



Durham
University

Science and Society

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Durham Energy Institute Review

This issue:

- DEI news round-up
- Leading the public energy debate
- Training the energy leaders of tomorrow
- Attitudes towards renewable energy
- Secondments with industry
- New biotechnology and bioenergy network
- Curating Europe's Oil



A message from the New Executive Director of the DEI

I am delighted to take on this exciting new role as executive Director of DEI. Since I arrived in Durham in 2010 I have been impressed by the development of the Institute and I look forward to helping grow the DEI's reputation further as an internationally leading institution which is recognised for promoting and delivering truly interdisciplinary Energy research.

I strongly believe that a key strength of DEI lies in its 'Science and Society' approach and I look forward to engaging with the wide range of energy experts we have across the University. We now have a new executive team in place which represents a number of different disciplines engaged within Energy research. We intend to strengthen the DEI Executive by appointing another co-Director to the team in the coming months. We plan to use this strategic opportunity to further increase DEI engagement with our social scientists. This places us in an even stronger position to achieve our ambitions and enhance our most distinctive feature – our truly multidisciplinary focus on energy.

The immediate hot topics on my agenda are the exciting opportunities for research and multi-sector engagement presented by funding initiatives such as Horizon 2020 and Local Enterprise Partnerships, focused on enhancing research and innovation in the region, Europe and beyond. By effectively engaging with industry and policy throughout the research process from idea to project execution, we can ensure that the impact of our research is relevant, timely and effective. This also enables energy policies, infrastructures and industrial processes to be informed by the evidence emerging from our latest findings and for Durham University and the DEI to be recognised for this contribution. My time working in industry with Alstom makes me even more aware of how important these connections are.

I will ensure that the energy research and expertise at Durham University has the external profile it deserves so that we can all enjoy the benefits that this brings. One of the exciting new initiatives that we have just launched is the formation of the DEI Policy

Expert Group – which will strengthen links between our experts and policy makers. The group will be liaising with key policy decision makers and producing resources to support and influence the development of effective national and international energy agendas. We have also begun the process of developing an international alliance of Energy Research Institutes; a network which will help us further promote our interdisciplinary approach to energy research and provide us with a stronger platform for influencing and participating in future collaborative research programmes and for informing international energy agendas.

I would like to take this opportunity to thank Wilf Wilde for his stewardship of the DEI over the last year. This is a very exciting time for Durham Energy Institute. I know that I am privileged to be given the opportunity to guide the Institute through its next period of development, based on some firm foundations laid-down by Wilf and the team over the last year.



“By effectively engaging with industry and policy throughout the research process from idea to project execution, we can ensure that the impact of our research is relevant, timely and effective.”



Simon Hogg
Executive Director,
Durham Energy
Institute

DEI News round-up

New executive team in place!

Durham Energy Institute has a new executive team in place which reflects our broad membership of energy experts across the Sciences and Social Sciences and deepens our leadership base from senior academics through to early career researchers. This will further support the Institute's purpose to foster the strong interdisciplinary ethos in energy research required to realise the UK's low carbon future.

DEI Executive Director



Professor Simon Hogg has extensive experience of leading large collaborative research in both industry and university environments. He is based in Durham University's School of Engineering & Computing Sciences and focuses on power generation turbomachinery, including conventional steam and gas turbine plants, wind turbines and organic rankine cycles for waste heat recovery applications. He leads two major consortiums: EPSRC Supergen V Wind Energy Technologies and EPSRC Future Conventional Power Research. He has over 10 years experience working for ALSTOM's Power division in Research and Development, Tendering and as Engineering Director of their Turbine Retrofit Business.

DEI Co-Directors



Dr John Bothwell is Reader in Bioenergy in Durham's School of Biological and Biomedical Sciences where he looks at the evolutionary, ecological, and economic importance of macroalgae (= seaweeds), including its bioenergy potential. John also has a strong commitment to early-career and staff equality and development, having won the Athena SWAN Gold award and co-authoring the RCUK Concordat for the Career Development of Researchers.



Prof Tooraj Jamasb is Chair in Energy Economics at Durham Business School. His research into energy economics and policy focuses on energy sector reform, networks, regulations, demand, innovation and community acceptance of technologies and developing countries. He has strong international links and interests in Energy for Development, with research focused on the energy experiences of many countries.

DEI Impact Fellow



Dr Chris Dent, Lecturer in Energy Systems Modelling in the School of Engineering and Computing Sciences, is supporting the DEI to enhance links with Industry and is using his track record of achieving impact to help DEI academics take their own research to wider audience. He recently received an inaugural Durham University "Excellence in Research Impact Award". Recognising his work with National Grid on the Great Britain Electricity Capacity Assessment report, and with DEI.

