Durham University

Inspiring the extraordinary

Durham Energy Institute Review:

Energy, Science and Society

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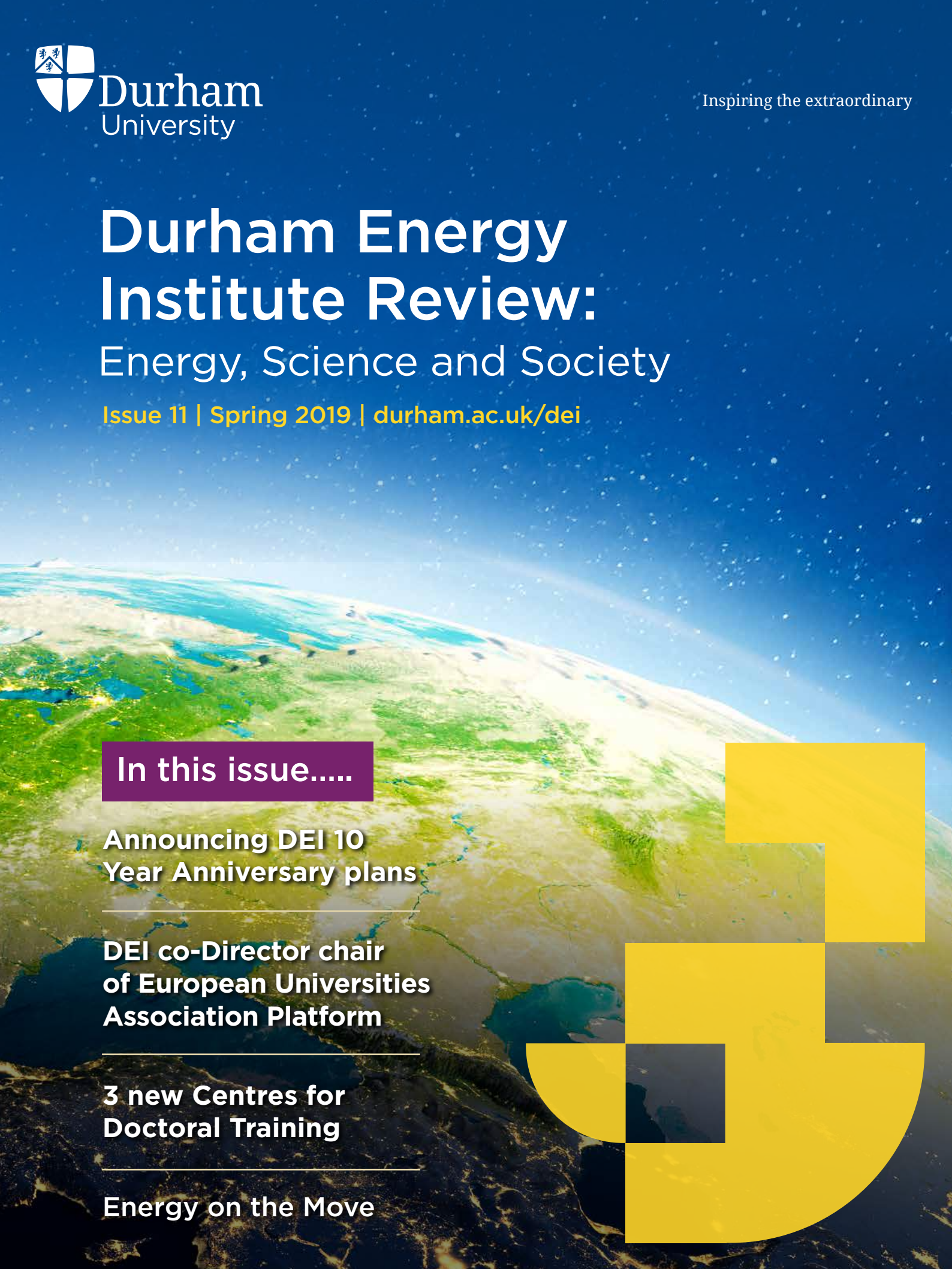


In this issue.....

Directors Message DEI Review 2019

It is my pleasure to present a new issue of the DEI Review magazine.

The past 6 months have seen an enormous amount of activity at DEI and some great successes. At the start of the year I had the great honour to be interviewed as part of the Business Debate in Davos. This is a thought-leadership series organised by Reuters to coincide with the World Economic Forum.

I took the opportunity to highlight the importance of University-Business collaboration to tackle global energy challenges and used our excellent strategic partnership with Ørsted in the offshore wind as a key example of the great impacts these collaborations can have. I also stressed that although great strides have been made in developing and introducing sustainable technologies there is still much more we need to do. A key area that has not had enough emphasis to date, particularly in the UK, is the need to decarbonise heat – by reducing waste heat from industrial processes and buildings, using our indigenous heat resources and re-using waste heat innovatively.

This was a significant opportunity for Durham University to showcase its world-leading research and impact on the global stage.

This month saw the announcement that co-Director Douglas Halliday has been given the honour of chairing the Energy and Environment Platform for the European University Association. This builds on the wonderful work Douglas has been doing with EUA and EU SET-Plan over that past few years championing multidisciplinary training, research and perspectives in energy. It is also a great indicator of how the UK will continue to be important in pan-European research collaboration regardless of what happens with Brexit. We look forward to hosting the next platform in Durham in September which will bring more than 100 leading energy experts from across Europe to our campus.

We have also recently announced the wonderful news that we have been successful in securing funding for two new Centres for Doctoral Trainings in energy – one focused on Wind energy emerging from our partnership with Ørsted, Siemens and Universities of Hull, Sheffield and Newcastle; and the other focused on Energy Materials which builds on our partnership with Newcastle and Northumbria Universities. These centres mean funding for a number of new PhDs in these areas and enables us to continue to deliver well trained, high quality engineers and scientists into the regional, national and international energy markets.

It is also my pleasure to announce the start of the DEI 10th year anniversary celebrations! It is amazing to think that 10 years have passed since DEI began. I remember my discussions with Richard Davies when he was developing the idea of an Energy Institute at Durham we were leading a field trip in Dorset and spent the night in a very cold caravan. The chill of the evening did not dampen the opportunity that both Richard and I saw emerging for Durham University and indeed DEI was in the back of my mind when Durham University subsequently approached me to tempt me from industry to academia.

We have some exciting plans for this year including a new 'Perspectives and Working paper series', Podcast series, a special issue of the DEI Review showcasing the research highlights over the past 10 years, a special roving exhibition – Durham Energy in 10 objects, as well as exciting series of events we look forward to seeing you at. Watch this space!

If you are interested in exploring collaborative opportunities with Durham Energy Institute please do get in contact.

We have a wide a range of energy expertise covering the social and technical aspects of energy, as well as a large cohort of high calibre students who are keen to undertake projects in collaboration with industry and policy.

The film of my interview is now live on the Reuters website at reuters.com/brandfeatures/business-debate/energizing-the-future

Find out more about our work on heat at durham.ac.uk/dei/research/geothermal

DEI News

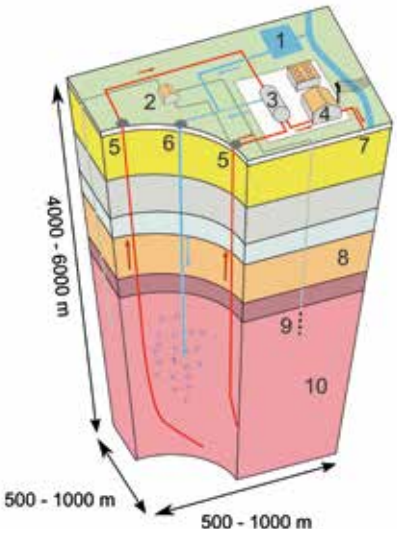
New DEI Associate Fellow – David Saddington

DEI invited David Saddington to join the Institute as an Associate Fellow based on his previous work and support for DEI while studying his Risk Masters at Durham. David is now Senior Executive Officer at BEIS where he is working on the future of the EU Emissions Trading System (ETS) post EU Exit. David is also leading work on climate change public engagement & education for BEIS. This builds on his extensive work in this field including organising climate change debates, public engagement events and film screenings while at Durham.

David is a frequent international public speaker on climate change who has given three TEDx talks and spoken in over 15 countries. David has shared the stage with heads of state and CEO's and talked at venues from the Hong Kong Science Museum to a conscious beach festival in Ibiza. His TEDx talk ' Why I Don't Care about Climate Change' is one of the most watched climate talks on Youtube. He is also a regular on BBC and LBC radio discussing contemporary climate & energy issues and he is a blogger for Huffington Post and Susan Rockefeller's sustainable living platform - Musings.

In 2015 David was invited by the United Nations to support the historic climate conference in Paris. In the years since he worked as a consultant for Ricardo Energy & Environment to help governments turn these high level climate change pledges into implementable policies. David is also a 'Goalkeeper' for the Bill & Melinda Gates foundation initiative to advance the implementation of the United Nations Global Goals for Sustainable Development.

