept, not to mention dissuasion of potential investors.

This PhD work builds upon the development of fast-running numerical models for jointed WECs, with application towards concept optimisation. Tailoring the optimisation approach towards these models also forms a large part of the work. The application presented here involves a bespoke genetic algorithm (GA), used to inform the future engineering design of a series of freely-floating, interconnected, sloped buoys. In addition to maximising power generation, a multi-objective version of the algorithm enables consideration of the forces on the joints, aiming to encapsulate the required level of maintenance costs without detailed cost metrics or empirical data.

Bio: Alfred obtained an MSci in Mathematics and Physics from the University of Bath. Prior to joining the CDT, he spent eighteen months before joining the CDT working in a lively secondary school and sixth form physics department.



Calum Edmunds

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Increasing participation of wind in GB reserve markets with lessons learned from Spain

To maximise renewable penetration at lowest cost, wind energy has a large potential to provide ancillary services in the future. Energy based subsidy mechanisms discourage renewable generators from providing these services. This talk outlines reserve markets in GB and makes recommendations for increasing provision of reserve from wind using lessons learned from Spain.

Key recommendations include moving from an energy to a capacity based subsidy for wind energy remuneration when providing reserve, Improving accuracy of wind farm output estimation to reduce error in curtailment payments in the GB capacity market, allowing mixed portfolio bids for operators to hedge risk during low wind output and allowing participants to stack reserve product offerings to maximise returns.

Bio: Calum graduated with the M.Eng. in Chemical Engineering with Energy Engineering from Heriot-Watt University. He has worked as a Process Engineer in fine chemicals and the energy industry. His research interests include optimal power flow, electricity markets and system balancing.



Lindsey Amos

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StrathFarm: A Control-Oriented Dynamic Wind Farm Simulation Tool

PhD Topic: Optimising structural loads of wind farm turbines through the application of wind farm control.

Wind turbine wakes generate the aerodynamic/mechanical coupling of wind turbines within a wind farm. A central wind farm controller, communicating with wind turbine power adjusting controllers, could influence the coupling.

Potential reductions in cost of energy through optimising wind farm power and structural fatigue loads underpin the motivation of this PhD research, and to design and analyse wind farm control algorithms in this context requires a control-oriented dynamic wind farm simulation tool.

The development and description of the wind farm simulation tool “StrathFarm” will be presented, alongside fatigue load analysis and discussion on the future potential of the tool.

Bio: Before joining the CDT Lindsey worked as a Senior Simulation and Modelling Engineer for Red Bull Racing Formula 1 Team (2008-2015).

She holds a MSc in Advanced Computational Methods for Aeronautics, Flow Management and Fluid-Structure Interaction from Imperial College London, and a BSc (Hons) Mathematics from University of Southampton.



Gabriele Amico

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Mitigation Techniques to Overcome the Cable Due Electrical Resonances in Wind Farms

One of the challenges of integrating wind farms into power networks is in the stability of the interconnection. The employment of power converter based technologies in such renewable energy systems curbs the stability performance of the turbine controllers, especially in those scenarios where long cables are used, for example in remote installations or in AC connected offshore wind parks.

This work investigates the problem of the wind farm resonances typically occurring in the range from 200Hz to 1kHz and mainly attributed to the shunt capacitance of the cables within the collector system of the wind farm. The purpose of the research is the identification and the concomitant experimental validation of portable mitigation techniques able to improve the stability of the turbine controller against the presence of the above-mentioned resonances.

Bio: Gabriele received a degree in Electronic Engineering from the Polytechnic University of Milan. Then, after several years working in the Oil & Gas industry, he undertook a MSc in Wind Energy Systems from the University of Strathclyde, before going on to start the CDT.



Bartosz Soltowski

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Smart Control System for the Bottom-Up Electrification in the Developing World

Over the past 20 years, off-grid systems have proved the most popular and immediate solution increasing energy access, mainly through rural electrification, across the Global South giving access to basic electrical appliances. Although deployed in significant numbers, issues remain with its cost, reliability, utilization, sustainability and scalability.

Interconnection of existing stand-alone systems using proposed controller to form a microgrid of connected prosumers and consumers may offer a solution that, by employing smart management of the power distribution amongst connected households, has the potential to unlock latent generation and storage capacity and so improve reliability and security of supply, reduce the system cost per head, and ultimately the levelized cost of energy supplied.