DEI Mid-Career Fellows



Dr Victoria Wells, Senior Lecturer in Marketing in the Business School, examines consumer behaviour and responses to marketing actions. One key aspect she explores is consumer behaviour in relation to the environment, and environmental behaviour change. Recent projects focus on community attitudes and public acceptability of energy technologies, such as wind power and producing energy from seaweed. She also explores the pro-environmental behaviour of employers in the workplace alongside the UK charity Global Action Plan (GAP).



Dr Corinna Hess Lecturer in the Department of Chemistry. Her research is in the areas of inorganic and bioinorganic chemistry. The focus of the research is on the development of catalysts for sustainable chemistry and renewable energy processes. A key project looks into raw materials for producing hydrogen a promising alternative fuel source.

Early Career Fellow



Dr A. Maria A. Kastrinou focuses on political anthropology and Middle Eastern studies, and has conducted extended ethnographic fieldwork in Syria looking at the formation and dynamics of power relations. Her work includes study of grassroots organisation of sustainable energy development in Syria.

PhD Fellow



Mr Andrew Crossland Research Postgraduate in the School of Engineering and Computing Sciences, focusing on Energy Storage in UK distribution networks and the benefits of enhanced electrical storage for developing off-grid electricity networks in Rwanda. Andrew is a member of DEI's Centre for Doctoral Training in Energy and is developing mechanisms to enhance DEI engagement with students across all departments at the University.



Leading the public energy debate

Reviewing DEI Public Events

Over the past few months DEI has hosted a number of exciting events which have engaged a wide range of people from industry, policy, the community sector and the general public. The DEI aims to guide public debate on the societal and technical energy issues which are so fundamental to all our lives. DEI events create opportunities for everyone to hear directly from energy experts and industry leaders about the debates in the media, to question them and explore the solutions we have available.

Fracking in the US: Local Responses to Complex Risks

The DEI and IHRR hosted a visit from Professor Susan Christopherson, Department of City and Regional Planning at Cornell University, whose research focuses on political-economic policy. Her talk examined how communities react to and prioritise perceived risks from hydraulic fracturing operations.

Shale gas exploitation (or 'fracking') has revolutionised the US energy market over the last decade, with the country as a whole experiencing lower gas prices and increased energy independence. Some gas-rich regions have seen booms in their economy with reduced unemployment and large financial rewards for landowners and certain local businesses.

However, many local residents have opposed such developments and are concerned about issues such as safety, industry regulation, and disruption to their way of life.

A key finding of Susan's research, which largely focused on the shale-rich state of Pennsylvania, is that US communities are not only concerned over the much publicised potential environmental risks associated with fracking, but also the long-term social and economic effects of large-scale shale gas exploitation.

The talk highlighted economic and social risks such as:

- Crowding out of local industries such as tourism and organic farming.
- Loss of property values due to proximity to drilling sites.

- Increase in crime due to large population influx.
- Lack of sufficient services to deal with increased populations.

Many local people were concerned about how the peripheral costs of shale exploitation will be met by the community. For example, fracking in an area puts increased strain on local traffic infrastructure; many communities are concerned that residents will incur the costs of maintenance and upkeep.

Similar concerns apply regarding increased demand on local health and education services for example. The talk concluded with a discussion of interviews conducted with members of the public in affected regions. A key issue highlighted from these interviews was the desire for greater local government regulation of the shale gas industry due to distrust of state or industry regulation.

Applying this to the UK situation, it will be vital to ensure that local communities feel that they are adequately compensated for any perceived costs incurred by a growing shale gas industry, and that trust is built through community consultations and openness on the part of industry and regulators.

Will the lights really go out? A panel debate

In Collaboration with DONG Energy UK, DEI hosted a panel debate discussing whether the UK can keep the Lights on over the next decade or whether we are truly facing widespread blackouts.

The panel consisted of: Jenny Saunders OBE, Chief Executive of National Energy Action; Benj Sykes, DONG Energy's UK Country Manager for Wind Power I; and Janusz Bialek, DONG Energy Professor of Renewable Energy at Durham Energy Institute and was skilfully chaired by BBC's Chris Jackson ("Inside-out North East" programme)

The possibility of an increased risk of blackouts in the UK began hitting the news headlines last year with various studies and energy experts indicating an uncomfortable squeeze in energy reserves. Industry Warnings centre around a projected shortfall in supply following the retirement of power plants which cannot meet EU carbon emissions targets and a lack of investment in new plants. This lack of investment from energy companies is said to result from regulatory uncertainty, the high prices of gas currently reducing the viability of gas-fired power plants, continued political reluctance to embrace Nuclear energy as an

option and the lack of Carbon Capture and Sequestration development to enable investment in coal powered plants.