Find out more about David's activities and our other Associate Fellows at durham.ac.uk/dei/aboutus/associate.fellows



DEI Geothermal work included in BEIS innovation map

The Durham Energy Institute's (DEI) work on geothermal energy has featured on an interactive map showcasing innovation across small businesses and organisations in the UK.

The map, produced by the Department for Business, Energy and Industrial Strategy, gives a snapshot of activity relating to the UK government's Industrial Strategy.

The Industrial Strategy is a long-term plan to boost productivity and earning power of people throughout the UK.

Heat accounts for half the UK's energy demand and Durham University research estimates the UK's range of geothermal resources could supply heat to the UK for over a century.

One opportunity investigated by DEI is the potential to use heat from water in flooded abandoned mines in County Durham and across the UK.

DEI has also worked on geothermal potential from ageing and abandoned oilfields, cave (karst) systems, deep sedimentary basins and naturally fractured granites, in the UK and with international partners in areas such as Tanzania and Kashmir.

View the Department of Business, Energy and Industrial Strategy's interactive map story.mapme.com/industrial-strategy-uk-innovators

Lynn Gibson, DEI Administrator, nominated as one of Durham's Women Making a Difference.

International Women's Day is a global day celebrating the social, economic, cultural and political achievements of women. Durham has an incredible history of women making a difference to the University community as well as the wider, international community in which we work. Each year Durham University celebrates the achievements of current staff and students as nominated by their peers. These women have made a difference in their professional field, or to the wider community.

Lynn goes out of her way to support the researchers and students in the Durham Energy Institute network, going far beyond her core administrator responsibilities. She also works tirelessly in the community supporting the Durham Miners Association and a range of Community Groups and activities in Spennymoor. She was one of the founding members of the Durham Women's Banner Group which aims to support and celebrate all women in their roles within trade unions, politics and communities and promote equality, fairness, recognition and camaraderie. It was the first all-female group to be recognised as an official banner group by the Durham Miners' Association. Lynn coordinated the Durham University contribution to the group's patchwork banner representing women from across the region which was marched in the Miners Gala in 2018. Two patchwork panels were created by women from Durham Energy Institute representing Women in Energy and Women in Education in relation to Durham University.

Alan Lowdon at NREL's Industry Growth Forum

DEI Advisory Board Chair Alan Lowdon is a reviewer for National Renewable Energy Laboratory's (NREL) Industry Growth Forum (IGF) in Denver in May. It seeks to match energy industry start-ups with early stage investment and there have been 170 applications this year.

Alan has been reviewing applications and is one of a panel of judges meeting in May for the main event. Professionals will also get the opportunity to meet Alan one-on-one as part of the Emerging Markets and Industry Growth Forum networking sessions. Alan Lowdon is looking at identifying IP-rich, high-growth-potential cleantech start-ups to establish a U.K. presence via the U.K. Government's flagship Global Entrepreneur Program, for which he is one of 17 Dealmakers.

DEI Berwick Energy Conference

DEI were invited by the Berwick Educational Association to provide a conference on the past, present and future of energy. The conference was led by DEI Executive Director Professor Jon Gluyas, with support from Professor Andy Aplin (Earth Sciences), Dr Douglas Halliday (Physics), Dr Adrian Green (History), Dr Charlotte Adams (Earth Sciences & Engineering) and Dr Andrew Crossland (Infratec).

The day started with an overview of energy – what it is and how it is used, followed by a session on the past, present and future of energy. The afternoon included lectures on the consequences of energy, in terms of rural development and environmental impacts, and finished with a local Berwick Case Study, considering heat, transport and power use in the context of the town and adjoining rural area.

Selected meetings

- DEI Director Jon Gluyas presented to **Parliamentary Group for Energy Studies** on 'How to secure the UK energy supply and save the planet' and was interviewed as part of the **Reuters Business Debate for the World Economic Forum.**
- Charlotte Adams took part in the prestigious 2019 **Bryan Lovell Meeting of The Geological Society** discussing UK Geothermal Energy.
- Alan Lowdon presented to **National University of Singapore**, Energy Studies Institute on Offshore Wind.

DEI 10 Year Anniversary Celebrations

2019 marks the 10 year anniversary since DEI was created. A lot of research, activity, outreach and collaboration has been achieved in that time. This is a great opportunity to celebrate all these achievements and to remember some of the key highlights.

DEI was born in 2009 out of the realisation that energy challenges cross conventional discipline boundaries and that new ways of thinking about and conducting energy research are required.

A key focus of DEI activities over the past 10 years has therefore been to connect energy research from different disciplines within the university and the wider energy sector. It was one of the first energy centres to focus on building true multidisciplinary research – not just between Engineers and Economists but also with Anthropologists, Geographers, Physicists, Chemists, Biologists, Philosophers, Law researchers etc.

We have also had a strong emphasis on developing collaborative research through partnerships with industry, policy and community organisations ensuring our research is relevant, effective and achieves maximum impact in the Energy sector.

DEI has now grown into an internationally leading institution, recognised for its ability to apply new methods and perspectives to existing and emerging energy challenges.

To celebrate the 10 year anniversary we plan:

- **DEI Podcasts** – chats with our key researchers and associates about their research and activities
- **DEI Perspectives series** – accessible articles with academic insights on emerging energy issues and research
- **DEI Symposium** – Celebrating 10 years of Society and Energy research
- **Roaming exhibition** – The History of DEI in 10 Objects
- **Celebration event** bringing together all the people who have contributed to DEI's success over the years
- **Special 10th Anniversary issue of DEI Review** – showcasing key research and collaboration highlights from the past 10 years as chosen by the DEI community

Nominate your key DEI highlight or achievement over the past 10 years!

Get in contact with your suggested DEI highlight, achievement or publication by email to evelyn.tehrani@durham.ac.uk

or @DEI_Durham and #DEIhighlights

or on @DurhamEnergyInstitute

or DEI Group linkedin.com/groups/4992133

Energy Events @ Durham

Find out more at durham.ac.uk/dei/events

EUA Energy and Environment conference at Durham 23 to 24 September

In September 2019, Durham Energy Institute will host the EUA Energy and Environment "Clustering Event", bringing together leaders from European Universities at Durham University to discuss topics such as energy transition, education, and climate.

Specific topics will include the Education 2030 Agenda, the Sustainable Development Goals and the United Nations Conference of the Parties.

For more information go to DEIs event pages durham.ac.uk/deievents or email Lynn Gibson via lynn.gibson@durham.ac.uk.

Student Energy Summit 2019 – Breaking Barriers 17 to 20 July

DSES and Durham Energy Institute are working with Imperial College London to organise the 2019 Student Energy Summit event that brings together the world's most enthusiastic students to learn and discuss the current issues and trends in energy.

SES has been hosted previously with great success in Canada, Norway, Indonesia and Mexico.

SES 2019, Breaking Barriers, will empower students to transform the energy industry and create a more sustainable and inclusive future. The Summit will be a one-of-a-kind experience where interaction, innovation and inspiration will unite, empowering everyone to shape the future of energy.

The International Student Energy Summit 2019 is an interdisciplinary summit created for students by students and brings together 650+ young energy leaders from over 100 countries as well as renowned energy experts from across the globe. The programme encompasses industry & technology, society & environment, markets & finance, and youth empowerment.

It will take places from the 17th – 20th July 2019 at Imperial College, London.

The vision for SES 2019 is an event that will build on the success of past conferences and inspire students to play a role in transitioning the world to a sustainable energy future.

The Summit encourages delegate engagement and attendees will not be silent spectators of the play, but actors on stage, speaking up and taking action. Delegates will also have the opportunity to shine in front of +50 leading companies spanning different sectors and industries. A blend of panels, workshops and a recruitment fair will give delegates many opportunities to build a strong network, gain valuable insights, and build skills alongside the companies attending the Summit.

DEI has been awarded 12 bursaries for Durham students which will be distributed via an essay writing competition. The bursaries are valued at £1,700 each made up of £1,300 funding from Student Energy and £400 from DEI to cover registration, accommodation and food for the duration of the summit.

Read the programme for the event and book your place at studentenergysummit2019.com

2 May – **Colonial implications of renewable energy developments in Western Sahara** - Joanna Allan seminar

30 May – **Remotely operated ground engaging vehicles for subsea renewable power infrastructure** - Ralph Manchester, Royal IHC seminar

12 June – **Public Lecture on Geothermal Mine Energy** - Jeremy Crooks - Coal Authority

26 June – **Research Generator lunch with Durham's Centre for Cultural Ecologies** – 'Geopower - Bio/Energy'

27 June – **Energy Transitions in Least Developed Countries** - Feisal Rahman seminar

17 to 20 July – **Student Energy Summit 2019** @ Imperial College - an interdisciplinary summit created for students by students bringing together 650+ young energy leaders from over 100 countries as well as renowned energy experts from across the globe

We are the wave of change that is taking the energy world by storm

SES 2019

23 to 24 September - **EUA Energy and Environment cluster event** – this event will bring over 100 senior Energy experts from Universities across Europe to Durham to discuss topics such as energy transition, education, and climate change.

