



Durham
University

ENERGY, SCIENCE AND SOCIETY

DURHAM ENERGY INSTITUTE REVIEW

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**NEW
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ENERGY SYSTEMS
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www.durham.ac.uk/dei

// A MESSAGE FROM...



DEI EXECUTIVE DIRECTOR

The first half of 2016 has seen the DEI move forward on a number of fronts. The University Science Faculty Meta Review has now completed. The DEI was one of five University Research Institutes at Durham who were reviewed by a team which included a number of world-leading scientists and academics from a range of UK and international research organisations. The review team commended the DEI for the widely acknowledged value that the Institute adds to the research environment across the University, our track record of engagement with external partners and the strength of our Advisory Board membership. The review team also acknowledged that opportunities exist for the DEI to do even more. We are currently working with the University to put measures in place to allow us to further expand our operations accordingly.

The DEI has supported a number of successful large grant applications in recent months. The largest of these is the award of the £20m EPSRC National Centre for Energy Systems Integration consortium project which was announced in May. This 5 year collaboration will be led by Newcastle University and draws on the expertise of leading academics from Durham and the universities of Newcastle, Heriot-Watt, Sussex and Edinburgh. DEI researchers from the Business School and the Departments of Anthropology, Earth Sciences, Engineering and Mathematics will all be involved in Durham's interdisciplinary contribution to the work undertaken by the Centre. Other major grant income news includes the strengthening of the University's relationship with the Mexican Science and Technology Agency, CONACYT. This Mexican government scheme provides funding for their postgraduate students to study research and training degrees at overseas universities. In May, Durham and Leeds Universities signed a partnership agreement with CONACYT for collaboration on energy research. This has resulted in a large increase in the number of PhD and MSc

students from Mexico funded through the scheme applying to Durham for energy research projects. We are expecting to welcome the first wave of these students to the University later in the year.

Changes to the DEI Executive team include Manuel Llorca was around a research fellow from the Business School who has joined as an Early Career Fellow. We are also sad to have had to say goodbye to Chris Dent, who left the University in September to take up a new assignment at Edinburgh University. Chris has been a very active and enthusiastic supporter of the DEI in his co-Director for Impact role and we thank him for his significant contribution to the DEI during the last few years. Our interactions will continue with Chris in his new position as Durham and Edinburgh are collaborating on a number of large consortium research projects involving him. We are currently moving forward with filling the vacant co-Director position, advertising internally for further DEI Fellows and advertising for the first time for new external DEI Associate Fellowship positions. Associate Fellows will act as external ambassadors

for the DEI who will promote the interests of the DEI externally and advise and support energy researchers at the University. They will be either senior practitioners in energy development from government, industry or academia, or a researcher or support staff worker who has previously worked at the University with a history of engagement in DEI activities.

Finally, we were sad to hear of the death of Davey Hopper, Secretary of the Durham Miners' Association, who died unexpectedly in July this year. The DEI has been strengthening links with the DMA in recent years, including holding our most recent public debate 'What role do fossil fuels play in future energy?' at the Miners Hall in Durham in May. Davey was an enthusiastic supporter of closer engagement between the DMA and the University and we are keen to continue this work building further on what he has helped us to achieve so far. The date for the next meeting of the DEI Advisory Board is 12th October. The meeting is to be held at the Durham Miners Hall.

DEI NEWS UPDATE

// VISITING RESEARCHER TO DURHAM RESEARCHING POLITICS OF GAS

We would like to welcome Dr Meg Sherval who joins Geography as a visiting researcher this term until December. Meg is Senior Lecturer in Geography and Environmental Studies at the University of Newcastle in New South Wales, Australia. She is supported by a Visiting Academic Women's Fellowship at St Mary's College. Meg works on issues of resource politics and environmental governance, environmental law and ethics, and the social and economic impacts of climate change. During her time at Durham she is progressing new research on the politics of unconventional resources (focused on shale gas in the UK and coal seam gas in Australia). Meg recently spoke at the Royal Geographical Society - Institute of British Geographers Annual International Conference in London on "Coal Seam Gas- Villain or Saviour? Competing visions of land use in Narrabri Shire, NSW, Australia" which reported on her research in Australia into perceived threats to agricultural pursuits by unconventional extractive industries such as coal seam gas (also known as coal-bed methane) and shale gas operations. Whilst in Durham, Meg will be investigating opposition to Shale gas operations in the UK and considering whether the tipping points for action/resistance are the same as those in communities in Australia or different and why that might be. She will be interviewing communities in the south of the UK and in Lancashire and York.

// If you are interested in discussing Dr Sherval's work or exploring potential collaboration please get in contact on meg.sherval@durham.ac.uk

// VACANCY FOR COLLABORATIVE PHD WITH OFFSHORE RENEWABLE ENERGY (ORE) CATAPULT

A PhD studentship is available for research into offshore investment planning under severe uncertainty, at the School of Engineering & Computing Sciences, and the Department Mathematical Sciences, Durham University. Support and active involvement will come from the Offshore Renewable Energy (ORE) Catapult, which has facilities in Blyth, Glasgow and Fife. The aim of the project is to investigate investment planning over a wide range of technology options by formulating a set of decision problems taking into account severe uncertainties in both operational and environmental data. The potential candidate will have a good degree (normally first class or equivalent) undergraduate or MSc degree in Engineering, Mathematics, or Statistics. A good background in Statistics is required.

// For more information about this opportunity please do not hesitate to contact Dr B Kazemtabrizi behzad.kazemtabrizi@durham.ac.uk, or Dr M Troffaes matthias.troffaes@durham.ac.uk as soon as possible and preferably before 30th September 2016. Proposed start date is 1st October 2016 but there is flexibility.

// VACANCY FOR 2 PHD STUDENTSHIPS IN DATA MINING WIND FARM OPERATIONAL AND MAINTENANCE DATA FUNDED THROUGH DONG ENERGY

Off shore wind energy is one of the fastest growing sectors, with major new projects planned within European waters as well as further afield. These new wind farm developments are sited further off shore than ever before (the Round 3 wind farm projects in the North Sea are some 200km off shore). This presents new challenges in terms of maintenance and repair: the cost of going on site is significantly greater (both financially and time).

These two linked PhD projects will develop novel data mining methods to maximise the information gathered from wind turbines' sensor arrays. The aim is to be able to identify that a wind turbine is developing a fault well in advance of that fault becoming sufficiently severe that it prevents the wind turbine from operating. Given this advanced warning, a wind farm operator is then able to organise maintenance and identify a good weather window to carry that maintenance out.

These projects will be undertaken with close collaboration with DONG Energy (Danish Oil and Natural Gas, one of the largest wind farm operators globally).

// These PhD studentships are available to Home and EU students. Please contact Dr Peter Matthews (p.c.matthews@durham.ac.uk) for further information preferably before 30th September.

STEM OUTREACH: WIND IN YOUR SAILS



Dr. Donaghy-Spargo is leading on developing a STEM programme for the DEI for future STEM events to inform school children about the scientific principles of energy generation, and the opportunities available for them to get engaged in shaping the future of energy. He is developing interactive models focused on the exciting principles of electricity and magnetism to show how we can apply those fundamental principles to energy generation, transmission and its end use. Electricity and magnetism is one of those subjects that can captivate any mind and it is fundamental to the workings of the world in which we live. The resource pack is aimed at developing interest in primary to early secondary age groups and includes a host of new and exciting demonstrations from magnetic levitation, motor and generator action, sparks/arcs, pedal power and some just plain scientific fun!