Unfortunately Bartosz cannot attend FutureWind&Marine 2019 to present his PhD research, if you are interested in his work, please contact him directly.

Bio: Bartosz studied an MEng in Electrical Energy Systems. He has previously been involved in 'Smart Grids' projects in Poland, France and Singapore. Currently a PhD candidate developing control systems and hardware for decentralised DC microgrids in the Developing World.



Ifeoluwa Garba

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Investigation into the Impacts of Optimised Energy Policy and Energy Business Models on Sustainable Development in Developing Countries

Adequate energy services are crucial for sustainable development and are vital for ensuring a good quality of life for people: this has led to increased interest and attention in the area of energy sectors. Yet, studies investigating the impact of adequate energy services on sustainable development in the developing regions are few.

Previous strategies and approaches to eradicate the absence of adequate energy services (energy poverty), have failed to accomplish set goals. One of the arguments for this has been the lack of understanding of the problem; a contributing factor to the lack of a comprehensive definition and quantification framework for the issue. To combat this problem, which the International Energy Agency predicts will increase by 2030 if not addressed, a better understanding of the energy services in the most deprived regions is necessary.

This research uses statistical modelling to quantitatively analyse the impacts of the lack of energy poverty on sustainable development indicators (set by the United Nations). This is used to propose a universal definition for energy poverty, as well as develop a novel framework which can be used in quantifying the issue.

Unfortunately Ife cannot attend to present her PhD research, if you are interested in her work, please contact her directly.

Bio: Ife graduated from Glasgow Caledonian University with a B.Eng. in Computer and Electronics System Engineering (CESE).

Resource & Environment Assessment



Offshore Low Level Jet Contribution to Wind Turbine Fatigue

George Elderfield — george.elderfield@strath.ac.uk



Assessing the Cumulative Environmental Impacts of Offshore Windfarms in the North Sea

Rebecca Hall — Rebecca.hall@strath.ac.uk



Forecasting and Analytics for Frequency Response from Wind

Leo May — leo.may@strath.ac.uk



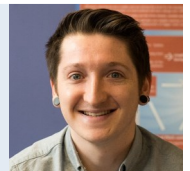
Capturing and Parameterising the Special and Temporal Variation of Combined Wave-Current Turbulent Inflow Conditions for Marine Renewable Energy Applications

Marilou Jourdain de Theulley — Marilou.jourdain@ed.ac.uk

Materials

Degradation of Blade Coatings due to Weathering and Rain Erosion

Grant Leishman — grant.leishman@strath.ac.uk



Computational Modelling of Leading Edge Erosion of Turbine Blades by Droplets and Solid Particle Impact

Kinan Bezem — kinan.bezem@strath.ac.uk



Operation & Maintenance & Condition Monitoring



Machine Learning in Wind Turbine O&M

Conor McKinnon — conor.mckinnon@strath.ac.uk



Predictive Wind Turbine Generator Bearing Failure

Alan Turnbull — alan.turnbull@strath.ac.uk



Wind Turbine Condition Monitoring: Experimental Validation of a Thermal Network Model

Becky Corley — becky.corley@strath.ac.uk

Electrical

Design of Inverter Controllers for Unstable Grids

Mathieu Kervyn — mathieu.kervyn@strath.ac.uk



Offshore Array Cable Optimisation Using Energy Storage

Peter Taylor — peter.taylor@strath.ac.uk



Application of Wind-Bandgap Power Semiconductor in Wind Energy Power Converter

Marlee Basurto — marlee.basurto@ed.ac.uk



New Concepts



Morphing Blades for Passive Load Control of a Tidal Turbine

Gabriele Pisetta — gabriele.pisetta@ed.ac.uk



Magnetic Continuously Variable Transmission

Adam Harris — adam.harris@ed.ac.uk



Electrical Infrastructure and Control Design of Multi-Rotor System (MRS) Turbines

Paul Pirrie — paul.pirrie@strath.ac.uk

Load Analysis

Design of Advanced Wind Turbine Controllers

Nicola Grieve — nicole.grieve@strath.ac.uk



Modelling of Wind Turbine Main Bearings

James Stirling — james.stirling@strath.ac.uk



Investigation and Assessment of the Benefits for Power Systems from Wind Farm Control

Matthew Cole — matthew.cole@strath.ac.uk



Wind and Marine Energy Systems CDT

The Centre brings together the leading UK research groups in Wind energy at Strathclyde University and Marine energy at Edinburgh University.