25 September - **DEI Annual Research Symposium** - Ten Year Anniversary Celebration

29 to 31 October - **Celebrate Science** - another fun-packed and fascinating 3days of FREE children's events, activities, workshops and experiments celebrating science! DEI will have its usual stall with interactive activities about solar, wind and hydro energy. Last year there were over 5000 visitors to the marquee and we made over 600 windmills! **durham.ac.uk/celebrate.science**

October - **Energy jobs showcase** – a DEI and Student Energy Durham collaboration allowing students to find out about employment opportunities in the energy sector and for local and national companies to recruit the best graduates.

October - **UK Magnetics conference** - collaboration with DEI and UK Magnetics Society

24 to 25 March - **Goepressure 2020**

DEI director in The Business Debate at Davos

We need to talk about heat

In January Professor Jon Gluyas interviewed as part of the Business Debate in Davos, a thought-leadership series organised by Reuters to coincide with the World Economic Forum.

Jon highlighted the importance of University-Business collaboration to tackle global energy challenges and argued that although great strides have been made in developing and introducing sustainable technologies there is still much more we need to do.

This was a significant opportunity for Durham University to showcase its world-leading research and impact on the global stage.

If you are interested in exploring collaborative opportunities with Durham Energy Institute please do get in contact. We have a wide a range of energy expertise covering the social and technical aspects of energy, as well as a large cohort of high calibre students who are keen to undertake projects in collaboration with industry and policy.

Find out more about our work on heat at www.durham.ac.uk/research/news and our other areas of expertise at www.durham.ac.uk/dei/research

Energizing the future – Extract from Reuters article on DEI

DEI's commitment to considering all sides of the debate in their research aims to produce major breakthroughs in our understanding of how best to meet the energy demands of the future and enable a more sustainable world.

And the world needs it. As more and more people slip into fuel poverty and energy security stands on fragile ground, it's become a fundamental social and environmental necessity to work together to identify viable sustainable solutions to ensuring equitable access to clean energy. This is not only a necessity but also an opportunity. The partnership between DEI and the leading offshore wind developer in the world – Ørsted – is testament to this. The offshore wind sector in the UK has made amazing strides over the past 10 years and Durham University's research has supported this technology to become cheaper and more efficient.

As with all universities, Durham's crucial societal role as a knowledge provider is vital in shaping the future, and DEI is at the heart of a positive future for the energy industry.

It's not going to be easy to challenge the dominance of fossil fuels, especially on a commercial basis. But the cost of renewables will continue to fall. The next challenge is to convince industry, government and society that there are low-risk, sustainable alternatives to damaging energy sources.

The film of Jon Gluyas' interview and accompanying Reuters' article are available on the Reuters website at https://www.reuters.com/brandfeatures/business-debate/energizing-the-future

Energy Infrastructure and the Political Economy of National Development – special issue

Professor Gavin Bridge (Geography department) has co-edited a special issue of Energy Research and Social Science (Volume 41) on 'Energy Infrastructure and the Political Economy of National Development.' The collection of 26 papers highlights the capacity of different energy technologies and infrastructural assemblages to shape political and economic outcomes, beyond their role in storing, transporting or transforming energy.

Papers draw on case material from Africa, the Americas, Asia, Australia and Europe and across a range of energy systems, including nuclear, gas, oil, hydro and solar.

Co-edited with Prof. Begüm Özkaynak (BoĐaziçi University, Istanbul) and Ethemcan Turhan (KTH, Stockholm), the special issue is an outcome from a British Council/Newton Funds Researcher Links Network Grant.

The Introduction and several papers are available open access, and the full collection can be accessed through the journal's home page.

Special issue: www.sciencedirect.com/journal/energy-research-and-social-science/vol/41/suppl/C

Introduction to the Special Issue: www.sciencedirect.com/science/article/pii/S2214629618302251

Energy on the Move:

Energy practices among informal settlers in capital cities of Nepal, Bangladesh, Nigeria and South Sudan.

Project team: Ben Campbell, Gina Porter, Cherry Leonardi and Raihana Ferdous

'Energy on the Move' is designed to bring social science perspectives to a growing field of research about energy use practices among groups of people in the global south who are not full beneficiaries of modern electricity grid systems. People are migrating in great numbers into peri-urban and informal settlements for reasons of conflict, environmental crises, and rural poverty. The project aims to better understand and develop routes to successful energy transitions for the poorest and most disadvantaged by understanding lived experiences of marginal people. Looking at what energy options they find, and how the cases of four countries' capital cities (Kathmandu, Nepal; Dhaka, Bangladesh; Abuja, Nigeria; and Juba, South Sudan) can be compared. We are also sharing perspectives across the disciplines of anthropology, history and geography.

Research teams communicated with interested local users of our knowledge through Country Consultative Groups. Engaging relevant ministries, NGOs, aid organisations, practitioners and other researchers to help shape the research focus, the selection of field sites, improve awareness of related research and policy, and share findings.

Energy resilience narratives can provide culturally nuanced information on poor peoples' energy needs, vulnerabilities and precarities.

Many projects which aim to bring about energy transitions in the developing world simply expect that with sufficient capacity building and partnerships, along with dialogue between the right stakeholders, solutions will be found to bring affordable, clean and reliable energy systems to address poor people's needs. Much of this research does not engage with the lived realities of the marginalised poor and how this affects energy access in rapidly growing cities, where simple approaches of knowledge transfer are not effective in facilitating sustainable energy transitions.

By contrast 'Energy on the Move' is producing information on the poor living in informal settlements, looking especially at women's perspectives on energy in their everyday lives, and their networks for energy access. The four countries' teams are comparing research findings in terms of 'energy resilience narratives' – in other words, they are exploring with people questions such as:

- What conditions of energy precarity do people find themselves in?
- What do they do in terms of pragmatic and socio-culturally distinct strategies?

How do people cope through redistribution, reciprocity and networks of social capital.

How do modern energy technologies and biomass fuels move among users through channels of gift, obligations to extended kin, within patronage of community leaders, and other networks of assistance?

Emerging energy resilience narratives

Our interviews, focus groups and life histories reveal information on how people go about **shoring up vulnerability to shortages** and lead us into **deeper understanding of precarities** like dependence on middlemen to access fuels such as charcoal in Sudan and Nigeria, or informal line connections in Nepal and Bangladesh.

Emerging findings and highlights to date include the following:

- **Energy safety and insecurity:** Safety for users, and concerns over accidents and deaths from fires and faulty wiring were often raised and require awareness training. Constraints on investment in energy technology can be recognised as due to worries of theft and of being evicted.
- **Energy practices and adaptations:** women can no longer fetch wood in South Sudan due to insecurity; Nigerian examples of occasional lack of wood or charcoal lead to women refusing to cook food for husbands due to 'lack of energy'.
- **Borrowing of fuel from kin and neighbours** is not practised in Nigeria or South Sudan as a reciprocal calculation of 'this for that', but is rather part of the gift economy among community members. It seems to be a matter of reputation and personal responsibility to care for people who are lacking fue
- **Energy appears not to be a matter of 'public' concern** but for individuals to sort out. This inhibits a more systemic approach to energy justice among the marginalised.
- People in informal settlements work in day labouring, construction, domestic enterprises and **contribute to the urban economy, but are only gaining access to less than adequate energy services** in conditions of considerable financial duress.
- There is a widespread energy policy dualism of urban grid vs renewables which ignores **the needs of people who live within the jurisdiction of grids, but cannot access reliable and legal supply.** This reduces the possibility for a greater diversity of institutional actors and pro-poor energy transition projects in informal settlements, which are rising in number.

Find out more about the project at durham.ac.uk/dei/projects

Green sargasso sea:

Report from DEI co-Director Dr John Bothwell on his visit to Dominican Republic

To paraphrase Oscar Wilde, there's only one thing in the world worse than not being flown to the Caribbean to see the beaches, and that's being flown to the Caribbean to see the beaches when they're hidden under a couple of feet of rotting seaweed.

Which is where I found myself six months ago, staring across sulfurous mounds of decaying *Sargassum natans* on a beach in Punta Cana, the idyllic resort to the east of the Dominican Republic. I was there because the Ambassador for the Dominican Republic had heard about Durham Energy Institute's work and wanted help to try to solve this problem. I was also there because bioenergy research is at a crossroads: we're perfectly capable of generating a range of biofuels from biomass, such as bioethanol, biogas, and biodiesel. However, what a lot of countries can't do is grow that biomass cheaply in the first place: Europe's flagship biomass plant at Drax in North Yorkshire runs on wood pellets imported from the US, and Iceland's 2018 advert "Rang-Tan's story" (that's Iceland the food store, not Iceland the country) played on the environmental costs associated with the low-cost palm oil that's often used as a biodiesel source. So, biofuel works, but only if you can lay hands on a ready store of cheap and renewable biomass.

Which is where the Caribbean comes in. For the better part of the last decade now, the Caribbean has seen increasingly massive annual seaweed blooms, starting in spring and lasting into autumn. The blooms were initially of the brown seaweeds, *Sargassum natans* and *S fluitans*, with other species beginning to be seen in the past couple of years (the word Sargazo is an old spanish one for seaweeds, hence their name and that of the Sargasso sea in which they're often found floating). We're still not sure why these blooms occur, although it seems likely that they're encouraged by fertiliser runoff in the Gulf of Mexico, the west coast of Africa, and the northeastern coastlines of South America as well as increased ocean temperatures as a result from climate change. Whatever their cause, the blooms are enormous: whole beaches across the Caribbean and across to La Paz in Mexico are covered under several feet of rotting seaweeds. These Sargassum mats damage local ecosystems and smell terrible, effectively closing tourist beaches for large parts of the high season.