The expansion of school and public outreach activity is a strategic aim for the DEI and this toolkit will help us to play a leading role within Durham and the wider North East in STEM outreach activity. This activity is crucial not only for increasing general awareness of energy dilemmas but also to help raise the aspirations of young people from local schools and colleges, who may not have considered studying these technical subjects beyond their compulsory studies at GCSE, yet alone embarking upon a university degree and a career in Science or Engineering.

Dr. Christopher Donaghy-Spargo, representing Durham Energy Institute and the School of Engineering & Computing Sciences, attended the Science, Technology, Engineering and Mathematics (STEM) outreach event at Beamish Museum in July 2016, entitled "Wind in Your Sails". This gave the general public an opportunity to gain an insight into the kinds of projects we work on and about our energy research, the challenges we face and how we are going about addressing those challenges. This engagement was part of a strategic increase in outreach activity aimed at informing the public and inspiring the next generation of engineers, scientists and mathematicians we need to continue to tackle not only the UK's, but the world's energy issues. The two day event took part in a splendid marquee on the Beamish Museum Events Field to celebrate everything linked with wind power; primary schools from across the North East had been taking part in a windmill competition since the Spring and the event was intended to celebrate their outstanding work, culminating in a prize for the best windmill - it was a great success and a pleasure to attend.

Dr. Christopher Donaghy-Spargo, a Research Fellow in Electrical Engineering within the School of Engineering & Computing

Sciences was joined by his brother Anthony 4 // DURHAM ENERGY INSTITUTE REVIEW

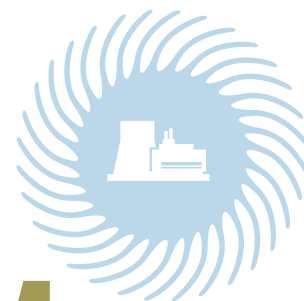
Spargo who is an Electromagnetic Design Engineer at Cummins Generator Technologies, Peterborough, UK. The pair has a history of attending STEM outreach events having both studied the same engineering degree at Newcastle University and joined forces on numerous occasions in the past to present to the public. At "Wind in your Sails" they exhibited alongside the likes of Northern Electric who were demonstrating how power gets from the power station to your home, EDF Energy who were explaining wind turbine use and energy generation and the Royal Society of Chemistry demonstrating the power of the sun and UV rays, in a spectacular showcase of just about everything related to Science, Engineering, Technology and Mathematics to thousands of interested school children, teachers, parents and the odd passing engineer!

As a family focused museum and event, the children were encouraged to take part in Beamish Museum's science based activities that were available over the two days, such as the opportunity to build and test your own rocket. Durham Research Fellow Susie Daniels and PhD student Andrew Messenger also represented DEI by running one of the engineering based workshops in which school children built paper rockets that were fired using compressed air - some of the rockets constructed went very far!

Tweeting about the event throughout (@CMDSE_EE), Dr. Donaghy-Spargo engaged with hundreds of school children and their parents, talking about science and engineering careers, the mysterious scientific principles of electricity and magnetism, as well as informing them about the Durham Energy Institute and the School of Engineering and Computing Sciences, the work we do, how we do it and why it is important. This event was a fantastic opportunity to showcase the DEI and engage with people from all backgrounds and discuss the importance of STEM to all ages. Besides the enthused school children, other visitors to the DEI stand included interested engineers who were keen to discuss the multi-disciplinary approach of the institute and also the technical challenges, with regard to energy sustainability and security, which we face.

The Beamish event was a great success, engaging thousands of school children and their peers from across the North East and beyond including some overseas visitors. We hope it has inspired some of those young people to go home and learn more about science, engineering, technology and mathematics and perhaps in years to come we will even see some of them join us at Durham as Engineering undergraduates.

ROUND-UP OF THE ENERGY SUMMER SCHOOL AT DURHAM



// “These two weeks helped me to see energy from a different angle, it is truly a transition of my energy related knowledge and perspective” (A participant of Energy Transitions in Contemporary and Emerging Societies summer school 2016)



In July, Energy Transitions in Contemporary and Emerging Societies saw the successful conclusion of its second international energy summer school. Students from Europe to Far South, UK to Australia came to participate in this two weeks course that enriches not only participants' knowledge but also enhances speakers and organisers' spirit. The course was held between 11 and 22 July with a number of stimulating lectures, seminars, workshops and exciting field trips.

The Energy Transitions in Contemporary and Emerging Societies caters for national and international students, researchers who are interested in pursuing their career in energy related field. The course is specifically designed to give participants an opportunity to look beyond their own discipline or research to develop an understanding of energy systems as a whole from an interdisciplinary perspective. During these two weeks the participants attended lectures from faculty, researchers, practitioner and industry professionals based in different energy sectors.

Within an overarching interdisciplinary approach, the course was divided into two parts: Energy and Society (week 1) and Technologies for Transition (week 2).

The first week was organised in a way so that participants learn to identify and problematize energy from a critical perspective using a wide range of social theory. The week was a combination of lectures, seminars, and workshops from researchers in Anthropology, Geography, Politics and environmental science. We were privileged to have academics from our own Durham University, as well as from York, Newcastle and Oslo Universities. A day was dedicated to High Carbon Energy and Geopolitics where Dr Joshua Kirshner from York University discussed the politics of the high carbon energy transition in Mozambique and Dr Jesse Salah Ovadia from Newcastle delivered a brilliant lecture on Petro-Developmental States in Africa and insights into Oil-Backed Development in the Global South. On the same day, Peter Forman presented his own research on Alternative Geographies of Energy Security. The next day our participants learned about the politics of energy, culture and the challenges of Development from Dr Tanja Winther, Dr Ben Campbell, Dr Emma Wilson. Using different case studies our participants travelled from the Arctic, Nepal to rural Zanzibar. The week not only delivered class based lectures, but also gave a chance for the students to participate in energy debates, watch documentaries, and to ask question about their own consumption.

In week two: Technologies for Transition, the students spent every day learning about new Technologies. Firstly, Dr Douglas Halliday Director of the Energy CDT at Durham introduced solar energy to the participants. The following days were dedicated to wind energy and nuclear energy where the students heard from academic faculties and industry professional about their activities all over the world. Our two day field trip was a special attraction for the students, a day at the Wilton International Site, a large chemical production complex in Middlesbrough, Teesside and a day at Drax power station, the largest coal and biomass power station in the UK. Erik, a Chinese student from Australia said “**although I study mechanical engineering, I never visit any field site like that**”.



// To find out about the International Summer schools planned for 2017 at Durham, including the next Energy Summer School, go to www.durham.ac.uk/international/summerschool

ADDRESSING FUTURE ENERGY CHALLENGES THROUGH NEW NATIONAL CENTRE

Durham University is part of a new national centre which will explore ways of improving energy efficiency, reducing customers' bills and lowering carbon emissions. The new £20m EPSRC National Centre for Energy Systems Integration (CESI), funded by the Engineering and Physical Sciences Research Council (EPSRC), Siemens and led by Newcastle University, will bring together energy experts from around the world to help unravel the energy network and understand future supply and demand.

As the availability of fossil fuels declines and traditional energy structures become obsolete, it is essential we develop new energy sources that can also help counter the threat of climate change, as well as building smarter, flexible and integrated energy systems. Durham's experts are at the forefront of developing these new energy solutions, which has been further enhanced by the University's role in CESI.

Looking for the first time at the energy system as a whole; gas, power, renewables, heating and cooling, the centre will pave the way to a flexible smart infrastructure, empowering customers and giving them greater control of their energy use while allowing industry to meet the tough new low carbon targets. Bridging a pivotal gap in our drive towards a fully integrated, smart energy network, the centre is crucial to improving energy efficiency, driving down customer bills and reducing carbon emissions.

Under the umbrella of Durham Energy Institute, researchers from Durham University's departments of Anthropology, Earth Sciences and Mathematical Sciences, as well the School of Engineering and Computing Sciences and Durham University Business School, will play a role in the EPSRC National Centre for Energy Systems Integration.

