December 2015, No. 21

Newsletter of the Energy Sector

FROM THE CHAIR

In the field of Energy, 2015 has been a ground-breaking year. The agreements from the Paris Conference are significant and Chemistry will undoubtedly have a major role to play in delivering the global commitments to reductions in CO_2 emissions.

Closer to home the Energy Sector started the year with our 3rd Annual Early Career Chemists' Symposium, where, as we find every year, the quality both of the research and the way in which it is communicated to the audience are extremely high.

July saw the Energy Sector run its first ever multi-day event; the 1st Chemistry in Energy Conference, held at Heriot-Watt University in Edinburgh. This was immensely enjoyable and a great success. A big thank you goes to David McCaffrey and the rest of the committee for arranging such an excellent event. And despite my initial reservations, the Ceilidh proved to an inspired idea - although those of you who witnessed my efforts might not agree!

At the 2015 Energy sector AGM the membership elected a number of new committee members to ensure that the interests of the members are well represented. I am delighted to welcome Mr Brian Shelley, Dr Alyssa Cotton, Dr Tristan Watson and Dr Lesley Sloss to the committee.

Looking ahead to the New Year, we already have a number of events in the diary for 2016 – please read on to find out more and for those of you who gained a PhD in 2015 there's still time to submit an entry for our PhD Thesis Award.

Merry Christmas and a Happy New Year to you all!

Richard Wain

EVENTS AND AWARDS

Energy Sector PhD Thesis Award 2015

Application Deadline 31 December 2015

The RSC Energy Sector holds an annual competition with a cash prize award for the best PhD thesis in the field of Chemistry for the Energy Sector. The purpose of the award is to spotlight UK PhD research in our sector. It's a great opportunity to have something special and distinctive to put on your CV. The competition is open now for PhDs completed in 2015. Submit a 1000-word summary now to enter the competition.

Full details at www.rsc.org/energysector

Next Generation Materials for Solar Photovoltaics 2016

Symposium to be held at Burlington House, London on 13 Jan 2016

Details page 11 and at:
http://www.rsc.org/events/detail/19252

RSC Energy Sector Early Career Chemist Symposium

Burlington House, London on 16 Feb 2016

Abstract Deadline 31 January 2016

Details page 11

http://www.rsc.org/events/detail/19859

What's inside

NEWS/EVENTS FROM RSC ENERGY SECTOR

NEW ES RSC EXECUTIVE COMMITTEE FACES

Mr Michael Harrington
MSci MRSC
Secretary of RSC ES

Michael graduated from the University of Bristol in 2010 with a Master's Degree in Chemistry with Industrial Experience and then went on to complete a 12-month Science & Engineering Graduate Scheme with EDF Energy. Since completing the graduate training scheme in September 2011, he has been working for NNB GenCo; the Nuclear New Build arm of the company. Michael works as a Chemistry Engineer in the Design Authority for the Hinkley Point C Project, where EDF Energy plans to construct and operate two new UK EPR reactor units, on the North Somerset Coast.

Michael's responsibilities as the Chemistry topic lead are to develop the nuclear safety case and the design of the UK EPR reactor, as well as liaise regularly with the Office for Nuclear Regulation, to ensure that the new nuclear reactors are fit for purpose in the UK and will be constructed, commissioned, operated and decommissioned safely.

Dr Stuart Norman
CChem MRSC
Treasurer of RSC ES

Stuart studied chemistry at the University of Oxford, gaining a Masters degree and then a PhD in Physical Chemistry, looking at the effect of magnetic fields on chemical reactions. Since starting work at E.ON's Technology Centre in 2006, he has worked on a wide variety of topics, including: power station flue-gas cleaning; assessment of the quality of coal and biomass; coal and gas-plant engineering assessments; before starting R&D work into hydrogen and fuel cells, and the greenhouse-gas emissions associated with electric vehicles. Having enjoyed the work on EVs, Stuart then moved into a new role in 2010 managing a portfolio of E.ON's R&D projects in the area of electric energy storage, cutting across both stationary storage and electric vehicles, examining the technologies – from kilowatts to megawatts – which could help provide cleaner and better energy solutions for the future energy system.

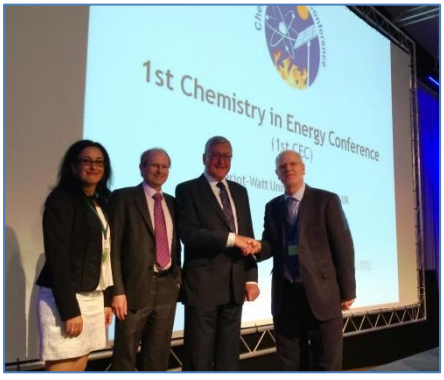
As Treasurer of the Energy Sector, Stuart will seek to keep the Interest Group on a firm financial footing, whilst facilitating lots of seminars and events to take place for members, and also supporting members with awards and bursaries.

THE 1st CHEMISTRY IN ENERGY CONFERENCE (CEC)

The '1st Chemistry in Energy' conference, organised by the RSC Energy Sector, was held at Heriot Watt University on 20th to 22nd July 2015, where the main purpose of this event was to bring together scientists and technologists from academia and from industry with interests in the applications of chemistry in the energy industry. It was the first event of more than one day organised by the Energy Sector and the first RSC Conference covering all aspects of chemistry in energy.