But they're also free biomass. And they're free biomass that countries are already spending money to remove, bulldozing them from beaches to send to landfill. So, in September 2018 I spent a week in the Dominican Republic at the invitation of their government to discuss ways in which their beach-cast Sargassum could be converted into useful bioenergy. This isn't quite as straightforward as it may sound: rotting biomass is a much less efficient feedstock than fresh or dried biomass, and Sargassum tends to accumulate high levels of metals and salts, which can both interfere with the anaerobic digestion or fermentation pathways by which biomass is converted into bioenergy. However, work in both my group and those of Phil Dyer (Durham Chemistry) and Chris Greenwell (Durham Earth Sciences) has been looking at these problems, which makes Durham uniquely well placed to address this seaweed bloom problem.

And, potentially, the Caribbean is only the start. Climate change means that we're seeing more of these unwanted seaweed blooms in more parts of the world: the east Chinese coast deals with annual blooms in the Yellow Sea, and similar "green tides" are beginning to be seen closer to home, on the shores of the Canary islands and, often, as far north as the English channel, in Brittany and off Portsmouth. So the problems faced in the Caribbean today are likely to be landing on our doorstep before too long.

This is all very much ongoing work, supported by the DEI and now through links that we're developing both with the Dominican Republic and commercial partners both there and here in the UK. But it's a good example of how the work of the DEI continues to look at innovative ways in which we can make sustainable energy generation work for a changing planet.

And maybe next time I'll actually get to go in the water...

Renovation for Energy Efficient Buildings (REBUS) project

REBUS
Interreg Europe

European Union
European Regional Development Fund

Durham County Council

Durham University has been working with Durham County Council on a pan-European EU Interreg funded project. REBUS stands for Renovation for Energy Efficient Buildings and brings together 8 partners from 8 countries, who share the same need for improvements in policy to promote energy efficiency in public buildings.

The project commenced in April 2016 and is due to run until March 2021. The overall objective is to improve the capacity of public authorities in European regions, to undertake efficient renovation works of their public building stock, thus saving energy and public resources.

The project is led by the Regional Agency for Waste & Resource Management (ARRR) in Italy and involves partners from Germany (Osterholz), Greece (Crete), Hungary (Miskolc), Poland (Krakow), Romania (Braila), Sweden (Malmo) and the UK (Durham). REBUS has enabled the partners to visit each other over a three year period for knowledge exchange following which, they then produce plans, or "Energy Renovation Pathways" using their knowledge to improve policy and implementation in their own areas.

Durham Energy Institute (DEI) has been working with Durham County Council to develop the Energy Renovation proposals, accompany staff on research visits and advising on current energy challenges.

One of these visits was to Heerlen, in the Netherlands, a town where warm water from the underlying abandoned mine systems is being used to provide heating and cooling for 200,000m2 of buildings. DEI has substantial expertise in this low carbon form of heating and has previously cited Heerlen as an exemplar city whose experience can be replicated in ex coal mining communities across Britain.

Durham's Energy Renovation Pathway proposals were presented to regional stakeholders at an event in January 2019 and the feedback was overwhelmingly positive to the three activities proposed.

The event was introduced by Cllr John Clare, Cabinet Support Member for Economic Regeneration, who said *"Our commitment to low carbon must be embedded and run through everything that we do. The time to ask, persuade, and lobby about sustainability has passed. It is time to insist"*

The three key actions which Durham will now take forward are:

- A new Low Carbon Strategy – building upon regional strategies that are in development and creating a new pipeline of low carbon projects in the County
- Unlocking renewable heat as a potential Low Carbon energy source for public infrastructure in County Durham
- A schools LED lighting retrofit project – 'Enlighten'

Further information: REBUS project website www.interregeurope.eu/rebus

Rich Hurst, REBUS Durham project manager said: *"The REBUS project has and continues to be a fantastic support for Durham County Council to develop its work on energy efficiency and low carbon projects, which was highlighted by the Mid-term event held in Durham on 30th January which garnered great support and sparked ideas for new collaborative projects. We really value the support of the Durham Energy Institute and look forward to continuing to work together on these significant initiatives for County Durham"*

Dr Charlotte Adams, DEI Minewater Researcher said: *"It is great that the REBUS event showcased the huge potential that abandoned mines have for decarbonising heat across the UK. County Durham has the resources and skills to become a leader in the development mine energy systems and we are working hard to develop large scale demonstration projects within the region."*

DEI co-Director to take up key European role

We're delighted that Dr Douglas Halliday, co-Director of the Durham Energy Institute and Associate Professor in our Physics Department, has been appointed to chair the European Universities Association's Energy and Environment Platform (EUA-EPUE)

What is the European Universities Association?

The EUA represents more than 800 universities and national rectors' conferences in 48 European countries. It has a crucial influence on EU higher education, research, and innovation policy.

EUA-EPUE is recognised by the European Commission as the main stakeholder representing the voice of universities in EU energy policy. The Platform connects universities and stakeholders who are active in energy and environment research, education and innovation. It aims to facilitate the full participation of European universities in energy- and environment-related EU programmes and to achieve the goals of the Energy Union and a sustainable energy future for Europe.

Douglas Halliday's work with EUA

This appointment builds on the contributions Douglas has already made to EUA's work in this area. He was a member of the UNI-SET Steering Committee andled the working group which developed the **Energy Transition Action Agenda for European Universities.**

In his role as Director of Durham's Energy Centre for Doctoral Training, Douglas' expertise in solar energy and in multidisciplinary energy training has provided invaluable insights to the agenda. The approach to multidisciplinary training in energy developed in Durham's Energy CDT has also been used as a model for the Action Agenda.

The **UNI-SET Action Agenda** has mobilised and drawn upon the skills of hundreds of academic experts at universities across Europe, to highlight best practices and propose new research and education actions to achieve the energy transition. It provides a flexible framework for the development of energy-related master programmes, short courses and doctoral training at European universities. The recommendations are based on a socio-technical perspective which universities can consult and use to create new programmes.

A European Atlas of Universities in Energy Research (uni-set.eu/index.php/atlas), has also been created containing information about several hundred research programmes and doctoral schemes at European universities, including those on offer at Durham University.

Find out more about the work of the EUA Energy and Environment Platform at energy.eua.eu

Dr Halliday said: *"I am delighted to accept the prestigious role of Chair of the EUA-EPUE Platform. This appointment recognises Durham's broad range of expertise in Energy supported by Durham Energy Institute. Energy and the Environment are two of the greatest challenges faced by our society today. The platform works to ensure the full contribution of universities to this challenge drawing on the wide-ranging and substantial expertise of academics in European Universities. It is my privilege to lead such a platform."*

Congratulating Dr Halliday, Professor Claire O'Malley, Pro-Vice-Chancellor (Global), said: *"I am delighted at Douglas's appointment, and I wish him and his colleagues all the best as they continue to promote the significant role of European universities in addressing these global challenges.*

"Durham University supports the Sustainable Development Goals and an equitable transition to a sustainable future. Education and research are crucial for achieving this. As chair of the EUA platform Douglas will provide leadership in helping to build a consensus and move forward the Action Agenda."

Social sciences and humanities to accelerate the energy transition

DEI co-Director speaks at SHAPE Conference

In January Simone Abram, DEI co-Director and Professor in Anthropology, was invited to speak at the SHAPE ENERGY pan-European conference on the panel for 'Cities as a catalyst for Transformation in the energy transition'. She discussed her at DEI work to incorporate societal perspectives into the energy system through projects such as Centre for Energy Systems Integration (CESI) and People+ project.

SHAPE ENERGY is the Đ2m European platform for energy-related social sciences and humanities (energy-SSH) aiming to develop Europe's expertise in using and applying energy-SSH. SSH research has played less of a role to date in shaping European energy policy than Science, Technology, Engineering and Mathematics (STEM) disciplines. The conference emphasised how crucial social data is to accelerating the decarbonisation of our economy and making a real dent in climate change.

She argued that energy research has focused too much on individual consumer decisions. *"We need to look at institutions, systems and energy practices rather than individual consumer behaviour and at the context of how we produce and use energy."*

A key issue is knowing how to work together and achieve a more people-centred approach. *"We need to push energy confidence in cities to use skills, knowledge and networks. Universities, local authorities and hospitals are the major employers in cities, so if they don't work together we will not achieve any solutions."* *Lowering energy use means "going outside the system as currently offered."*

Find films and text from the conference at www.friendsofeurope.org/event/designing-future-energy-policies

Find out about CESI and PEOple+ project at durham.ac.uk/dei/projects

New book: Electrifying Anthropology

Exploring Electrical Practices and Infrastructure

Editor(s): Simone Abram (Durham University), Brit Ross Winthereik (IT University of Copenhagen), Thomas Yarrow (Durham University)

What kinds of expertise and knowledge relate to electricity, and where is the space for alternative voices? How can the new roles for electricity in social and cultural life be acknowledged?