The UK, along with all advanced industrial and post-industrial countries needs to transform its energy flows, move away from carbon-producing fossil sources, and adapt to new technologies

like electric vehicles and new kinds of energy storage. Durham Energy Institute's experience of interdisciplinary research is key to the new centre's goals - to enable the UK energy system to be transformed into a renewable system that serves diverse users of the future in ways that are just and sustainable.

Our expertise in conventional and unconventional energy generation, in smart grids, in the sociology of science and anthropology of energy will be crucial to the centre's aim of drawing together diverse knowledge and expertise to integrate energy systems.

// EXISTING EXPERTISE IN ENERGY SOURCES & SYSTEMS

- Recent research into the use of waste industrial heat and natural geothermal heat that could provide warmth to UK homes for 100 years and cut carbon emissions by up to 40 per cent. Durham also co-founded and manages the BritGeothermal national research body for developing geothermal energy systems in the UK.
- Work to assess how scientists involved in energy systems integration develop their ideas, looking at the social and ethical aspects of energy systems, including customer energy practices and options. Durham led on the social research undertaken in the Customer Led Network Revolution project which included one of the largest trials of customer energy practices ever undertaken in the UK and

explored energy usage patterns and options for developing a smarter power grid which can cope with new demands on the current electricity network.

- Identifying options for increasing the flexibility of conventional steam and gas power plants to enable existing infrastructure to cope with more variable renewable energy generation, and assessment of how this will operate in the future power system. Find out more about the Future Conventional Power Consortium at www.durham.ac.uk/dei/projects/futurepower
- Work to design the quantitative risk modelling for the GB Distribution Network Statutory Capacity Assessment and capacity market, to assess the risk of electricity capacity shortfalls. Associated research includes work with the Electric Power Research Institute on Transferring UK experience to other systems and a new project funded through the Supergen Hubnet on '**SMART-SAFE: sequential modelling, analysis and reporting toolkit for system adequacy and flexibility**'.
- Assessment of uncertainty in predictions from large scale energy systems models and how this might be used in decision support.
- Research into Energy Storage for Low Carbon Grids to assess the value of storage in future energy systems, with particular emphasis on security of supply.
- Work to drive forward UK wind energy research and capacity to deliver integrated, cost-effective, reliable and available offshore wind through leadership roles in the Supergen Wind Energy Technologies Consortium and the follow-on Supergen Wind Hub.

// For further information contact Durham Energy Institute at dei.admin@durham.ac.uk

DEVELOPING THE FUTURE OF SOLAR PV



SOLAR PV RESEARCH AT DURHAM IS FOCUSED ON DEVELOPING THIN FILM SEMICONDUCTOR MATERIALS FOR THE NEXT GENERATION OF SOLAR CELLS. REDUCING THE COSTS AND INCREASING THE EFFICIENCY OF SOLAR ENERGY CAPTURE.

Solar PV has achieved some significant milestones over the past year. The UK's total installed solar PV capacity is now over 11 GW. In May this year solar PV produced more electricity than coal for the first time. In the last month solar PV has generated between 20-60 GWh each day with the daily maximum power in excess of 7 GW (when the sun shines!). Solar PV is now a significant contributor to the UK's electricity supply. For those of us working in solar PV research it feels as though it has taken a long time. This has been achieved through a combination of good scientific research and also economic factors such as the continued reduction in price for solar PV. The government's solar incentive schemes, although short lived, also played an important role.

To date over 90% of the world's solar PV cells are fabricated from the semiconductor silicon. Whilst silicon is an abundant element, it is found in sand on the beach, it requires significant processing and refinement to produce the crystalline or poly-crystalline silicon found in solar cells. This process involves melting the silicon at over 1000 C in enormous foundries which consumes large amounts of energy. Silicon is also not very efficient at absorbing sunlight with silicon solar cells having to be at least 300 μm thick to absorb incident sunlight.

Thin film semiconductors have significant potential as candidates for sustainable, low cost, high efficiency solar PV devices. They are generally over 100 times more efficient at absorbing sunlight. The main consequence of this is that thin film solar cells require a thickness of 5 μm of

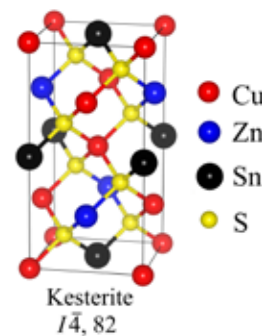
semiconductor to absorb all the available energy from sunlight, instead of the 300 μm of traditional PV, therefore significantly reducing the economic and environmental costs of producing the technology.

At Durham research is focussed on identifying alternative thin film solar materials. One of these is the semiconductor $\text{Cu}_2\text{ZnSnS}_4$. This has the advantage of being composed of very abundant, low cost elements, an important factor when considering how to grow solar PV into the Tera Watt regime. A 1 GW solar PV installation based on thin film materials will require around 100 tons of semiconductor. Some thin film semiconductors are simply too expensive to produce at this scale. There are also limitations when considering the relative scarcity of some elements used in thin film solar cells.

$\text{Cu}_2\text{ZnSnS}_4$ has been known to geologists for decades as the mineral kesterite. It has only recently been identified as a good candidate for thin film solar PV. It has a complex crystal structure where many of the important electrical and optical properties are limited by the presence of defects in the crystal. The properties and character of the material therefore need to be better understood.

Recent research undertaken by Durham has seen a series of measurements being made on crystals of this material at the Diamond Light source in Oxfordshire to elucidate the crystal structure. Work is now underway at Durham to develop a process to grow $\text{Cu}_2\text{ZnSnS}_4$ thin films for solar cells. We have also developed a chemical process

which enables $\text{Cu}_2\text{ZnSnS}_4$ nanoparticles to be fabricated in solution. This "ink" can then be used to produce thin semiconductor films as the first step in a solar cell. $\text{Cu}_2\text{ZnSnS}_4$ is a very promising material for thin film solar cells. Further work is required to understand the complex optical and electrical properties of this semiconductor and optimise the fabrication process to achieve high efficiency solar cells.

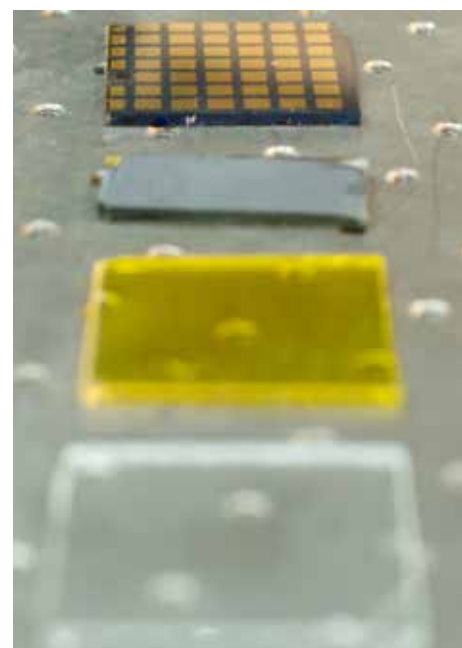


Solar has come a long way, but with this research we are confident it can make an even more significant contribution.

Research Team in Physics Department
Douglas Halliday
Peter Hatton
Budhika Mendis
Marek Szablewski
PhD students: Chris Bosson,
Max Birch and Yasir Altowairqi.



Credit Image: Ken Fields



BUILDING THE SMART GRID OF THE FUTURE.....