The overall aim of the Research Centre is to meet the needs of the **fast growing wind and marine energy industry** by providing high calibre PhD graduates with the specialist, generic and leadership skills necessary to lead future developments in wind and marine energy systems.

A formal programme of training and research is completed to develop and enhance students' **technical interdisciplinary knowledge**, and broaden their understanding of the social, political and economic contexts of wind power and marine energy systems.

The CDT is the only academic centre with an accredited graduate scheme for achieving chartered status by both IMechE and IET, administered by students through their Professional Engineer Training Scheme (PETS).

With expertise unrivalled in the UK, the Centre's multi-disciplinary research teams are working closely with industry to help develop its global position in the field and meet ambitious **renewable energy targets**.

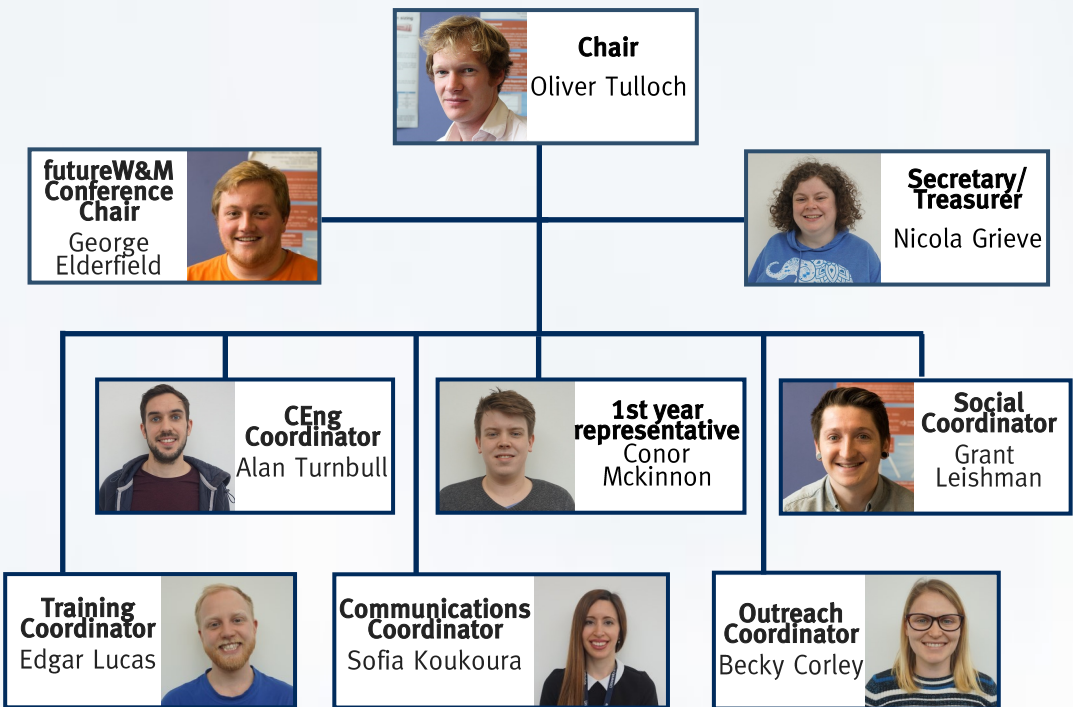


Professional Engineers Training Scheme

The Professional Engineers Training Scheme (PETS) CDT helps students to develop a wide skill set, including competencies in areas out-with their PhD research.

The scheme is overseen by the PETS Committee, a body of 9 CDT students elected each year at the PETS AGM in March. The PETS committee is integral to the students’ experience while at the CDT.

Being elected to a role on the PETS committee is valuable for students because it offers unique opportunities to gain chartership competencies in areas which would normally be difficult to obtain in a research environment, such as team management and leadership skills.



CDT Success

We would like to share with you our CDT achievements and successes from over the last year.