This new DEI associated book re-describes electricity and its infrastructures using insights from Anthropology and Science and Technology Studies. The collection explores the infrastructures that have become part of our lives by considering electricity as a form of life that enables certain life forms while making others more difficult, raising fascinating questions about the contemporary world and its future.

Through detailed studies of bulbs, bicycles, dams, power grids and much more, the contributors shed light on practices that are often overlooked, showing how electricity is enacted in multiple ways. The focus extends to the various experts involved in the production of electric knowledge and infrastructure as much as to the 'consumers', who are more routinely the subject of social scientific attention.

Electrifying Anthropology moves beyond the idea of electricity as an immovable force, and instead offers a set of potential trajectories for thinking about electricity and its effects in contemporary society.

Vice-Chancellor showcases DEI wind energy partnership to Board of Trade and Liam Fox

In February Rt.Hon Liam Fox MP, Secretary of State for International Trade, came to the University as part of a UK government Department for International Trade visit to County Durham.

Dr Fox praised Durham's tremendous global reputation and our commitment to areas such as data and technology.

As part of the visit, our Vice-Chancellor, Professor Stuart Corbridge, spoke to UK government ministers and the Board of Trade about how our research is meeting complex challenges across the world, from finding alternatives to fossil fuels to helping local businesses solve industry challenges. This included a focus on the successes emerging from our strategic partnership with Ørsted which are helping to strengthen growth and innovation in the UKs offshore wind energy sector.

We are one of the founding partners of Hull University's Project Aura cluster, together with Siemens Gamesa, Ørsted, OREC, Humber LEP and the University of Sheffield. This consortium has already had notable research successes including EPSRC funding for 'A New Partnership for Offshore Wind' (£3.8M EPSRC + £2.5M industry) and a Centre for Doctoral Training in offshore wind energy and the environment (£5.5M EPSRC).

Aura is the model for clusters in other regions and has been a key exemplar in the Offshore Wind Industry Council sector deal negotiations with BEIS.

Durham University is also taking the academic lead in work led by the NE LEP to develop a North East region Offshore Renewable Energy cluster.

Find out more about our partnership with Ørsted durham.ac.uk/dei/partnerships/industry/orsted

CDBB funded network

Methodologies for Planning Complex Infrastructure Under Uncertainty

Infrastructure assets are typically capital intensive investments with long lifetimes – they include both single megaprojects (e.g. Hinkley C, HS2), or resource allocation across multiple options for smaller projects (e.g. in transport, energy or communication networks). Megaprojects also have public and private stakeholders and take years to develop and build adding to their complexity/uncertainty. These investment decisions are thus intrinsically made under great uncertainty over the future planning horizon.

Complexity may variously arise from intrinsic complexity of the asset itself, the need to plan assets against a complex background, the development of regulatory incentives on regulated infrastructure companies, or the need to develop general planning guidelines for a particular class of smaller asset.

The Network has taken an interdisciplinary approach engaging planners, policy-makers, infrastructure companies, social scientists, and modelers to discuss understandings of:

- The state-of-the-art in use of modelling support for infrastructure planning decision making, both in industry and policy practice, and in the research community;
- Needs of the practitioner community for research and innovation on methodology;
- Research communities which must be engaged to achieve this, and at a high level the methodologies which might have applied to the challenges elicited from the practitioner community.

The Network was led by Chris Dent (DEI Associate Fellow and former DEI co-Director, now at Edinburgh University and Alan Turing Institute), and was facilitated by Durham Energy Institute. The core team comprised:

- Chris Dent, Adam Anyszewski, Tom Reynolds and Gordon Masterton (University of Edinburgh);
- Hailiang Du and Evelyn Tehrani (Durham University);
- James Hetherington (Alan Turing Institute);
- Henry Wynn (London School of Economics); and
- Kat Lovell and Gordon Mackerron (Sussex University).

The network hosted 2 workshops to draw on knowledge and expertise of a wide group of decision makers, practitioners, industry and applied-researchers. The first workshop explored the needs for new capabilities in analysis underpinning infrastructure planning decisions. The subsequent workshop scoped the research and activities needed to meet these capabilities.

A literature review, survey and in-depth discussions with key individuals were also undertaken.

The final report from the network will be available through CDBB shortly. This report outlines current work in this area, gaps in research and innovation, as well as possible projects and activities that could be developed to meet these needs.

Find out more about this and other CDBB funded network at www.cdbb.cam.ac.uk/CDBBResearchBridgehead/Networks

For further information, please contact the PI Chris Dent (University of Edinburgh and Alan Turing Institute) on Chris.Dent@ed.ac.uk

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Centre for Digital Built Britain

The University of Edinburgh

Durham University
Durham Energy Institute

The Alan Turing Institute

University of Sussex

LSE

Innovative Demand Side Response project receives BEIS funding for demonstration phase

DEI's Fellow Dr. Hongjian Sun, Durham University lead on Smart Energy, is a partner in the Ubiquitous Storage Empowering Response (USER) project consortium which has been awarded Phase 2 funding1 from the Department for Business Energy and Industrial Strategy (BEIS) as part of the Domestic Demand-Side Response (DSR) competition launched last year.

The USER project will be implemented by a consortium of the following organisations:

Levelise Limited, Heatrae Sadia, Ecuity Consulting, Engenera, Durham University and Energy Systems Catapult.

The project seeks to unlock the prosumer role in the domestic sector by means of AI-led hot water tanks. Currently, there are 9 million hot water tanks across the country, which if appropriately managed, represent a 27 GW demand response opportunity. Through the addition of communications infrastructure, sensor technology, AI-led optimisation services and consumer settlement infrastructure, these hot water cylinders could be cost-effectively turned into flexible assets capable of providing demand response whilst also opening peer-to-peer energy trading opportunities. The water heater can be set to run using the electrical immersion heater during periods of excess supply on the national, district or local electricity system, and release the heat when required. Through aggregation and optimisation of domestic storage assets, flexibility services could be provided to the grid by hot water systems, generating revenue for the consumer and delivering benefit for the energy system.

Both retrofits in existing properties and installations in new-build homes will be done during the project. Installations will also be made in homes that have PV installations with and without domestic battery storage. The trial will therefore provide valuable information on how the technology can support DSR in homes with existing gas and electric heating systems as well as in homes with renewable energy systems that we expect to see in the future.

The BEIS funding forms part of the incentive to support innovative applications for smart energy systems, enabling demonstration of new technology and will subsequently help the USER project prove its commercial potential and demonstrate the benefits it can deliver to both individual households and National Grid. It will also give valuable insight to help the Government understand how climate targets can be met with greater support from the energy system's demand side.

Find out more at www.durham.ac.uk/dei/projects

1. **Levelise Limited**
2. **Durham University Smart Grid Laboratory led by Dr Hongjian Sun**

Commenting on the project, Dr. Hongjian Sun of Durham University said *"This will be a very timely demonstration, showcasing the power of AI-techniques for enabling end-users' involvement in power system operations."*

Fellow consortium member and stakeholder engagement lead, James Higgins from Ecuity commented: *''Hot water production represents one of the largest sources of energy consumption in UK homes – roughly 20% of total demand and this has a significant impact on greenhouse gas emissions. The opportunity to provide energy bill savings to customers without any detriment to their day to day use of hot water whilst supporting a smarter energy system is incredibly exciting.''*

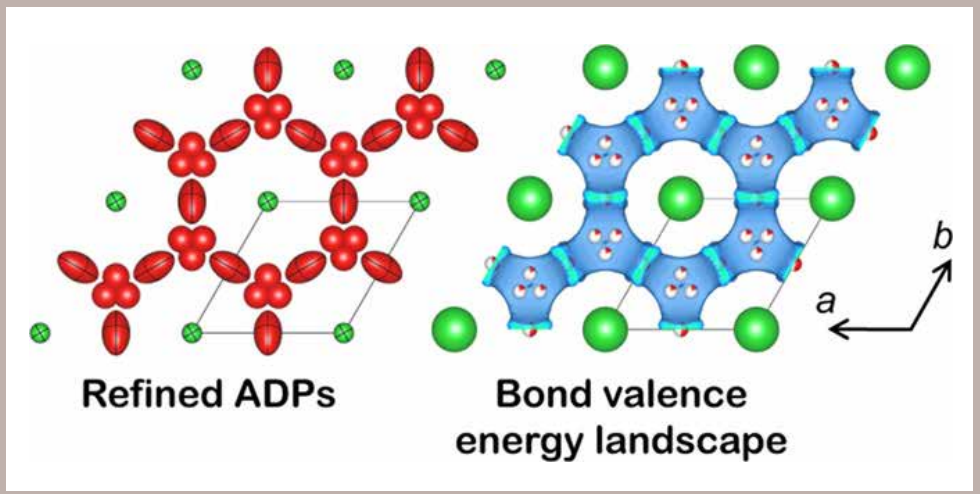
From Materials Discovery to Devices: Oxide Ion Conductors for Energy and Environment-Related Applications

Dr. Ivana Evans (Associate Professor in the Department of Chemistry and DEI Mid Career Fellow) has recently been awarded the prestigious Royal Society – Leverhulme Senior Research Fellowship. The scheme only awards seven fellowship per year across all natural sciences and recognises researchers who have demonstrated scientific excellence in their work. During the fellowship Dr Evans will develop further understanding of the structure-property relationships in selected excellent oxide ion conductors and apply this understanding to the fabrication of these materials in device-ready forms and their testing in devices.