SMART GRID TECHNOLOGIES PROMISE TO TACKLE MANY CHALLENGING ISSUES IN POWER SYSTEMS, SUCH AS INTEGRATING INTERMITTENT RENEWABLE ENERGY SOURCES (RESS) WHICH HAVE FLUCTUATING LEVELS OF PRODUCTION, AND MEETING RISING ELECTRICITY DEMAND. TO REALISE THE FULL POTENTIAL OF SMART GRIDS, IT IS ESSENTIAL TO DEVELOP APPROPRIATE INFORMATION COMMUNICATION TECHNOLOGY (ICT) INFRASTRUCTURES AND TECHNIQUES, AND TO PROPERLY INTEGRATE THEM TO POWER SYSTEMS.

Dr Hongjian Sun (Fellow of Durham Energy Institute) of Durham's School of Engineering and Computer Sciences, is leading on three major new smart grid projects which will develop these tools and infrastructures.

Find out more about our smart grids research at www.durham.ac.uk/dei/research/smartgrids

// TESTING AND EVALUATING SOPHISTICATED INFORMATION AND COMMUNICATION TECHNOLOGIES FOR ENABLING A SMARTER GRID (TESTBED) PROJECT: H2020 MSCA-RISE.

TESTBED is a major interdisciplinary project coordinated by Durham that combines insights from three academic disciplines - Electronics Engineering, Power Engineering and Computing Sciences, to address the difficulties of data transmission in smart grids. The EU funded project will coordinate action of 5 Universities and 3 enterprises from EU and China, to build and test sophisticated ICT to facilitate the successful implementation of smart grid applications.

Smart grid technologies can significantly improve the efficiency, reliability, and economics of the production, transmission, and distribution of electricity. In order to perform smart grid

applications it is crucial to exchange and use huge amounts of information. However, in reality the exchange of information over multiple networks is unreliable, leading to unpredictable network Quality-of-Service and thus unreliable smart grid applications. This is made worse by the massive scale of data needed, including metering data, measurement data, structured or unstructured data, which makes it challenging to exploit useful information. There is an urgent need to solve the research problem: how to coordinate multiple networks to reliably transmit data, and then manage ICT system resources to efficiently extract useful information for supporting smart grid applications?

Led by Durham the project partners include:



// TOWARDS JOINT POWER-COMMUNICATION SYSTEM MODELLING AND OPTIMISATION FOR SMART GRID APPLICATION: VIRTUAL POWER PLANT (TOPMOST) PROJECT: UK EPSRC.

The UK's electricity networks are serving millions of people everyday but now are facing a challenging future, with ageing infrastructure but increasing penetration of Renewable Energy Sources (RESs). As such, the Office of Gas and Electricity Markets (Ofgem) has approved plans to spend £17bn for upgrading the UK's electricity networks till 2023 by using smarter technologies. As one of the most promising solutions, smart grid has attracted much attention, since it is capable of enabling bidirectional flows of energy and communications in the power grid infrastructure, that is crucial in improving the reliability, security, and efficiency of the electric systems and keeping the lights on at minimum cost to consumers.

In this project Dr Hongjian Sun, working with project partners Sunamp Limited (an innovation leader in the field of Thermal Storage) and Intel Corporation Ltd (the computing and smart technology innovators), will be focused on developing the key smart grid application, Virtual Power Plant (VPP). This is designed to aggregate the capacity of many diverse distributed energy resources (DERs) and flexible demands to create a single operating profile - the single "virtual power plant" which will help balance supply and demand in real time. To facilitate VPP, both optimisation algorithms and communication technologies play a significant role, but the full potential of VPP has been hampered by the lack of joint power-communication system models and the thorough analysis of the impact of communication system

imperfections to optimisation algorithms.

The project will develop better understandings of these two systems operating with close interactions in VPP, more advanced methods in the design of VPP, and implement a hardware testbed of VPP with two-way real-time communication capability in Durham Smart Grid Laboratory. These could potentially lead to more efficient management of RESs and flexible demands, ultimately to improved operational efficiency of power grids for system operators and to reduced cost for consumers.

Perhaps most importantly, however, is that this research will enable us to begin asking how we shall optimise the performance of smart grid technologies, considering not only power systems but also realistic communication systems, thus encouraging multidisciplinary research and cross-fertilising both fields.

// SMARTER GRID: EMPOWERING SG MARKET ACTORS THROUGH INFORMATION AND COMMUNICATION TECHNOLOGIES (SMARTER-EMC2 PROJECT): H2020-LCE7.

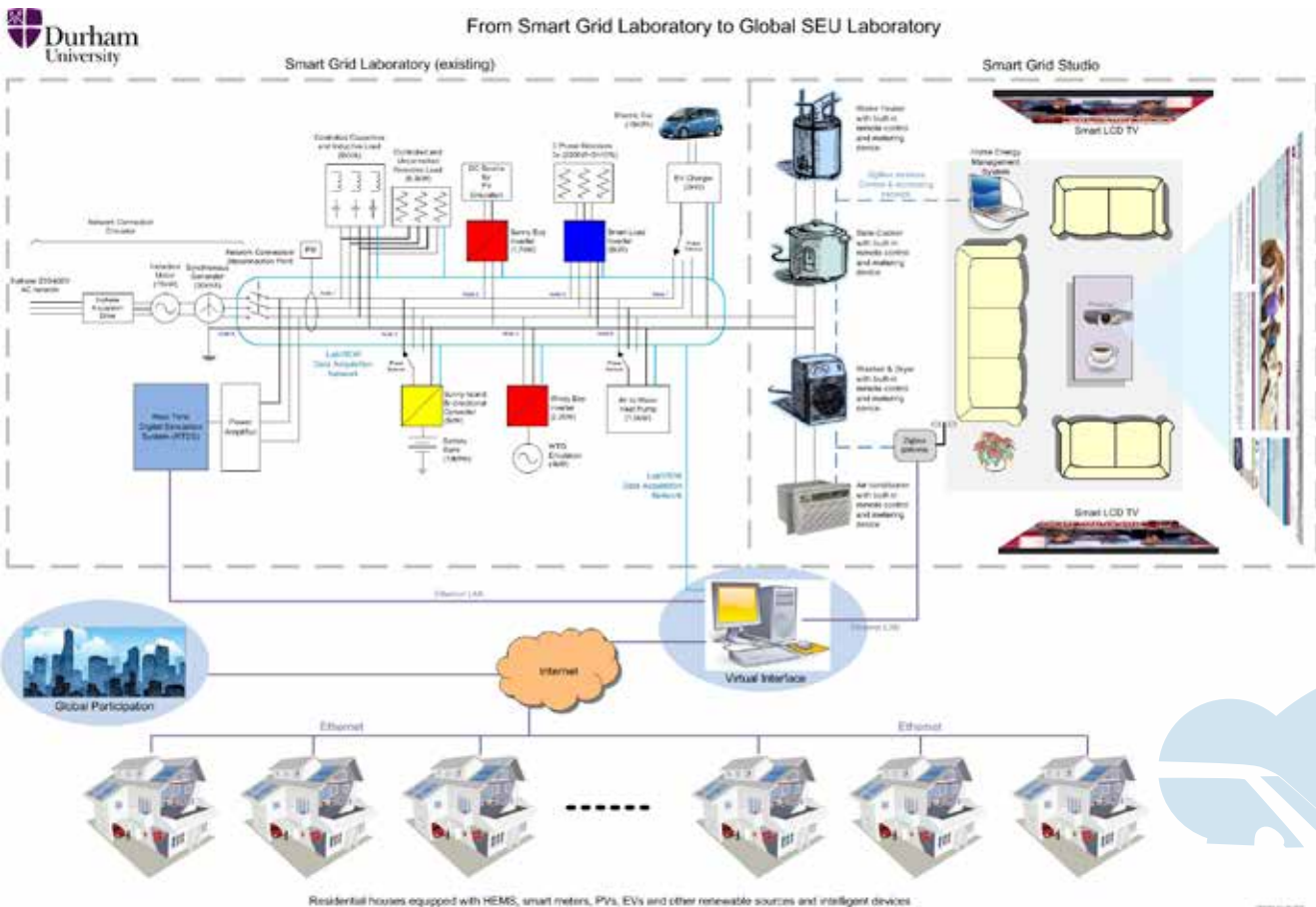
The international consortium (1/1/2015-31/12/2017) led by Intracom Telecom (Greece) includes Durham University, Institute of Communications and Computer Systems (Greece), Thales Italia, Instituto de Engenharia de Sistemas e Computadores do Porto (Portugal), Aydem Electricity Distribution (Turkey), Electricity Distribution Services (Turkey), Aalborg University, Fujitsu Laboratories of Europe, Hellenic Electricity Distribution Network Operator and Hellenic Telecommunications Organization (Greece).