Wind and Marine Energy Systems CDT Wins Green Energy Award

The Wind and Marine Energy Systems CDT won the “Contribution to Skills” award at the Scottish Renewables Green Energy Awards 2018.

The CDT beat off three other finalists to win the award, as over 100 students have been trained in the centre, to become tomorrow's energy leaders. Over 70% of the students go into the renewable energy industry after completing their PhD.



Professor William Leithead, Director of the CDT, accepted the award on behalf of the centre, and was joined by CDT students and staff.



Reaccreditation for CDT Chartership

This year the CDT was reaccredited for its engineering chartership scheme by both IET and IMechE for a further 4 years. This provides recognition that during the 4-year studentship, students will gain much of the skills and competencies required to become a chartered engineer. This is through both exceptional research and access to a variety of opportunities designed specifically for continuous engineering professional development. The CDT is the only academic centre to hold this accreditation.

**Institution of
MECHANICAL
ENGINEERS**



CDT Success

International Research Between Industry and Academic Institutions

Sofia Koukoura, CDT student, had both an industrial and an academic visit this year, in two leading institutions of the wind energy field. She spent a month in Ørsted in Denmark working on with the vibration analysis team on the development of AI solutions for diagnostics.



She also returned to National Renewable Energy Laboratory (NREL) in US.A to work on SCADA data analysis. The collaboration with the two institutions is still ongoing and solutions for optimised O&M of wind turbines are being explored!



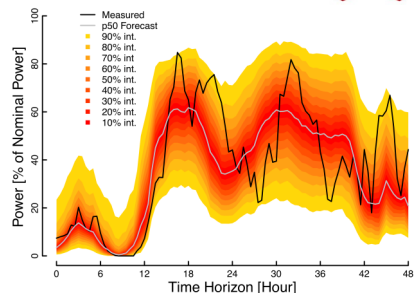
In September, Sofia was one of the 10 PhD students selected worldwide to take part in the Prognosis and Health Management Society's Doctoral Symposium. An opportunity for PhD students to present their work to a panel of experts and get feedback.



Research Collaboration in Energy Forecasting



CDT student Ciaran Gilbert recently spent three months as a guest at the Danish Technical University working with Professor Pierre Pinson at the Energy Analytics & Markets group. Here he worked on a project evaluating the benefit of using ultra-high resolution weather models in wind power forecasting at the Danish wind farm, Horns Rev I.



The research visit was supported by the Anglo-Danish Society and the Energy Technology Partnership.

CDT Success

Small Wind Leads to Big Things



PhD student Alfie Alsop's research is closely linked with the charity Wind Empowerment (WE), an international network of small wind practitioners with the common goal of developing and advocating for the use of small scale wind generation in appropriate contexts. In 2017 Alfie was elected to the WE executive board and also works as a research contractor.

In March 2018 Alfie travelled to Nepal to work with the Kathmandu Alternative Power and Energy Group to conduct a National Market Assessment for small scale, off-grid wind turbines for rural electrification. The Market Assessment project aimed to map the country and identify potential areas for small scale wind implementation.



As part of WE's conference in India, Alfie contributed to an international training course provided by the National Institute of Wind Energy in Chennai. They provided a training course on how to build small wind turbines and showcased some productive uses.

Funding Award Success for Innovative Business Concept

CDT student, Bartek Soltowski and Future Power Networks CDT student Jonathan Bowes have won the prize for Best Student Team at the IEEE Empower a Billion Lives Competition. The team have previously won an number of other funding awards.



The team secured funding to test their innovative solution for widening energy access in developing countries in a remote Rwandan village later this year. Their solution - a smart power controller for distributed microgrids - utilises excess solar generation to create local peer-to-peer energy networks in under the grid communities.

The team will present their field trial results at the Global Final, held in Baltimore in late September, as they compete with regional champions from Asia, Africa and the Americas for a share of the grand \$1,000,000 prize fund.

CDT Success

Student Contributes to RealTide Project

During CDT student Marilou's mini-project (and now PhD), Marilou was part of the RealTide project. This involved working with many European partners, in particular the French tidal developers Sabella.

In the project, the team from University of Edinburgh is in charge of the site data acquisition, with novel instrumentation. This feeds into high resolution hydrodynamic models. Marilou and the team went to Brest in August to install turbine mounted sensors, and they will return this summer to deploy a seabed frame with more instrumentation.