Oxide ion conductors are key components in a number of technologically important applications, including oxygen sensors and pumps, membranes for oxygen separation and solid oxide fuel cells (SOFCs). In SOFCs, they act as electrolytes transporting oxide ions to react with a fuel (such as hydrogen, although other fuels can be used) in the direct conversion of chemical to electrical energy. Better understanding of how the structures of such materials lead to high oxide ion conductivity will lead to more efficient fuel cells with lower operating temperatures, potentially leading to significant technological and environmental impact.

Research in the Evans group at Durham Chemistry on the development of new oxide ion conductors, based on a range of experimental methods and computational simulations, has resulted in new insight into the relationships between structure, dynamics and properties in some of the leading solid electrolytes based on different structure types. This work has demonstrated the importance of variable coordination environments of cations and the rotational freedom of their coordination polyhedra as key structural motifs which facilitate high oxide ion mobility at relatively low temperatures.

During the fellowship, crystallographic knowledge (gained from diffraction-based techniques) and computational methods will be used to provide atomic-level insight into the oxide ion diffusion pathways, especially about the directionality of diffusion and hence the anisotropic nature of conductivity. Calculations will be supported by experimental methods which probe dynamics directly, such as impedance spectroscopy and neutron scattering. Measurements will be carried out both on ceramic samples and on oriented single crystals produced using the floating zone furnace method. The information about facile conductivity directions will be used to inform thin-film growth of selected promising materials, to enable their characterisation in device-ready form.



Sustainable futures for solar and battery systems - a whole systems approach

Network lead: Dr.Britta Turner (Department of Anthropology)

Off-grid solar PV and battery storage solutions have become a dominant feature in the global agendas of energy access and the Sustainable Development Goals (SDGs). Until recently the main focus has been on diffusion – the task of enabling off-grid solar solutions to provide access to energy for more people and communities. But there is now increasing awareness that off-grid solar solutions have limited life-span and that the sustainability of their deployment depends on the ability to develop bespoke reuse, recycling and waste management strategies for them.

The future challenge of solar PV waste is global. A recent report from the International Renewable Energy Agency (IRENA 2016) estimates that by 2050, global cumulative PV waste volumes could reach 78 million metric tonnes. But although it is a global issue it is not the same kind of problem across different geographies. Recognising the different challenges solar PV and battery waste represents in different places, the Durham-led Sustainable Futures for Solar and Battery Waste project is a partnership between Durham University, the University of Kota in India and Strathmore Energy Centre in Kenya. The 6 months networking initiative is supported by a grant from the Whole Systems Networking Fund, which is led by UKERC and funded by EPSRC.

The network brought together researchers and non-academic stakeholders from across the disciplinary and sectoral spectrum to discuss current and future scenarios for end of life management of solar and battery wastes. With a social science lead, the project emphasised in particular the need to move beyond a discussion of solar and battery waste as a technical problem towards better understandings of the social and political challenge it represents.

3 workshops were held in Nairobi, Kota and Durham seeking to bring together different perspectives and support collaboration and research capacity across the three countries. These workshops addressed both material and social aspects of the challenge of end of life off-grid solar solutions, and covered a range of issues including:

- Current and future repair, reuse and recycling infrastructures and strategies
- Formal and informal economies of solar and battery wastes and related types of waste

- Sustainable recycling and resource recovery strategies
- Global value chains
- International governance frameworks
- Circular economies

The project was an excellent opportunity to build on existing DEI partnerships and build new links with researchers at a number of UK and international Universities and with organisations such as SOFIES, Levin Sources, Energy Saving Trust, Zero Waste Scotland and Toxics Link.

The discussions, ideas and partnerships from this network are now being developed with future interdisciplinary and whole systems collaboration in mind.

For more information or expressions of interest please contact Dr.Britta Turner at the Department of Anthropology britta.turner@durham.ac.uk

3 New Centres of Doctoral Training at Durham

Global Challenges CDT

Durham University has a new Global Challenges Centre for Doctoral Training (CDT) launched in March. The CDT, which will receive £3m over three years from the UKRI Global Challenges Research Fund (**re.ukri.org/research/global-challenges-research-fund**), involves researchers from across the University and will see PhD students working in developing countries to address global issues. The research that will be conducted will be focused on challenge-related, multidisciplinary projects, across a variety of global challenges aligned with one (or more) of the UN Sustainable Development Goals.

DEI co-Director Dr Douglas Halliday, takes on the new role of Director of the GCRF CDT. He brings to the role a wealth of experience of multidisciplinary training as former Dean of Durham University's Graduate School and current Director of the Multidisciplinary Energy CDT **www.durham.ac.uk/dei/cdt**

Addressing global challenges

Durham University will receive £3m over three years from the Global Challenges Research Fund to train postgraduate students who will work on projects in developing countries.

Twenty-six research students from 17 different nations have been recruited to the Centre for the first cohort.

Working with our experts across 15 departments in the Sciences, Social Sciences, and Arts and Humanities, the students will work to solve global problems through their PhD projects.

The first cohort of GCRF students projects include several focused on energy including:

- A project focused on Environmental Philosophies of Saharawi Refugee-Citizens
- A whole lifecycle approach to solar PV in India, managing the operation, end-of-life recycling.
- The development and characterisation of "green" ionic liquid solvents for algal biofuel extraction in India.
- Governing the energy-water nexus; sustainable resource governance for development in Turkey

Other projects focus on the global challenges of climate change, tropical diseases, water and food security, earthquakes and flooding.

Promoting the development and welfare of developing countries

Students will study in Durham and spend four to six months at a partner overseas university in the country their research is helping.

They will also have the chance to work with other groups such as non-governmental organisations.

Once their PhD is complete, it's planned that students will return to their home countries to continue their work and implement the knowledge they developed during their PhD.

The Global Challenges Research Fund is a £1.5 billion fund as part of the UK's Official Development Assistance commitment. It supports research that addresses challenges faced by developing countries.

Find out more Durham Global Challenges Centre for Doctoral Training www.durham.ac.uk/globalchallenge-cdt

Two new Centres for Doctoral Training in Energy

Durham University's Energy Institute are expanding their research and training activities after successfully receiving funding for two new Centres for Doctoral Training (CDT). These Awards see Durham and its partners developing the pipeline of energy talent and expertise in the region, driving the transition to our low carbon economy. **Durham Energy Institute Director, Professor Jon Gluyas said:** *"I am absolutely delighted to learn that the expertise of Durham Energy Institute has been recognised by the award of two doctoral training centres along with our partners in northern and eastern England. This award enables us to continue to deliver well trained, high quality engineers and scientists into the regional, national and international energy markets. They are our future"*

The EPSRC Centres have a total worth of £10.7 Million will create a host of opportunities in energy research for over 130 post-graduate PhD students.

Renewable Energy Northeast Universities (ReNU) CDT

The aim of ReNU CDT will be to train the next generation of Energy Materials Scientists and Engineers who will affect change in a wide range of renewable energy technologies, stretching across batteries, solar cells, fuel cells and wind turbines to name a few. Over the next 5 years it will train more than 60 PhD students across Durham, Newcastle and Northumbria universities.

Dr Chris Groves of the Department of Engineering is leading the ReNU CDT at Durham University, and undertakes research to understand how the structure of plastic solar cells can be controlled to improve their performance. He said:

"De-carbonisation of energy is one of the most fundamental challenges facing our society. Huge changes in how we generate, transport, store and use energy are needed to meet the expectations of the Paris agreement. We are excited to be playing a leading role in training tomorrow's leading engineers, chemists, physicists and materials scientists who will perform the research that enables this transition."

The importance of renewable energy technologies to the UK economy is fundamental and the next energy revolution will stem from our ever-increasing demand for electricity. This includes the transition to zero carbon transportation, huge numbers of interconnected personal devices and sustainable buildings. ReNU will help to meet this demand by creating high quality people who have excellent scientific and engineering skills but also specialist training in business, innovation and internationalisation.

ReNU is backed by a strong portfolio of 36 partners including 27 companies (both SMEs and multinationals), non-profit organisations, key networks, local government and prestigious academic institutes across the globe. The combination of these partners and academic excellence will ensure that ReNU provides a key contribution to the Clean Growth Grand Challenge identified in the UK Government's Industrial Strategy.

RENU emerges from the North East Centre for Energy Materials (NECEM) formed between the universities of Newcastle, Durham and Northumbria, which unites engineers, chemists, biologists and physicist undertaking research on energy materials research and addressed the interfaces between the materials within it and their interaction with the environment in which they operate.

A range of PhD Projects are currently being advertised. If you have a strong academic background in a science, technology, engineering or mathematics discipline and are motivated by the opportunity to create a more sustainable future them please get in touch.