The SmarterEMC2 project is funded by the European Commission's Horizon 2020 Framework Programme (H2020/2014-2020). It aims to implement ICT tools that support the integration of consumers through Demand Response services and the integration of DG/RES through Virtual Power Plants and facilitate open access in the electricity market. These tools take into account the Smart Grids Architecture Model (SGAM) as well as the future structure of the Distribution Network, as described by the relevant EU bodies and organizations. The project explores whether the existing telecommunication infrastructure is sufficient to support in mass scale the emerging business models and Smart Grid services. The project will also contribute to the standardization of data models to market-oriented standards (e.g. IEC 62325-351) and field level standards (e.g. IEC 61850).

This project is fully dedicated towards achieving a maximum of impact. To validate the proposed technologies, the project includes 3 real-world pilots and large-scale simulation in 3 laboratories. The former will demonstrate the impact of Demand Response and Virtual Power Plants services in real world settings, while the latter will reveal the ability of the communication networks to support massive uptake of such services.

The project vision is to create the innovative ICT tools which will become part of the infrastructure of the Distribution Systems Operators (DSOs), telecommunications operators and other independent entities, to enable the provision of novel smart grid services through a unified ecosystem to all market participants.

// More information about SmarterEMC2 project can be found at www.smarteremc2.eu





OUR MINING HERITAGE: THE LEGACY OF DAVE HOPPER

The Durham Energy Institutes emphasis on the combination of Energy, Science and Society is particularly exemplified in the North East of England where the historical legacy of coal mining has shaped the local communities, landscape and society. The importance of this legacy is strongly recognised by the DEI and we have endeavoured to build on this through our social and scientific research, engagements with communities and partnerships across the region. This is why we are particularly excited to be developing strong links with Durham Miner's Association, working together to bridge the energy past with our energy future.

// DAVE HOPPER

The sudden death of Dave Hopper, the General Secretary of Durham Miners Association, at the age of 73 just a week after the 132nd Durham Miners' Gala in July 2016 was a huge loss to the region. Through his championing of local communities and sustaining the Durham Miners Association and Gala he ensured that the miners' struggles were not forgotten, that former pitmen won the compensation they so deserved and that the region's voice continues to be heard.

Dave Hopper was born in Sunderland, where his father worked at Wearmouth Colliery, in 1943. Following in his father's footsteps at the age of 15, Dave's first job at the pit was stone picking on the surface screens. Once he turned 16 and was allowed 'down the pit' he first worked at the shaft bottom loading tubs into the cage. From there, he progressed in-by and finally, at the age of 19 and fully face-trained, he began hand-filling on a three-foot-high coalface – the most physically demanding job at the pit.

By 1972 Dave began to take a keen interest in the union. He read avidly about the history of the labour and socialist movement and became convinced

that capitalism was the enemy of working people the world over, never wavering from this view. By the end of the miners' strike in 1985 Dave was elected General Secretary of the NUM (Durham Area).

When the last pit in Durham closed in 1993, all appeared lost. However, that was not how Dave saw it. The building assets of the Durham Area were put up as collateral and the union fought a court battle for compensation for members suffering from the industrial disease vibration white finger. When they won, £1.7 billion in compensation was paid to miners throughout the coalfields of Britain.

The Durham Miners' Gala, which under Dave Hopper's leadership has grown and developed into Europe's largest celebration of community and trade union values, is his legacy and he leaves it to us all to cherish and guard with all the passion he demonstrated throughout his life.

// HISTORY OF THE MINERS GALA

The Durham Miners Association held their first Miners' Gala in 1871 in Wharton Park, Durham. At its peak, the Gala attracted more than

300,000 people, more than seven times the population of Durham itself. After the Second World War the numbers attending increased and only started to decrease in the late 1960's and seventies due to closures. After the 1984/85 strike, Dave was instrumental in inviting banners from the wider trade union movement to march behind miners banners and only after 1993 did banners from closed pits start to march. Numbers attending began to increase after 1994, over 60 banner groups have now sprung up in the villages making new and replica banners.

No active deep mines remain in the Durham Coalfield. Despite this, the Gala continues to be organised. The 132nd miners' gala on 9 July 2016 saw an estimated 150,000 people attending, making it one of the biggest political gatherings in Europe. During the day more than 100 banners from former mines, trade unions, schools and groups were marched to the racecourse where speeches from Dave Hopper (DMA), Frances O'Grady (TUC), Jeremy Corbyn MP and Dennis Skinner MP were heard.



// HISTORY OF COAL MINING IN THE DURHAM COALFIELD

The 1183 'Baldon Book' mentions a coal miner at Escomb, stating that the coal miner provided coal for the iron-work of the ploughs at nearby Coundon. By the mid 1300s, mines were recorded at Cockfield, Coundon, Hett, Lanchester and Ferryhill, along with others further east at Lumley and Rainton. From the later eighteenth century the landowners of the county, including the Bishop of Durham, accumulated vast wealth from their collieries.

During the nineteenth century, coal mining rapidly expanded in County Durham and over 200 pits were sunk during this time. The growth of the mining industry during this period saw it transforming the landscape and the population of County Durham. The industry was having a profound effect on trade unionism, public health and housing too.

The coal mining industry continued to grow throughout the early twentieth century. The development of coal mining in Durham brought about a remarkable increase in the population. Many previously rural villages, grew into small colliery towns almost overnight, increasing from around 7,000 colliers employed in 1,787 to

170,000 miners at the industry peak in 1923. During this time, the Durham Miners Association was founded (1869). Its membership quickly rose to 4,000 becoming the largest miners' union in the UK. By 1900, membership had risen to 80,000 and the DMA's existing residence on North Road in Durham, which opened in 1875, became unfit for purpose and the new Miners' Hall was opened in 1915. The Miners' Hall is a handsome and impressive building which remains as a fitting tribute to the heritage of coal mining in County Durham.

Many pits closed in the 1950s and 1960s, often with devastating consequences for small mining communities which relied on coal mining for work. By the end of the miners' strike in 1985 there were just 11 coal mines in operation. In 1994 the closure of the Wearmouth Colliery in Sunderland saw the end of the last remaining colliery in the Durham coalfield. The site is today marked by Sunderland football club's Stadium of Light.

// BUILDING ON THE MINING HERITAGE

Research at Durham University has looked at the coal resources which remain in the ground and their potential role in UK energy security. It is also identifying sustainable and low-carbon opportunities for building on this mining

legacy such as using naturally heated water from abandoned mines in community heating schemes. Research has also addressed the social and economic impacts of the closing of the mining industry on the region.