The topic generated a lively debate, with insightful questions from the 120+ strong audience of researchers, students, business people and campaigners from the region. A lively contribution was also generated through the twitter hashtag #Durhamenergydebate.

The panellists themselves were broadly in agreement that the risk of blackouts was low, however the costs of energy would continue to rise for the consumer. As Prof Bialek pointed out, an electrical blackout would only occur in a harsh winter where there were additional problems with power plants. One particular tool that energy suppliers could use to avoid blackouts would be to pay companies to reduce their demands at peak times in order to enable other demands to be met. He argued that this might in fact be the best approach, as it is a more responsive, immediate and short term solution, cheaper than building new power plants for the sake of a few hours of demand.

However, Jenny Saunders argued that, although we may not be facing an electricity blackout, ever increasing energy prices would mean more vulnerable people would not be able to afford to keep their lights on. The lights might stay on but at such a high costs that many people will have no choice but to turn theirs off. Although the middle classes can afford and should expect to pay more for energy in order to secure our low carbon future, it is unfair to expect poorer customers with shrinking incomes to pay for this investment equally.

Jenny argued that with 4 million people currently in fuel poverty we must stop relying on market mechanisms and ensure the public sector undertakes massive investment and upgrading our old housing stock and introducing renewable technologies.

These distributional aspects are unfair and need to be made clear.

Benj Sykes, provided an industry perspective, and agreed that companies do need to take responsibility and invest. He said the argument of regulatory uncertainty discouraging investors no-longer holds true with the new Energy Bill and Electricity Market Reform in place. There is in fact a great political consensus on the need for investment in low-carbon technologies. Now is the time for companies to invest in the energy system and in research and development to make low-carbon technology cheaper and more effective. This is exactly what DONG energy are doing in off-shore wind with expected investments of £1million every year in research and development, as well as investing in support to help their customers to cut their energy use.

On the issue of the energy mix, the panellists agreed there is a place for a broad mix of energy generation technologies in our system, including nuclear, but that more investment is needed in low-carbon technologies.



Ian Marchant's Vision of a UK Energy Future

Durham Alumni, Ian Marchant, and former chief executive of SSE, spoke at DEI in February on his vision of a UK Energy Future. His talk addressed some of the key energy problems we are currently facing including high domestic energy bills, a growing lack of trust in the energy industry and the decision on what mix of energy sources we should be investing in for the future. His thoughtful and humorous talk provoked many questions and interesting discussion from the mixed audience of students, academics, and representatives from the energy industry and third sector.

In his lecture, Ian Marchant argued that the UK energy market is in need of a fundamental review. Currently, the energy market is being intervened in and regulated too much with failed results. Ian criticised both the current Government's Electricity Market reform and Labour's plans to freeze electricity prices as misjudged and ineffective interference.

If we are to avoid a real energy crisis he argued, "we need a high level grown-up debate about whether we want a fully and independently regulated market or one driven by market forces". According to Ian, both solutions can be made to work if they are done properly but the muddle we are experiencing now is dangerous and a recipe for a real crisis.

On the question of what should be our future energy mix, Ian reviewed the implications of different energy sources for household bills and carbon emissions. He concluded that we need a mix of energy sources to enable us to keep bills at similar levels to the amount paid today but would carbon emissions to only 0.5 tonnes pa. Ian's ideal mix would be:

20% from a combination of energy efficiency and distributed generation

40% from a variety of renewables; wind, marine, solar, biomass

40% from gas fired generation.

However he emphasised that investment into research and development of carbon capture and storage is also needed.

Ian finished by arguing that a sustained campaign to rebuild public trust in the Energy sector is essential. Energy is now one of the most distrusted of all consumer industry sectors. However, energy really matters and is fundamental to our modern way of life. Economic prosperity is linked to energy prices, the Energy Industry is an important employer across the UK and how we produce energy directly affects the environment.



Videos, reviews and podcasts of DEI events are available from www.dur.ac.uk/dei/resources



Training the Energy Leaders of tomorrow

Many scientists, engineers and politicians believe that having a secure, sustainable energy supply is the greatest challenge facing society today. Concerns about the long-term impact of global warming are also inextricably linked to the world's growing demand for energy. The DEI is committed to addressing this energy challenge through a unique combination of research, training and outreach.