Find out more about www.northumbria.ac.uk/research/cdt-renu

AURA CDT in Offshore Wind Energy and the Environment

The new Aura CDT is led by the Energy and Environment Institute at the University of Hull, with partners Durham, Newcastle and Sheffield Universities. It will enable 70 post graduate researchers to develop their skills in offshore wind and the low carbon economy, and integrating engineering and the environment.

Durham's involvement in the Aura CDT goes beyond the Engineering Department and includes researchers from the Earth Sciences & Geography Departments. The University will lead 15 PhD projects through the CDT and more than 20 academics from the University are engaged in developing projects and forming supervisory teams to lead the PhD studies.

Professor Simon Hogg, Ørsted Chair in Renewable Energy at Durham University and Durham's lead on wind energy research and Project Aura, said: *"Offshore wind power is now making a substantial contribution to UK electricity supply. Projects are in the pipeline to grow this to 30GW by 2030, by developing the UK's Round 3 sites. These are GW scale wind farms which will consist of hundreds of wind turbines, many more than a hundred miles from shore. The focus of this CDT is to train researchers and innovators with a particular focus on the environmental and systems level integration of offshore wind power into low-carbon electricity networks".*

Project Aura is a collaboration between major companies in the offshore wind industry, leading academic institutions and government and non-governmental organisations. It aims to act as a catalyst for collaboration and innovation to support the sector's growth. The Aura partners' vision is to create a world leading offshore wind research, talent and innovation hub supporting the developing offshore wind sector towards sustainability, establishing it as a vibrant industry in the Humber – the UK's Energy Estuary, for the benefit of the region and the country.

Aura is led by University of Hull, and includes Durham and Sheffield Universities, Humber LEP, Ørsted, Siemens Gamesa Renewable Energy, ORE Catapult and HCF Catch.

The Aura CDT is an enabler for innovation in the offshore wind sector, unique in its cross-disciplinary engagement of engineering and environmental scientists, industry and policy makers.

The Centre will provide the opportunity to develop and integrate practical examples in taught courses across the first year with industry-led and challenge-led projects, followed by three years of focused doctoral research.

A range of 4-year Doctoral scholarships are currently being advertised starting 16 September 2019.

Find out more at durham.ac.uk/dei/projects/aura and auracdt.hull.ac.uk

Find out about all Energy training and postgraduate research opportunities at Durham University at durham.ac.uk/dei/training

DEI supports development of new North East Energy Cluster

On the 7th March the UK Government published the Offshore Wind Sector Deal, a transformative partnership that will ensure UK offshore wind remains at the forefront of the global shift to clean growth, supplying a third of the country's electricity by 2030.

The North East, including Durham University, will be a major player in this strategy to 2030 and has been named as one of the regions that will be instrumental in delivering the Sector Deal.

This Deal is the culmination of an extensive period of negotiation between the UK Government and the Offshore Wind Industry Council (OWIC), chaired by Benj Sykes, who as well as his role as UK Country Manager for Offshore for Ørsted, is also a DEI Advisory Board member.

Offshore wind is the first renewable energy technology to agree a Sector Deal with the Government, and is one of only ten Sector Deals across all industries. The Deal will cement offshore wind as an integral part of a low-cost, low-carbon, flexible electricity system and boost the productivity and competitiveness of the UK supply chain, tripling jobs in the sector to 27,000 by 2030 whilst improving diversity.

The UK is already the world leader in offshore wind, with more installed capacity than any other country (currently 8 GW with a development project pipeline in place to grow this to 30 GW by 2030), the biggest offshore wind farms and the most powerful turbines. The supply chain extends to every part of the country, and UK companies are already exporting our offshore wind products and services to more than 20 countries. A good example is Tekmar Energy, manufacturer of Cable Protection Systems, based in Newton Aycliff and exporting around the world. With the Sector Deal now in place, the sector's exports are set to increase fivefold in value to £2.6 billion a year by 2030 and over £5bn by 2050.

The £250 million investment in the supply chain, including the Offshore Wind Growth Partnership, will work to make companies right across the UK into world leaders in offshore wind innovation. This will mean increased investment in areas such as robotics, advanced manufacturing, floating wind and larger turbines.

Professor Simon Hogg, (Head of Engineering at Durham and former Executive Director of DEI) is taking the academic lead in work led by the NE LEP to develop a North East region Offshore Renewable Energy cluster. Durham University has been a key academic player in the offshore wind activity in the Humber region through its role as a founding partner of Hull University's Project Aura cluster, together with Siemens Gamesa, Ørsted, OREC, Humber LEP and the University of Sheffield. Aura is being used as the model for clusters in other regions and was a key exemplar in the OWIC Sector Deal negotiations with the Department for BEIS.

Professor Hogg said: 'The transition to low carbon energy supply and the associated systems and environmental integration challenges, present a huge array of exciting new research and innovation opportunities for both academia and industry. Durham University and the DEI have played important roles in helping to shape the Humber offshore wind regional cluster through our partnership with Project Aura and Hull University. Publication of the Offshore Wind Sector Deal provides a fantastic opportunity for the University to use this experience to lead the academic engagement in the NE regional cluster. Universities have a key role to play in both the skills development and the research development and innovation aspects of the cluster's work. There will be opportunities for all five of the NE Universities. Durham's involvement will provide an important direct link to the academic network that has built up around the Humber cluster. We are looking forward to the exciting challenges ahead and to playing our part in supporting the future development of the offshore wind industry in our region.'

The North East Energy Cluster will focus on supporting the oil and gas industry to transition to the renewable energy sector, as well as supporting the development of the large scale energy storage solutions that are mandatory for a low carbon energy future. The opportunities afforded by the low-carbon energy transition and offshore wind sector are centrally important to the growth agenda of the region.

The Chair of the OWIC, Benj Sykes, who is also UK country manager for Ørsted's offshore wind business, said: *"The Sector Deal addresses the Government's Grand Challenge of Clean Growth, ensuring that our economy continues to grow whilst reducing carbon emissions; a big part of that is around positioning the UK as a clean-tech leader, not only in the deployment of offshore wind, but also in the development of innovative technology as the sector grows.*

"We've seen that a really effective way to do this is for academia to work closely with industry in order to address the real challenges and opportunities that arise from such a rapidly growing sector.

"At Ørsted, for the past seven years we have partnered with the Durham Energy Institute (DEI) including collaboration with Masters and PhD students enrolled in DEI on projects and research that have positively impacted the renewable energy industry, producing some great results.

"When it comes to the future of energy, and addressing climate change, we must work collaboratively, and the North East cluster already has the right elements in place. As well as the existing links between academia and industry, there is a huge manufacturing base here, including facilities producing major turbine components and winning contracts worth millions of pounds, which then of course feeds into jobs, local investment and other supply chain opportunities. To me, this is what the regional cluster development is all about."

Developing the North East's energy strategy

The North East Local Enterprise Partnership has worked with cross-sector partners across the region to develop an energy strategy for the North East

Andrew Clark, North East LEP Energy Programme Lead and DEI Advisory Board member, gives an insight into the Energy for Growth strategy.

It's clear that the North East excels in energy, and it's an area of potential growth which we are working hard to capitalise on.

Alongside the world-class businesses we have in the region, for example those operating within the offshore energy sector, we also have a very unique and comprehensive set of energy innovation and demonstration capabilities, and various regional project opportunities which can deliver on a wide range of national policy objectives at scale. This broad range of strengths keeps us at the forefront of the agenda, and presents a number of opportunities for our economy.

In the next few weeks we will be launching Energy for Growth, the new strategy which aims to build on these strengths to drive regional growth in the North East, while delivering on national energy policy goals. Energy for Growth will build on the ambitions laid out in the North East Strategic Economic Plan (SEP). The Plan is the roadmap for creating more and better jobs in the North East, with energy pinpointed as one of our four areas of strategic importance, with potential to bring investment, skills and jobs to our communities.

Through the Department for Business, Energy and Industrial Strategy (BEIS) local energy programme, all Local Enterprise Partnerships have been tasked with developing an energy strategy for their geography, identifying regional strengths, challenges, and opportunities which align to national policy across power, heat and transport.

The strategies will raise awareness of these regional strengths, challenges and opportunities, to gain buy-in for collaborative implementation, and to shape a pipeline of strategic projects to be supported through delivery.

Here in the North East we've been working closely with our partners and stakeholders to develop our Energy for Growth strategy, to ensure it defines our strengths and opportunities, and identifies delivery priorities to be supported through our regional pipeline of strategic projects.

Durham Energy Institute is one of these partners, and has provided extremely valuable input to help shape the strategy. The Durham Energy Institute, and Durham University, provide international thought leadership and expertise on several areas of focus for us regionally. This includes geothermal heat, and in particular opportunities to provide heat from abandoned mine workings, an early area of focus for our Energy for Growth project pipeline.

Through the Energy for Growth strategy we will focus on harnessing our cross-sector regional capabilities, and working in partnership to define our regional project pipeline. By bringing forward coordinated projects we can deliver at scale on national energy policy, while bringing more and better jobs to the North East.

Andrew Clark, North East LEP Energy Programme Lead.

Read more about the North East Strategic Economic Plan at www.nelep.co.uk and the Energy for Growth strategy at www.nelep.co.uk/the-plan/energy

DEI Supports Durham Student Energy Society

New Energy Mentoring scheme set-up for Durham Students

DEI Advisory Board members are lending their industry expertise to students at Durham and providing advice on finding employment within the energy sector.