Durham Energy Institute have also been developing a close collaboration with the Durham Miners' Association and held a successful first joint event at the Durham Miners Hall in May 2016. The panel for the debate on 'What role will fossil fuels play in future energy?' included Alan Cummings, President of Durham Miners Association as well as Barbara Vest of Energy UK, Professor Alan Lowdon of Invisotech, Jonathan Elmer from the Green Party, Professor Paul Younger from Glasgow University as well as DEI's Professors Simon Hogg and Andy Aplin.

We plan to continue to develop joint events, educational programmes and research opportunities as well as helping to support the fundraising for maintenance of the listed Durham Miners Hall building

Dave Hopper was an enthusiastic supporter of this closer engagement and DEI are keen to continue to build on what he has helped us to achieve so far.

// **Acknowledgements**
www.durhamintime.org.uk/durham_miner/redhills_hall.pdf
 'The Limestone' by Dave Temple, DMA Press Officer
 Durham Miners Association: www.durhamminers.org
 Durham Mining Museum www.dmm.org.uk
www.durhamrecordoffice.org.uk/Pages/CoalminingandDurhamcollieries.aspx
 England's North East, David Simpson www.englandsnortheast.co.uk/CoalMiningandRailways.html
 Front cover Whitworth Colliery painting by Derek Slater www.derekslater.co.uk



Credit image: Roy Lambeth @ Durham Mining

Article by Lynn Gibson (DEI) and Dave Temple (DMA)

BUILDING INTERNATIONAL COLLABORATION THROUGH NEWTON FUNDING

The Newton Fund uses science and innovation partnerships to promote economic development and social welfare of partner countries. There are a wide range of countries the UK is partnering with under the Fund including India, Turkey, Brazil, Mexico and China. Durham Energy researchers have recently received funding to develop links with India and with Turkey. To find out more about these opportunities contact DEI offices or go to www.newtonfund.ac.uk



// ENHANCING SOLAR ENERGY TRAINING AND RESEARCH IN INDIA

The DEI has entered into an exciting new partnership with the University of Kota in the state of Rajasthan, India. The University of Kota is a State Government University established in 2003 and supported by the University Grants Commission of India. The Newton Bhabha Fund aims to support the UK and Indian scientific research and industry sectors to identify solutions to the challenges facing India in economic development and social welfare. Through collaboration, training and people exchanges the fund aims to use the UK's strengths in research and innovation to build skills and capacity in India. This project is a collaboration between the Durham Energy Institute, University of Kota, MSA Renewtech Foundation and Cranfield University (UK). The University of Kota will use this collaboration to help develop its M.Tech Solar Energy Programme, enhance physics and engineering education and develop collaborative research opportunities. The first stage of this project was a visit to DEI by Dr Namrata Sengar, Associate Professor at the University of Kota for 4 weeks to learn about the work of the DEI, our energy training approaches and solar energy research at Durham. During her visit Dr Sengar also gave a seminar on the energy challenges faced by the state of Rajasthan and India. The next stage of the project will be a visit to the University of Kota by Douglas Halliday to deliver a series of lectures on solar PV technology.

// **Anyone interested in supporting this project or in finding out further information should contact Douglas Halliday, Senior Lecturer in the Department of Physics and Director of Centre for Doctoral Training in Energy on d.p.halliday@durham.ac.uk**



// INTERNATIONAL WORKSHOP ON ENERGY INFRASTRUCTURE: SECURITY, ENVIRONMENT AND SOCIAL CONFLICT, ISTANBUL JUNE 2016

Securing reliable, affordable and environmentally sustainable energy supplies is one of the grand challenges of the 21st century. New energy infrastructure is key to addressing this challenge but raises profound questions for society: Whom does infrastructure serve? Who has a voice when infrastructure decisions are made? How do infrastructures shape resource flows and consumption practices? To what political possibilities do energy infrastructures give rise? With support from a Newton-Katip Çelebi Fund Researcher Links Workshop Grant, Professor Gavin Bridge (Geography) convened an international workshop to explore these questions with research partner Professor Begüm Özkaynak at Bogaziçi University, Istanbul. Turkey is experiencing transformational growth in energy infrastructure but current research gives limited attention to its public acceptability and socio-environmental consequences. Energy policy-making remains centralized and divorced from public participation, and mounting opposition to new energy investment is increasingly framed in terms of citizenship and social justice. In Turkey, as in the UK, questions about who bears the costs of power stations, pipelines and other energy infrastructures animate calls for more just, inclusive and sustainable energy systems.

Held in Istanbul at the end of June 2016, the week-long workshop brought together 30 early career researchers and six senior mentors from the UK and Turkey. A combination of keynote lectures, panel discussions, and participation by representatives from local community groups, municipal authorities and the government policy community in Turkey identified core issues. Poster presentations by researchers, researcher-led discussions and a field excursion fostered horizontal linkages among workshop participants with the aim of building research collaboration into the future. Outcomes from the workshop include a journal special issue and a number of project proposals now undergoing further development. Durham participation involved Professor Gavin Bridge, Professor Marcus Power and Dr Jonathan Silver.



NEW RESEARCH UPDATE

// NEW PROJECT ON HYDROCARBON POTENTIAL OF THE CONTINENTAL SHELF

Jonny Imber, Andy Aplin, Jon Gluyas, Bob Holdsworth, Stuart Jones and Ken McCaffrey have started a 2-year, £250k project funded by the UK Oil & Gas Authority to evaluate the hydrocarbon potential of the continental shelf to the southwest of Britain. This region of approximately 90,000 square kilometres is larger than the Southern North Sea gas basin, but has only 29 exploration wells, many of which date back to the 1970s and 1980s. The funding will allow us to apply modern technology and geoscientific concepts to the Southwestern Approaches area, and will benefit from a package of new Government-funded seismic reflection data that will be made available in the Spring of 2017. The project is led by Durham University (Department of Earth Sciences), with partners at Keele University (School of Physical and Geographical Sciences), the University of Leicester (Department of Geology), Geospatial Research Ltd., Trace Editors Ltd. and Applied Petroleum Technology (UK) Ltd.

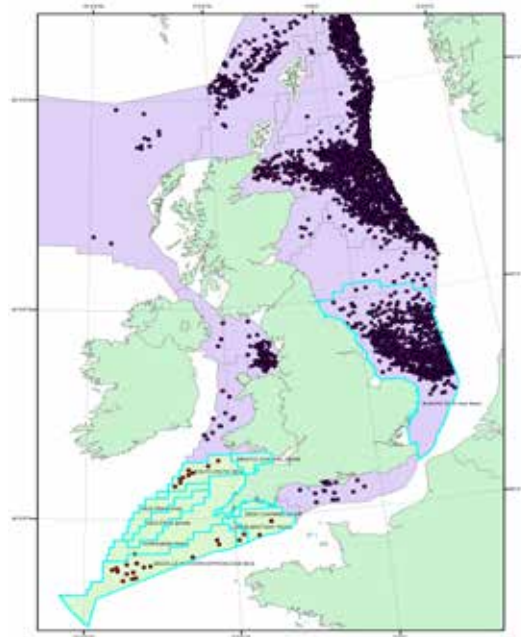


Figure showing the Southwestern Approaches study area highlighted in blue. Key geological features (e.g. South Celtic Sea basin) are named. The locations of hydrocarbon exploration wells within the study area are highlighted in red. By way of comparison, hydrocarbon wells in other areas are coloured purple, and the Southern North Sea basin off the east coast of England is also labelled and highlighted in blue.