A key strategic aim of the DEI is early career researcher training. This is delivered through the DEI's Multidisciplinary Centre for Doctoral Training in Energy (CDT) which was launched in October 2009 and funded by the EPSRC. The CDT is Durham's largest and longest running CDT with 45 PhD students based in eight different departments from both the Science and Social Science faculties. Durham's unique approach to solving energy issues is achieved through linking science, technology and technical issues with societal, political and economic perspectives. Students have the opportunity to undertake world class research in a specific energy area, while also gaining a broader knowledge of energy ranging from engineering to social and international development aspects. They learn the valuable skills of dialogue between different subject areas and the ability to address challenges from multiple viewpoints using a range of research methodologies.

The CDT aims to produce highly employable graduates and believes that energy researchers with the ability to understand energy in its broadest context are crucial to continued success in the energy sector. In order to remain competitive, the UK will require a critical mass of versatile individuals trained in a wide range of skills. The reliance of society on energy means that this sector can offer graduates an exciting, rewarding and secure career choice with many opportunities for diversification.

The Multidisciplinary CDT in Energy is also a member of the national EPSRC-funded Network of Energy CDTs. This provides links between the 13 Energy-related Centres for Doctoral training across the country,

which, together train over 600 PhD students. It allows our researchers to collaborate with those in other universities, giving access to a wider range of training, facilities, events and networking opportunities.

Each student in the CDT is awarded an additional 6 months' funding on top of their main PhD programme to allow them to participate in the CDT programme. The programme includes: seminars, workshops, a guest lecture series, the "Energy Perspectives" series of lectures by DEI academics, site visits, public engagement events and residential fieldtrips. An important facet of the training programme is the requirement for CDT students to present their work to their CDT colleagues and discuss issues and approaches. This builds valuable communication skills, highly valued by all employers.

The CDT students' research a wide range of topics which fit with the main energy themes of the DEI. Previous research undertaken can be found at www.durham.ac.uk/dei/cdt/students.

One important part of the CDT programme is outreach to schools and the local community. Two recent events highlight the CDT's innovative approach to outreach and encapsulate the considerable creativity, skill and drive of the students:

1. Energy Dragons' Den Event at the British Science Festival

PhD students from the CDT ran an interactive energy based activity for GCSE level pupils at the 2013 British Science Festival in Newcastle. The session aimed to increase the pupils' awareness of the growing energy gap within the UK, highlighting the challenges faced by today's government and society. The Energy Dragons' Den format has been used subsequently for other school public engagement events.

The task is introduced by setting a scene of impending doom; the UK is importing more fuel from foreign sources than ever before in order

to cover the gap caused by the decrease in UK indigenous energy resources. To reduce this gap, the students were split into groups and given £300M to invest in energy resources. They become the Energy Dragons. Each group visited five energy stalls run by CDT students, each vying for their investment. Nuclear energy, wind energy, geothermal energy, Carbon Capture and Storage (CCS) and biofuels formed the five resources available for investment. The groups' aim was to invest their money such that the annual energy consumption of Newcastle-Upon-Tyne (6000 GWh) could be covered, whilst trying to keep CO2 emissions as low as possible.

The final results showed the Energy Dragons had understood the need to spread their investment widely across all resources, thus achieving the goal set by the CDT group.

2. Durham Energy Futures Film Festival (DEFFF)

The CDT organised the Durham Energy Futures Film Festival (DEFFF) in 2012. The event took place in the Tyneside Cinema in Newcastle and consisted of a photo competition, a drinks reception and the screening of energy-related short films. Finally there was a question and answer panel session with some of the film makers, and a talk from Professor Phil Taylor, the then CDT Director. The photo and film competition was entered by students from across the National Network of Energy CDTs. The event was free and attended by a mixture of students, academics and members of the public.

You can find all the film entries on the [Durham CDT YouTube channel](#).

DEFFF 2 is currently in the planning stages and will take place in winter 2014!

Both these events were planned, developed and delivered by students in the CDT and give a sense of the exciting environment the CDT provides.

Opportunities for industry partners to engage with Energy CDT

The Durham Energy CDT is entering a new phase which will build on the outstanding success and achievements of the last five years. We are developing more opportunities for industrial collaborators to engage with CDT students and CDT events, as well as to attend some of the training available through the CDT. We are looking for companies who would be interested in supporting the work of the CDT beyond the period of EPSRC funding. The EPSRC's Senior Energy Programme Manager attended a CDT showcase event in March 2014 and commended the work of the CDT as "very impressive". Opportunities exist for partners to:

- Co-supervise CDT PhD researchers
- Act as CASE partner for research council funded PhD researchers
- Offer internship places to CDT students
- Provide guest lecturers for the CDT training programme
- Host site visits
- Provide professional mentoring for those wishing to work in the energy industry
- Give informal careers advice
- Propose a topic for the annual CDT mini project undertaken by most of the CDT researchers