Shaun Hunt the 2018/19 Durham Student Energy Society (DSES) President and an ex. Officio Member of the DEI Advisory Board asked at the October board meeting if members would consider providing mentoring support to some of the 200 student members of Durham Student Energy Society who are interested in finding work in the energy sector. 12 board members have offered their support which will allow undergraduate and post graduate students to engage with experienced professionals from a range of sectors. Mentoring will include discussions on studies, career options and opportunities.

The Board Member representing Durham County Council, Maggie Bosanquet, proposed to extend the mentoring initiative by inviting groups of students to meet with the 20 Sustainability Professionals at the Council to understand and experience first-hand the 'front line' of sustainability. Students will visit facilities where the Sustainability Team has introduced new measures to improve the sustainability performance of buildings. This initiative supports the transition from academia to post graduate careers for the student and ultimately inspire the next generation of energy professionals.

Student Energy Society at Durham University

DSES is working to educate and equip students at the university with the necessary hands-on skills and knowledge to succeed and contribute to change during the sustainable low carbon energy transition. The DSES works alongside the Durham Energy Institute to provide students with a diverse range of interactive talks and workshops on the world of energy.

The UK's energy environment is unstable and, following the recent 'Brexit' vote, uncertain. As students, we will be deeply impacted by vital decisions regarding the nation's energy future. The society aims to educate and inspire students to develop their interest and understanding of this ever-increasingly important sector.

Student Energy Durham has successfully grown as a society on the Durham University Campus after gaining accreditation with the Durham Student's Union (DSU) in December 2015. Durham Energy Institute (DEI), has been providing support to DSES since its inception and has helped to develop exceptional links for the student group with the wider energy research community at Durham University but also to industry and policy stakeholders beyond the university. The DEI has also helped the student group to invite leading energy industry representative to Durham to speak to the students for its events programme including:

- a workshop with Ørsted Energy, Europe's leading wind farm operator;
- a talk by Ian Marchant former Chairman of SSE and Director of the Wood Group;
- a panel debate on fracking
- a panel debate on the Future of Energy with Young Energy Professionals forum and Energy UK.
- A public lecture on Nuclear fuel as a source for sustainable energy

Additionally, the Student Energy Executive body has a significant role in planning and organising the upcoming International Student Energy Summit 2019 in London (17-20 July), for which DEI Director Jon Gluyas is on the Advisory Board **www.studentenergy.org/international-student-energy-summit-2019**

Student Energy Durham www.studentenergy.org/chapters/durham-university is the largest Student Energy Society at a UK university

WindAfrica Project suggests wind power guidelines for Tanzania.

The GCRF project being led by Dr Ashraf Osman from Durham's Engineering Department is developing performance-based designs for foundation systems of WIND turbines in Africa.

It is estimated that about 35% of the world resources for wind energy are located in the African continent. However there are many challenges which hinder the development of infrastructure for wind energy in Africa. Designing suitable foundations to sustain the loads typically applied by wind turbines represents a particular

challenge. Site investigations have shown that many areas that have been identified as suitable for wind turbines are underlain with expansive soils. These soils are particularly sensitive to soil moisture changes; as the water content of the soil increases during the wet season, the soil swells causing surface heave. During the dry season, shrinkage occurs producing settlements. This seasonal shrink/swell cycle can cause significant damage to buildings directly founded on these soils.

As part of the WindAfrica project a workshop on wind power guidelines was organised in Dar es Salaam Tanzania. Ashraf Osman, Tanzanian power generation experts from academia and industry, and their counterparts from various countries gathered at the workshop to develop the design guidelines for foundation systems of wind turbines that will have to be followed when developing the renewable energy source.

Dr Osman said that the collaboration between stakeholders of the wind energy industry in Tanzania and the WindAfrica consortium will accelerate development of the renewable energy industry in the country. Wind energy is a sustainable energy resource which is yet to be fully exploited in Tanzania.

"Many turbines are planned in the next ten years in Tanzania so small improvements in efficiency will result in significant overall savings. The proposed design guidelines will aid geotechnical engineers to select the most appropriate foundation solution to suit unsaturated expansive soil conditions subject to extreme weather conditions" Dr Osman noted.

Site investigations have shown that many areas that have been identified as suitable for wind turbines are underlain by expansive soils. These soils are particularly sensitive to soil moisture changes during the wet season – the soil swells which causes the surface to have and during the dry season, shrinkage occurs. The seasonal shrink-swell cycle can cause damage to buildings. The guidelines will also indicate the best options for turbines that can withstand all conditions.

Stakeholders at the workshop agreed to develop training courses for young engineers in Tanzania on design methods for wind turbine foundations to meet domestic needs in evaluating optimal foundation designs in unsaturated soils.

Currently more than half of the energy use in Africa involves traditional biomass consumption, which entails health risks due to smoke inhalation and social disparities in wood collection.

The Wind Africa consortium is a £1.27 Million funded by UK Engineering Physical Sciences Research Council (EPSRC) under the Global Challenges Research Fund GCRF project led by Ashraf Osman from Durham University with support from Durham Energy Institute. The project also features Cambridge University (UK), University of Pretoria (South Africa), University

of Khartoum (Sudan), WSP Parsons Brinckerhoff (UK), Arup (UK), Jones and Wanger (South Africa), Aurecon (South Africa), and the African Development Agency of the African Union.

Tanzania stakeholders involved in the project include UDSM's College of Engineering and Technology, Tanesco, Tanzania Renewable Energy Association (TAREA), Geological Survey of Tanzania (GST), and a foreign private renewable energy developer, Energio Verda.

Find out more about the project at durham.ac.uk/dei/projects/windafrica

In Conversation with Dr Douglas Halliday ....

Co-Director of Durham Energy Institute, Director of Multidisciplinary Energy CDT and GCRF CDT and Chair of EUA Energy and Environment Platform

We caught up with Douglas to ask about his work, research loves and aspirations for the future.

What or who has been you biggest influence to date?

From my early years it would be my parents. My dad was a very good engineer / mechanic and had his own business for many years. Outside our house there was always lots of machinery – tractors, cars, fishing boat engines – he would fix these for local people often in exchange for products they grew, farmed or made. So I was interested in machinery from a very young age and learnt to service cars and fix things, I developed a natural curiosity about how things worked.

At secondary school I also had an excellent Physics teacher who had a PhD and encouraged me to take up science.

What are the real myths around energy and climate change?

I think there is now compelling evidence that Climate Change is a real phenomena that is directly influenced by human activity on the planet. There is no denying it! Thinking about how humans consume energy is essential. We will not survive if we believe human development requires high energy consumption. So we need to re-think how we promote global development of our societies in a sustainable way.

If you had £1million to spend on research what would you do with it?

I would develop a research training programme for PhD candidates and Early Career Researchers. If you train them effectively they can undertake essential research with a lasting impact on the challenges we face. Our experience of training people at DEI is that people need to understand energy from multi-disciplinary perspectives, the whole energy system and how society interacts with it. In addition to being technical experts they will need to understand the societal, political and economic implications of energy systems.

What would you say to students looking for a career in the energy industry?

Smart people have much to contribute to the energy sector. Solutions are not just about technological knowledge – you need to understand so much about society and and to take time to understand the social, political and economic dimensions of energy.

What is your vision for the DEI?

DEI is increasingly recognised as leading the energy debate in terms of thinking about the relationship between society and energy. My vision is that we are able to train energy professionals who will have clear and accurate insights into challenges of the energy transition and that they will have effective strategies to achieve the climate targets we need. I am working to extend the DEI's insights and influence beyond the UK working with Universities across Europe and globally such as India to develop energy training. I am very proud to have been asked both to chair the Platform on Energy and Environment for the European Universities Association and to be Director of Durham University's new Global Challenges Centre for Doctoral Training. I am really looking forward to this wonderful opportunity to share the principles of and insights from DEI's Multidisciplinary Energy CDT.

This year marks the 10 year anniversary for the DEI – what do you consider to be the biggest highlight / achievement over the past 10 years?

It is a great achievement to have had 82 PhD students from a whole range of disciplines in our Energy CDT since it started. Many of these students have gone on to positions of influence globally and will spread our message across different energy sectors.

Douglas Halliday is DEI Co-Director and Director of the Multidisciplinary Centres for Doctoral Training in Energy and Global Challenges Research Fund. He is a Chartered Physicist and a Fellow of the Institute of Physics, a Fellow of the Energy Institute and a Fellow of the Higher Education Academy. Before taking over as Director of the Energy CDT, Douglas was Dean of the Durham University Graduate School for five years. Under his leadership the Graduate School received the Times Higher Education Award for Outstanding Support for Early Career Researchers. He is chair of the European Universities Association Platform on Energy and Environment, and was a member of the European Universities Association UNI-SET Steering Committee.

Douglas undertakes research into solar photovoltaic devices. To be able to generate power at the Tera Watt level PV devices need to manufactured from abundant, low-cost raw materials. Douglas is currently undertaking research into alternative materials to replace silicon in the next generation of thin-film photovoltaic devices.

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