// LEVERHULME RESEARCH FELLOWSHIP, TO THE ENDS OF THE EARTH: NEW GEOGRAPHIES OF RESOURCE EXTRACTION AND CIRCULATION

Professor Gavin Bridge (Geography) has been awarded a Leverhulme Research Fellowship to research and write a book on extractive resources. The periodic expansion of resource extraction towards the 'ends of the earth' raises concerns about resource security, livelihood sustainability and the breaching of planetary boundaries. But what drives resource rushes and shapes their unevenness in space and time? How are subterranean mineral resources assembled as objects of metropolitan investment and speculation, and with what consequences for lands and livelihoods? Professor Bridge will be examining two periods in which distinctive new geographies of resource extraction emerged at the world scale: the late 19th century (anchored by archival research on tin mining in northern Nigeria, gold in Guyana, and London as a centre of mining finance); and late 20th century (exemplified by copper and gold mining booms in Guyana, Peru, United States, and London and Toronto as key financial nodes). His project develops an original theoretically-informed account of the spatial and temporal dynamics of resource extraction. The resulting book combines a rigorous theoretical treatment of the political economy of 'making nature' in the context of non-renewable mineral resources, with empirically-grounded research on practices through which extractive economies take shape.

// BRINGING ENERGY TRAINING AND INDUSTRIES CLOSER

PEOPLE

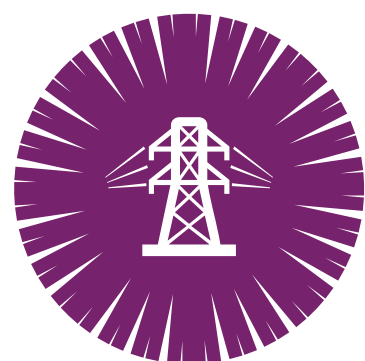
Anthropologists Professor Sandra Bell and Dr Simone Abram, and Evelyn Tehrani of the DEI, are part of a successful funding application to the EU Erasmus Plus Programme. The PEOPLE project brings together universities, research institutes and companies from UK, Slovenia, Netherlands, and Czech Republic, to develop and integrate innovative approaches to people-centred learning and research. It aims to equip young people with the knowledge and skills needed by industry and provides lessons for tutors that will be passed to future generations of learners. The project will involve post-graduate Anthropology students working with companies, such as Kemuri in the UK (www.kemurisense.com/), on projects to improve the design, and testing of products and services in the field of Sustainable Living through the use of social science research approaches. New training and teaching modules will also be developed through the learning process.

Kemuri



// HEAT TO HEAT ELECTRICITY CONVERSION

Dr Claudio Balocco is being funded by the EPSRC for his project entitled 'Nano rectennas for heat-to-electricity conversion'. This project addresses a new technology to convert radiant heat to electricity, using large arrays of electronic nano-devices known as nano-rectennas. We envisage their use in micro (also known as domestic) combined heat-power (mCHP) systems, converting part of the heat from the burner into electricity, operating with sources at temperatures of up to a few hundred degrees centigrade. Unlike thermoelectric devices, our proposed energy converters are neither in physical contact with the hot source, nor require materials with a high toxicity or strict disposal regulations. Our rectennas are fabricated using "green" materials, and are based on common metals (e.g., titanium, platinum and gold), carbon (in the form of graphene) and non-toxic, highly-stable organic layers.



THE END OF THE GREEN DEAL

Students from the MSc Energy and Society course at Durham undertook a group fieldwork project as part of their training exploring why the flagship Government initiative - the Green Deal – had ended. Their findings fed into the DEI responses to enquiries into Government initiatives for home insulation which can be found at www.durham.ac.uk/dei/partnerships/government

The Green Deal was a UK government initiative that ran from January 2013 to July 2015 that enabled customers to pay for energy-saving improvements for their home through a pay-as-you-save scheme. Customers could apply for a government loan for home improvements such as insulation, new boilers and efficient lighting, which would then be repaid through the customer's electricity bill. These energy efficiency measures meant that customers would be able to repay their loan without seeing an increase in their bill, a principle that was referred to as the "golden rule". The Green Deal was closed in July 2015, with the government citing low uptake, concerns over industry standards and the need to save taxpayers' money as key reasons for the closure.

The students, Ije Achara, Seun Akinsoji, Ellis-Anne Dunmall, Alex Hill and Weni Igrigi, employed a combination of literature searching and interviews with participants in the energy savings industry. They found that several aspects of the scheme led to its poor uptake and that the picture presented by the government to justify its closure was overly simplistic.

- The interest rate on Green Deal loans was very unattractive.
- Scheme did not take into account that people with poor credit ratings would be unlikely to prioritise energy efficient retrofit over other debts.
- There were enormous problems in understanding and communicating the scheme early on and the initial message about Green Deal having 'no upfront cost' was also misleading.
- The attempt to induce a market mechanism, in the form of loan finance combined with accreditation scheme and a customer process for Green Deal, had the effect of rapidly creating a retrofit market removed from other energy supply and home improvement services, which was unnecessary and arguably counterproductive.

- The Green Deal was directly communicated to and widely anticipated among energy and environmental sector professionals but not among design professionals and domestic tradespeople/contractors, who would have had the appropriate skill levels to deliver it. It was also barely communicated at all to the general public, relying on community groups to market the scheme.
- The combination of Green Deal and ECO subsidies tended to exclude most households or make it very difficult for them to engage with the Green Deal.
- Many of the participants reported that the scheme was complicated as it had several unusual and conflicting elements
- Due to the reduction in funding to the Green Deal scheme, private companies were attempting to make money without personal investment, causing industry standards to fall. Instead of investing in their businesses to ensure standards were met, they compromised on the quality of work which was being carried out even to the detriment of their reputation.

// RECOMMENDATIONS FOR FUTURE SCHEMES

Their research suggests that for future schemes the government would be advised to:

- Communicate more effectively with small businesses to address financing and structural issues early on;
- Communicate and integrate more with existing home improvements market from designers including architects, construction and building services and installers;
- Increase advertising to general public to increase uptake;

- Integrate the scheme into local council plans to enable a more tailored local fit;
- More account needs to be taken of what home improvements people are willing to pay for which is shaped by social and historical factors. People were disinterested in taking out loans for insulation preferring to pay for solar panels or new boilers. This seems to have been influenced by the visibility of improvements that could be shown to neighbours and due to insulation being free under past government schemes which made people feel they should not have to pay for that;
- Design a more simplified process which is easier for households to navigate options.

// You can read the full report, watch a presentation on the project findings or see other reports from MSc Energy and Society students at www.durham.ac.uk/dei/resources/mscpapers

Are you interested in why energy efficiency measures often fail? Why some energy technologies spread, while others disappear? Or, how can people be persuaded to change their energy habits? Then the MSc in Energy and Society is for you!

This course investigates energy systems from all angles, bringing in leading experts in energy studies at Durham from Anthropology, Engineering, Economics, Law, Geography, Geosciences and many other departments. On this course you will look at energy in practice, what it means to make an energy transition, what we mean by energy justice, and how energy practices change. You will learn about current and new energy technologies, histories of energy, how to understand energy policy, and how to study energy practices.

Find out more about the course at www.durham.ac.uk/mscenergyandsociety

// EXCHANGES AT THE 'LOLO' STUDENT-LED ENERGY CONFERENCE

by Michael J Laiho

Visiting the 'LOLO' (The London-Loughborough EPSRC Centre for Doctoral Research in Energy) was a change of perspective from Durham's CDT and provided me with the opportunity to explore with other researchers some of the issues of interdisciplinary research we grapple with in our Centre.

Professor Bob Lowe (UCL Energy Institute) opened the student-led conference in a remarkable manner by posing the question 'Why do we need a conference on methods?'

'Energy demand is a very complex phenomenon, where any single method is inefficient and with such high stakes that actually we need to know.' 'Energy demand,' a research theme the Professor specialises in, 'is not about ivory tower science — the world is embedded in change so we need to be prepared for challenges.'