If you would like to partner with us in this new phase of the CDT please do get in touch with Dr Douglas Halliday, CDT Director, on d.p.halliday@durham.ac.uk





Credit: Charlie Plumley

Integrating energy science and society

Attitudes towards investment in renewable energy

The last few years has seen considerable research expenditure on renewable fuel technologies with successful innovative processes being developed and rolled out in many areas. However, in many cases, the necessary sustained and long term funding from the investment community has not been realised at a level needed to allow technologies to become reality. According to global consulting firm Deloitte's renewable energy report in 2012 many renewable energy projects stalled or were not completed because of issues including the global economy, the state of government finances, difficulties in funding, and regulatory uncertainty. A group of researchers from DEI and across Durham University (Durham University Business School, Durham Psychology Department and Durham Law School) worked together to investigate this issue and explore the potential barriers and enablers in the market for investment in a range of renewable technologies.

The researchers interviewed 14 representatives from renewable energy producers, banks, and investment companies to ensure that views of those who had and had not been invested in, plus the views of those investing were taken into account. Analysis of the interview data identified 8 key factors affecting the psychology of investor behaviour in renewables. These 8 key issues included a range of barriers and enablers: the role of government, balance between cost/risk

and value/return on investment, investment timescales, personality/individual differences of investors, and the level of innovation in the renewable technology.

It was particularly notable that in the findings the role of the government was discussed more than other themes (both as a barrier and an enabler) and generally in quite critical terms highlighting the need to ensure consistency in government funding and policy and a greater understanding of how government decision making happens.

A number of barriers were highlighted by the respondents. These included cost barriers, communication barriers and fiduciary duty barriers, amongst others. It was however pleasing to note that respondents felt that stakeholders who they were working with were beginning to looking beyond financial return and were asking them to take other things, including the environment, into consideration, although it was noted that legal reform is needed to support this further. Risks of investment in unproven technologies were also highlighted by the respondents and they often noted that the level of innovation was a key factor in investment decisions.

A number of possible enablers to support investment in renewables were also noted by the respondents. Appropriate knowledge and skills was thought to have the upmost importance. It was also felt that this knowledge and skills could be gained through a strong support network and could also help companies get their 'foot in the door'.

Personality factors and individual values were also raised by a number of the respondents. The personality of investors was discussed with respondents highlighting the personality of

the city as "ego, testosterone and macho chest building" and the potential disconnect and a lack of fit of this with renewables technologies and their image.

Overall the research found that government plays a role as both an enabler and a barrier to investment in renewables, and stability and longevity of policy plays an important role in investment decisions and in particular reduced risk. However the research also highlighted a range of other issues, some of which are highlighted above, that play a role in this complex and multifaceted market.

These findings illustrate the value of crossing disciplinary boundaries. Further research is needed to build on these preliminary findings, to track these perceptions over time and to explore the impact of specific government policies and technological developments.

Currently the researchers have turned their attention to explore how consumers make investment decisions in high street banking and how these can be categorised as 'socially responsible investing (SRI)' and 'environmentally responsible investing (ERI)'.

The full report can be found in Interface Focus: Wells, V.K, Greenwell, E.F, Covey, J, Rosenthal, H, Adcock, M, and Gregory-Smith, D (2013) An exploratory investigation of barriers and enablers affecting investment in renewable companies and technologies in the UK, Journal of the Royal Society Interface Focus, 3 (1): 6th February 2013, <http://dx.doi.org/10.1098/rsfs.2012.0039>



Curating Europe's Oil: How fossil fuels have shaped our culture

If one casts an eye over calls for funding in the field of energy, the extent to which this area has been constructed as the domain of the natural sciences is immediately apparent. And yet increasingly major funding programmes, such as Horizon 2020, are also asking for research that attends to aspects such as 'social innovation' or 'removing non-technological barriers' to change. This signals another step in the growing recognition that energy is an issue that transcends traditional disciplinary boundaries.

In a recent article published in University Affairs, Dominic Boyer, the Director of the Centre for Energy and Environmental Research in the Human Sciences at Rice University, and Imre Szeman, who holds the Canada Research Chair for Cultural Studies and leads the Petrocultures Research Group at the University of Alberta, make a strong case for the role of the humanities in tackling pressing questions related to energy. "Solving our dilemma", they claim, "requires the humanities' involvement – not as an afterthought to technology and policy, but as a forerunner researching the cultural landscape around us and imagining the future relationship between energy and society that we need to strive toward."¹ Theirs is an important challenge, to the humanities and to the sciences alike, calling attention to our need urgently to find ways of making the humanities central to discussions about energy and environmental dilemmas.