CDT Students Leading the Way in Diversity & Inclusion

The CDT has expanded its efforts to increase diversity and inclusion (D&I) within the university and wider engineering community. Central to this effort are our outreach activities to school and museums. This year we ran 16 events, reaching over 700 young minds.

CDT students have published a report which documents their learning to date with regards to approaches to improve D&I and makes recommendations for next steps. These recommendations are currently being discussed with university HR to explore how lessons learned might benefit the wider university in terms of policy and practice.

Additionally, we are launching 'Strathclyde Game Changers', an internship program designed to open up research to a wider audience. This summer we have three fully funded 6 week placements during which interns will contribute to research projects being undertaken at the university.

CDT students and staff are part of the Electronic and Electrical Engineering department D&I working group, who are working towards Athena SWAN reaccreditation, recognising commitment to advancing women's careers.

Funding for the Centre for Doctoral Training in Wind and Marine Energy Systems and Structures

In February the CDT won £6m funding from the Engineering and Physical Sciences Research Council (EPSRC) for another 5 cohorts of students, allowing us to recruit and train 70 more doctoral students.

This new centre joins together two successful CDTs – Wind and Marine Energy Systems and Renewable Energy Marine Structures – along with their industrial partners. It is a collaboration between the universities of Strathclyde, Edinburgh and Oxford, which will create a comprehensive, world-leading centre covering all aspects of wind and marine renewable energy, both above and below the water.

It will produce highly skilled industry-ready engineers with multidisciplinary expertise, deep specialist knowledge and a broad understanding of whole-energy systems. Our graduates will be future leaders in industry and academia world-wide, driving development of the offshore renewable energy sector and helping to deliver the Government's carbon reduction targets for 2050. This will help ensure that the UK remains at the forefront of this vitally important sector.

An important aspect of the centre's plans is the involvement of a large number of industrial partners. 23 of the studentships will be funded by industry with support from Armour Edge, Atkins, Atlantis, Eire Composites, EON, Fraunhofer IWES, Fugro, Orsted, Ramboll, Siemens Gamesa Renewable Energy and Wood. The remaining studentships have been committed by the EPSRC and the three universities.



Funding for the Centre for Doctoral Training in Wind and Marine Energy Systems and Structures

Siemens Gamesa Renewable Energy (SGRE) will co-fund two PhD fellowships each year starting from 2019 to 2023, with the recipients completing their PhDs in areas closely aligned to its research priorities. Steffen Frydendal Poulsen, SGRE's Head of Technology Development, said: *"We are very much looking forward to partnering with the new Centre for Doctoral Training. Many of the research areas in the University of Strathclyde are aligned with SGRE's pioneering research interests."*

The new CDT includes academic investigators whose teams are at the forefront of:

Geotechnical design	Chris Martin Byron Byrne	Oxford
Offshore renewable energy fluid dynamics	Richard Willden	Oxford
	Venki Venugopal Ignazio Viola	Edinburgh
Composite material technology	Conchur O'Bradaigh	Edinburgh
Powertrain technologies	Alasdair McDonald	Strathclyde
Condition monitoring and machine learning	James Carroll	Strathclyde
Wind turbine and farm control	William Leithead	Strathclyde
Structural integrity of offshore structures and floating wind	Fergal Brennan	Strathclyde
Risk and asset management	Athanasios Kolios	Strathclyde

The team are currently working towards recruiting the first cohort of students in October 2019.

Call for Research Proposals

Mini-Projects:

Each 1st year student carries out 2, 8 week mini-projects which run towards the end of the training year. This helps the students to get a flavour of different areas of research.

Call for proposals: 1st project—**April 2019**. 2nd project—**June 2019**.

PhD:

PhD topics are pitched to students in August September, after their mini-projects.

Call for proposals: **June 2019**

The CDT has an open environment, designed for and encouraging of interaction with industry and other academic institutes. The PETS committee are always looking for speakers to come in and share their expertise with our students, and in return will endeavour to make the trip as valuable as possible for our visitors.

If you are interested in joining or working with the CDT, please contact the CDT Administrator, Drew Smith
drew.smith@strath.ac.uk.

Visit us online “Wind and Marine Energy Systems CDT”.