To summarise his keynote speech, Bob told us that his own work on building physics is limited unless engaging with other disciplines and methods. This was one of the key reasons why I joined the energy CDT at Durham, to tap into more cross-disciplinary research cultivation, and my own discipline, human geography, has always seemed an exemplary model for mixed methods and disciplines.

One clear comparison between the LoLo group and my own energy CDT at the DEI was that Durham has a stronger focus on interdisciplinarity. Though this buzz-word is touted a lot in academia as a means to explore research funding interests which cross-over

from one camp to another, the intellectual stimulation from learning new approaches to energy-related problems is highly rewarding. The LoLo energy CDT comprised principally of engineers, with methods students numbering a few critical, philosophical, but mostly stats-oriented, thinkers. Any of my peers in the LoLo group focused on engineering and infrastructural problems relating to the energy transfers and conservation but few tackled innovative ways of sourcing power sources. In Durham the cohort combines not only engineers but also Geographers such as myself, Physicists, Chemists, Earth Scientists, Mathematicians and Anthropologists focused on energy sources, generation, distribution and consumption. However, it was pleasing to see the extent to which social science methods, such as social anthropology and philosophy methods, are used in the LoLo group.

In the first break-out session, it became evident that there was a lot of concern among researchers about how to navigate the tensions between acknowledging the limits of positivism and abstract measures while still meeting the need to measure something. A couple of toe-to-toe presentations were used to bait other participants and I was one of the participants who voiced their concerns about taking either too empirical or theoretical approaches to solving energy problems.

Later that day, Clare Hanmer (LoLo), a former Durham MSc Energy and Society student, explained why her research suggested that a change in the 1960s natural gas conversion took place in spite of earlier developments in central heating technology. Anthropological change could be understood using Actor-Network-Theory

(ANT), which presents human-technology relations in way that one notices how technology shapes people, as well as vice versa. Further questions, such as how suppliers advertised to their consumers, or how stability takes place when multiple changes are possible, continue to inspire Clare's PhD work at LoLo.

Dr Kathryn Janda from the Environmental Change Institute, Oxford University, gave an inspiring keynote presentation — framing stories about energy triumphs and tribulations, and explaining how we live in a 'monomyth' culture. Her work touched on a few of the questions cropping up in my own research that invited us to become critical about Cornucopian approaches which marries technology and science with socio-ecological concerns. According to Kathryn, government discourse too often proclaims that 'Technology will save us!' However, the modern-age problem is not about science anymore, it is that people do not care enough.

As for me, I was invited to present a research poster on how the EU imagines Arctic space because my methodology was considered complementary to more discursive, qualitative work undertaken by LoLo students. I would like to thank Durham's CDT and DEI for their generous support with financing my travel and accommodation in London. The opportunity to present my work and engage in discussions about energy science and society with new groups of researchers will help me in developing my own PhD.

Donate to the DEI Student travel and internship fund!

Durham Energy Institute seeks to support undergraduates and postgraduates to access academic and career development opportunities. Students often struggle to meet the costs of travel to conferences and meetings which are so important to their research and career development. Other students are awarded prestigious summer placements overseas but find they are unable to cover the travel costs. We believe finance should never prevent talented students accepting such opportunities. DEI therefore provides travel bursaries for students to carry out research projects or attend conferences when other funding options are not available.

To make a donation go to www.dunelm.org.uk/donate/DEI





IN CONVERSATION WITH...

// **ANDREW WRIGHT, SENIOR PARTNER IN ENERGY SYSTEMS AT OFGEM, MEMBER OF DEI ADVISORY BOARD AND DURHAM ALUMNUS**

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

1. What did you want to be as a child?

As a younger child I was always obsessed by science and nature (stars, planets, dinosaurs, animals and so on), and had a vague wish to be some sort of scientist. As a sixth-former I would probably have rather been in a punk band, but I ended up reading Physics at Durham, without much idea about where that might take me.

2. What are your best and worst memories of Durham?

I have many good memories, but I never forget the warm welcome when I arrived as an overwhelmed 17 year-old for my interview. In those days, the university was on a human scale, and interviewees were met individually by undergraduates at the station. Durham gave me a "token offer", which, as bright kid from a working class background with a dubious work ethic, I badly needed.

My worst memories are probably my Sunday evening struggles with my weekly Physics problem sheet. I had a fairly quick and sobering realisation that I was unlikely to be the next Einstein. It took me a number of years to find my vocation after that.

3. What or who has been your biggest influence to date?

Undoubtedly my wife, Judith has been my biggest influence. We met just after I

graduated from Durham, and we more or less grew up together. We have shared many personal and political battles and I have never met anyone more determined or principled. She is both an inspiration and a motivation.

4. What are the real myths around energy and climate change?

The biggest myth around energy is that it could, or should be treated just like any other product or commodity. Energy is an essential public service, the lifeblood of a modern economy and has a huge impact on our environment. The biggest myth around climate change is that we can carry on regardless and somehow everything will be OK. We can't and it won't.

5. What is your biggest regret?

I was diverted early on in my career from an academic path in the pursuit of money. I had little choice at the time, but my recent exposure to academia at Durham has reminded me how much I may have missed out. Working at Ofgem is a happy compromise and provides plenty of opportunity to satisfy my curiosity and desire for a social purpose.

6. What would you say to undergraduates looking for a career in the energy industry?

I would advise them to jump right in without hesitation. The energy industry is at the heart of some of the biggest challenges facing our society today – not least, how can we adapt our societies and economies to prosper without relying on fossil fuels. Energy touches every part

of people's lives. How we deal with the energy transition will determine what sort of world future generations will live in. The technical, economic, cultural, intellectual and political challenges match anything you can find in any other sector.

7. What are you hoping to achieve through your engagement with Durham Energy Institute's Advisory Board?

Aside from compensating for the academic career that never was, I hope that I can add value to the work of the DEI, both through my role in Ofgem and my lifetime of experience in the energy sector. We are at a time of transition in energy when universities can add tremendous value, mapping out the ever changing energy landscape. It is already the case that my contacts and discussions through the DEI have enriched my approach to the issues I face every day at Ofgem.

// **Andrew Wright is Senior Partner in Energy Systems at Ofgem, the gas and electricity regulator for Great Britain. He is a member of the Gas and Electricity Markets Authority, Ofgem's governing body. Andrew has 30 years' experience of working in the gas and electricity sector.**

After graduating in Physics from Durham, Andrew went to Cranfield University, where he wrote his PhD thesis on the statistical modelling of soil erosion. He then worked as post-doctoral research associate in the Energy Research Group at Cambridge University and, later, as an energy sector consultant.

// EVENTS @ DEI MICHAELMAS TERM

DEI Public Lecture: The nuclear option – To what question are Small Modular Reactors the answer? (9 November, 18.00) Candida Whitmill, Managing Director, Penultimate Power UK Limited.

DEI SEMINARS:

Biogas at Altitude: a case from Nepal (27 October) Dr Ben Campbell, Department of Anthropology

Contested Powers: Energy, Sovereignty and the Good Life in Latin America (3 November), Dr John McNeish, Visiting Fellow, Department of Anthropology

Spaces energy and climate change: mythologising carbon through the EU's Arctic Policy (24 November), Mika Laiho, Geography and member of Durham University Energy CDT

Paris and Syria: Climate Change and Energy Wars (14 December), Dr Wilf Wilde, DEI Advisory Board Member

Energy on tour: the politics of visitor access to power generation sites (15 December), Tristan Loloum, Visiting Fellow, Department of Anthropology

// **To find out more about planned DEI events and to book your place go to www.durham.ac.uk/dei/events**

CONTACT

Durham Energy Institute Durham University South Road Durham DH1 3LE UK
+44 (0)191 334 2649 www.durham.ac.uk/dei/ [@DEI_Durham](https://twitter.com/DEI_Durham)