My own research, which sets out to understand the cultural landscape of societies dependent on hydrocarbons, aligns itself with the ambition of the energy humanities. The central claim shaping my work is that we must fully understand how closely enmeshed many aspects of our culture are with fossil fuels. Only then will we be in a position to imagine

possible energy futures that go beyond the predominant images of catastrophe or technical over-optimism. Probing the nature of our relationship with oil, I have carried out a number of small-scale projects investigating aspects of 'petroleum culture', including a British Academy-funded project on the Nobel Prize-winning chemist, Wilhelm Ostwald, and his contribution to the cultural sociology of energy,² and a project funded by the Carnegie Trust for the Universities of Scotland investigating the role of 'Petroleum in the Austrian Cultural Imaginary'. Much of my work involves examining the ways in which artists and artworks construct and engage critically with 'petroleum culture'. In 2012, I co-curated, with the London-based Azeri artist, Zeigam Azizov, an exhibition of contemporary art on the theme of 'OilScapes', which brought together a number of artworks that offer new perspectives on the connectedness of contemporary global culture as it relates to oil.

Arriving in Durham, I have found the ideal research environment in which to develop a larger research project related to these activities. Since its inception, the DEI has sought to emphasize the importance of social science perspectives on energy research and there is now considerable critical mass in this area. The Centre for Visual Arts and Cultures, meanwhile, with its strategic focus on the 'Construction of Knowledge' and 'Environments' also offers important support, as does the Centre for Humanities Innovation. 'Curating Europe's Oil' investigates cultural responses to the central dilemmas of the hydrocarbon age by focusing on the ways in which European petroleum culture has been – and is being – archived, collected and displayed.

Examining key sites of memory – petroleum museums, technological museums, natural history museums, corporate archives, national archives, film, art projects, literary texts – in which the experience of 'living with oil' is stored, categorized and controlled, the project explores the role that oil plays in twenty-first century cultural memory. In assessing this aspect of

European cultural heritage, it also considers the ways in which our understanding of petroleum culture shapes the future possibilities of managing energy transition. Essentially, this project sets out to assess how the acts of cataloguing, controlling and challenging the experience of 'living with oil' in Europe might aid – or hinder - us in imagining new possible energy futures. This is not simply about removing non-technological barriers, but about seeking to understand, at a deep level, why we make certain decisions, why particular courses of action are open to us, while others remain unthinkable, and why, ultimately, we are often unable to imagine change.

Underpinning 'Curating Europe's Oil' and the linked project 'After Oil', (a large-scale interdisciplinary collaborative project led by University of Alberta), is the pressing question of how research in the humanities might enable us to address more effectively those barriers that have to date prevented serious social engagement with the problem of energy transition. This represents both a challenge and an opportunity for the critical humanities.

Professor Janet Stewart recently joined Durham University's School of Modern Languages and Cultures. To find out more about her projects and publications visit www.durham.ac.uk/dei/people/energy_and_society

¹ Dominic Boyer and Imre Szeman, 'The Rise of the Energy Humanities', University Affairs (March 2014): 40, www.universityaffairs.ca

² Janet Stewart, 'Sociology, Culture and Energy: the Case of Wilhelm Ostwald's "Sociological Energetics"', Cultural Sociology, Online First 14 April 2014.

Working with industry

Durham scientists win funding to work with industry to develop sustainable chemicals, energy, medicines and food

Durham University has won access to £45 million in Government funding to work with industry on new advances in biotechnology including bio-energy.

Universities and Science Minister David Willetts announced on 18 December 2013 that Durham would receive a share of an initial £18 million to develop networks with companies and other Universities to harness the properties of metals found in biological molecules.

Metals are now estimated to drive about half of the reactions of life. These vital elements include iron, calcium, magnesium and zinc plus some less appreciated essential metals such as copper, cobalt, manganese and nickel. In all, nearly a third of genes need some metal or other for their products to work.

Researchers from a diversity of disciplines will work together to exploit these biological molecules for a range of uses including the production and processing of biopharmaceuticals, materials, valuable

chemicals and sustainable energy-supply. Biologists will investigate genes and other molecules that manage metals in cells, working alongside chemists exploring how the chemical properties of each metal are tuned when bound to biological molecules.

The Durham-based network has seven industrially-relevant sub-themes:

- Metals in bio-processing
- Metal-related antimicrobials
- Metal circuits for synthetic biology, bio-energy and industrial biotechnology
- Metals in the environment
- Metal-related nutrition and supplements
- Metallo-enzyme engineering for bio-energy and industrial biotechnology
- Tools and technologies for metals in biology

Durham is unusual in having biologists embedded in its Department of Chemistry to enable deeper understanding of how elements such as metals interact with the molecules of living organisms. The initial funding will be shared between 13 networks and has come from the BBSRC under its Networks in Industrial Biotechnology and Bioenergy (NIBB) project. It allows access to a further £45 million in funding to drive economic growth and create jobs.

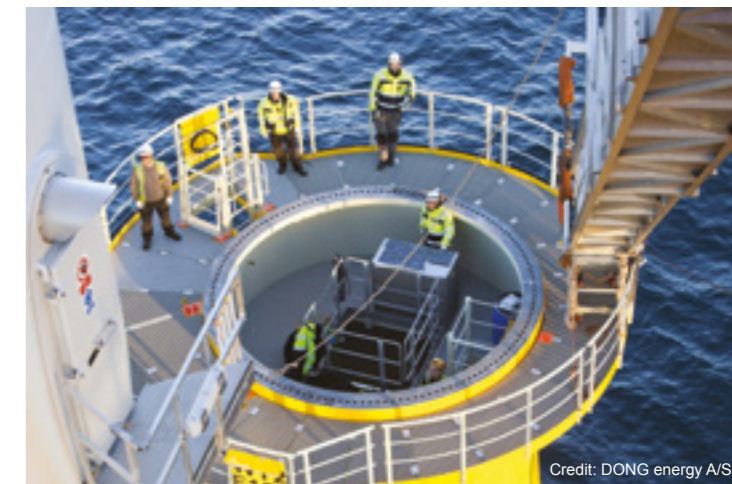
Durham's researchers will collaborate with colleagues at the University of Kent, and elsewhere, on the network. Durham University and the UK more broadly, have world leaders who have discovered how living cells handle metals and how cells use metals as catalysts. The aspiration is to translate this recent knowledge into solutions for industry.

Network Principal Investigator Nigel Robinson said: "Understanding the properties of metals when bound to different types of proteins presents us with opportunities to engineer cells and biological molecules to generate new activities or to improve them for biotechnology. For example, by engineering the iron-sensing systems of yeast it has become possible to produce isobutanol on a commercial scale, taking advantage of an introduced iron-dependent enzyme"

Universities and Science Minister David Willetts said: "To get ahead in the global race we need to turn our world-beating science and research into world-beating products and services, as set out in our Industrial Strategy."

Individuals who want additional information or want to join the network (free of charge) should contact Dr Pamela Robinson (Network Manager) by emailing: metals.bbsrcnibb@durham.ac.uk

or visit the website: http://prospect.rsc.org/MiB_NIBB



Improving wind turbine data analysis through a secondment to DONG Energy

DONG Energy has funded a chair in Energy at Durham University's School of Engineering and Computing Sciences (ECS). As a result of this collaboration, Dr Peter Matthews, one of the Energy group lecturers in ECS, was able to organise a four month secondment at DONG Energy's Copenhagen offices. Peter has specific interests in applying and developing data mining methods to support the operation and maintenance of technical products.

In this secondment, Peter was able to use DONG's large database of turbine SCADA data for development purposes - a unique and extensive resource for wind turbine data mining development. The SCADA data used were readings and control settings taken from each wind turbine every 10 minutes (a typical turbine has about 200 such readings, which include power production, wind speed, various hydraulic systems pressures, etc.).

The secondment also provided the opportunity to meet frequently with a wide range of wind turbine experts and be able to discuss what

was important to understand, and what was less interesting. This formed a critical part of the secondment for two reasons. Firstly, it provided the opportunity to discuss what was important to understand about wind turbines and what was less interesting enhancing the effectiveness of research for the wind energy industry. Secondly, it forged stronger ties between Durham and various individuals at DONG Energy which will provide the basis for on-going research partnerships.

The work focused on developing methods to identify turbines within a farm that appear to be performing below their expected level. While it would be too early to diagnose any potential problems within the turbine, this early identification enables the wind farm manager to schedule an inspection visit before any more significant faults develop. The aim is to improve the data mining process so that expert domain knowledge can be incorporated into the data analysis process to ensure a more accurate identification of problems and possible causes. Ultimately, the aim is to improve the insights that can be generated about wind turbines based on the SCADA data being generated by the turbines.

The secondment at DONG was very successful and has generated useful results, insights and new ideas for collaborative work going forward which will help to develop the field of research as well as the wind turbine industry. Peter Matthews has now returned

to Durham and is in the process of writing up academic papers and developing new research proposals in collaboration with DONG, which will continue to strengthen the Durham-DONG connection.

To find out more about the potentials of data mining please contact Dr Peter Matthews on p.c.matthews@durham.ac.uk



Research secondments in industry can be a very effective way of ensuring that research meets the most important needs of the energy sector and that cutting-edge research is quickly incorporated into energy processes. Closer collaboration of industry and universities will help to ensure the innovation necessary for us to meet the demands of a sustainable energy future.

If you are interested in organising a secondment at your company or would like to explore a potential research partnership, please get in contact with us at dei.admin@durham.ac.uk



In Conversation with Dr Charlotte Adams, Research Manager – BritGeothermal, Department of Earth Sciences

We caught up with Charlotte to ask about her career, research loves and aspirations for the future.

What was your first memory?

Sitting on a stool eye to eye with our Springer Spaniel.

What did you want to be as a child?

An aircraft engineer, I love vintage jets.

What or who has been your biggest influence to date?

Probably my school teacher Mrs Wallace who inspired me to study Earth Sciences at school.

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

Drill a couple of deep boreholes for geothermal research!

What are the real myths around energy and climate change?

I think there is a lot of misinformation and it is hard for people to know who or what to believe. When I worked in industry doing energy audits I often had to dispel the myth that it is better to leave lights on in a room if you are only going out for a short time - it's always better to switch off!

What are you most proud of?

Of having helped the BritGeothermal research partnership to grow and having been successful in bringing in funding to help it to continue.

What would you say to undergraduates looking for a career in academia?

I would recommend getting industrial experience before returning to academia. My industrial experience has been very valuable to me both for the contacts I made and the

experience and skills I gained. This means I have an understanding of the economic pressures that some companies face and also has made me more confident in dealing with clients outside academia. It also helps my research to have practical application.

What makes Durham University so good?

The fact that we are compact means that it's easy to meet up with people from other departments, also working with an interesting mix of enthusiastic and supportive people amongst a backdrop of Durham University's rich history is very inspiring.

If you didn't do this, what would you be doing?

Either something creative, I love drawing and painting or working on my smallholding.

What is your vision for Durham Energy Institute over the next five years?

For there to be even more cross disciplinary projects as there is plenty of potential to be exploited here. For DEI to grow and benefit from increased funds. It would be great for the DEI researchers to use their skills to design a zero carbon building that could house the Energy Institute.

Events at the DEI 2014

Durham Business School / DEI Corporate Forum – The Future of Energy Institution of Civil Engineers, London

The forum will showcase Durham University's role in assisting organisations to understand and manage issues surrounding the generation, distribution and societal responses to today's energy challenges. 3 key partnerships will be explored: GAP, Scottish Power and London Borough of Haringey. The forum aims to share Durham's cutting edge research as well as foster networking and collaboration with the Business community worldwide.

Probabilistic Methods Applied to Power Systems 2014

7 to 10 July, Durham University

International conference on the application of probabilistic methods to energy systems. The leading forum for engineers and scientists worldwide to share and discuss their research on probabilistic and statistical modelling applied to power systems. For further information visit www.dur.ac.uk/dei/events/pmmaps2014/

The use of nanomaterials for energy production

22 October, Durham University

Visiting Seminar by Andrew Barron – the Charles W. Duncan, Jr. - Welch Chair of Chemistry and Professor of Materials Science at Rice University. Event jointly hosted by DEI and Chemistry Department

Coming soon...

DEI-DONG Energy Public debate

The second debate in the series will be in Manchester. Further details to follow.

DEI Invited Lecture: Ragnar E. Löfstedt – Nuclear Energy and Building Public Trust Director, King's College London Centre for Risk Management

A key focus of Ragnar's research is risk communication and management in such areas as renewable energy policy, nuclear power and fuel policy.

DEI Invited Lecture: Canadian High Commissioner, Gordon Campbell – Wind Energy

Mr Campbell was previously Premier of the province of British Columbia during which he was recognized for his leadership on climate change issues helping to introduce legislation to encourage the development of renewable energy.

Gavin Bridge - Resource scarcity and politics of oil

Further details to follow

For further information on any of these events, contact dei.admin@durham.ac.uk or visit www.durham.ac.uk/dei/events

Connect with the DEI!

Please get in contact if you would like to find out more about any of our work or to explore opportunities for engaging with the DEI.

We welcome partners interested in developing opportunities for knowledge exchange, research collaboration,

secondments, public events and training within our research and training programs. DEI addresses energy challenges collaboratively through strong partnerships with industry, international partners, governments, community

groups and other academic institutions. This ensures our research is relevant and effective and allows you to learn from the latest research insights as they emerge. Please contact dei.admin@durham.ac.uk