The scope of this conference was broad and included, but was not be limited to fossil fuels including oil, gas and coal, nuclear, renewables, energy storage, energy distribution and energy conversion. Research students were strongly encouraged to submit papers, attend and give presentations and there was a very significantly reduced and subsidised conference fee for students, made possible with an ESED Grant, generous sponsorship from several industrial organisations (please see the conference website, www.chemistryinenergy.org) as well as a donation from BIAWPS, which provided 12 student Conference fee bursaries and an RSC travel grant, which provided travel expenses to 15 RSC Member students.

This conference covered all aspects of Chemistry in Energy currently being carried out in the UK and had participants from most of the major UK organisations carrying energy R&D. The Conference began with a strong message in the Opening Plenary Address, which was given by Fergus Ewing MSP, Minister for Business, Energy and Tourism of the Scottish Parliament. As the first conference of its kind in the UK, it was considered a significant technical success and was attended by just over 125 participants, including 43 students where 29 of the participants were from overseas representing 15 countries. The conference had 68 oral presentations, which were presented in two parallel sessions, 3 plenary addresses and 1 keynote address, as well as almost 40 poster presentations. The Plenary Speakers were invited to give presentations on specific themes, policy, nuclear, and fossil fuel issues, to cover present and future developments in these fields. A highlight of the Conference dinner was the inspirational after-dinner speech, which was presented by Prof Lesley Yellowlees, Professor of Inorganic Electrochemistry, University of Edinburgh, and former President of the Royal Society of Chemistry.



End of 1st Plenary Session : Left to right : Prof. Mercedes Maroto-Valer, Herriot Watt University, Prof. Julian Jones, Vice-Principal and Deputy Vice Chancellor, Herriot Watt University, Mr. Fergus Ewing, Minister for Business, Energy and Tourism of the Scottish Parliament and Dr. David J.A.McCaffrey, Conference Chairman.

In addition to the benefits to RSC Members derived from attending and taking part in this technical conference as described above, there were five other positive and tangible benefits to the RSC.

1) RSC Student Members were able to attend this Conference at a considerably reduced Conference Fee as a direct result of the ESED Grant and the other donations.

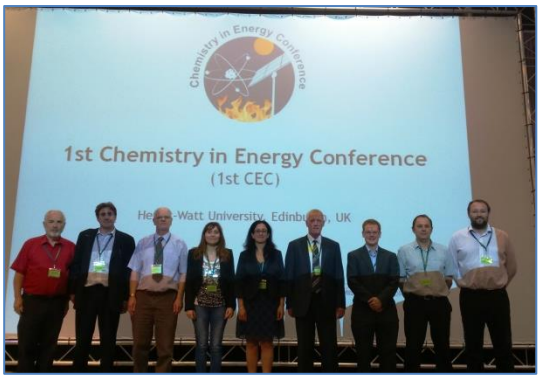
2) The Conference was able to accommodate a session for the presentation of the award and the oral presentation of the 2015 RSC Sustainable Energy Award to Prof. John Irvine, University of St Andrews, “Low carbon energy generation and the development of electrode materials for solid oxide fuel cells”.

3) The Conference was able to provide an exhibition stand for publicity for RSC publications and the complimentary attendance of a Member of staff of the RSC.

4) The Conference will generate a number of papers for the RSC Journal “Environmental Science: Processes & Impacts”.

5) During the conference registration process, at least 5 new RSC Members were recruited that were known of and possibly more that are not known of, as a direct result of the lower conference fees for RSC Members.

This first conference attracted a mainly UK audience, however, this event was publicised worldwide to overseas Chemical Societies with the help of the RSC. On the basis that this first conference was successful, the Energy Sector will consider making this conference a biennial or triennial event.



The Conference Executive Committee. Left to right : Prof. Ben Anthony, Prof. James Anderson, Dr. David J.A.McCaffrey, (Conference Chairman), Dr. Susana Garcia-Lopez, Prof. Mercedes Maroto-Valer, Mr. John Greene, Dr. Stuart Norman, Dr. Richard Oldroyd and Dr. Trystan Watson, (Mr. Michael Harrington and Mr. Brian Shelley not present).

For those Energy Sector Members not able to attend this event, the abstracts for both the oral and poster presentations are on the conference website, www.chemistryinenergy.org, as are a selection of the presentations.

RSC ENERGY SECTOR EARLY CAREER CHEMISTS' SYMPOSIUM

The 3rd RSC Energy Sector Early Career Chemists' symposium (after the highly successful meetings held at Cranfield University and UKERC, London in 2012 and 2013 respectively) was held at the Rolls-Royce Learning and Development Centre, Derby, on February 6th 2015. The meeting attracted ~40 delegates from academia and industry, including two who made the trip from Ireland just to attend the event! As ever, the aim of the event was to give young chemists a chance to network with their peers and to gain useful insights into careers in the energy industry. Accordingly, the first half of the meeting was dedicated to scientific presentations, whilst the second half focused on careers.

We were privileged to have the meeting opened by Paul Stein, the Chief Scientific Officer of Rolls-Royce, who outlined the challenges and opportunities open to the younger generation of scientists in the field of energy. Following this, the delegates enjoyed a talk about bimetallic titanium sandwich complexes from Sandy Kilpatrick of the University of Sussex, who won the poster presentation prize at the 2013 Energy Sector Early Careers Meeting, and on carbon capture and storage by Dr Alissa Cotton of Shell, the winner of the 2013 Energy Sector Thesis Prize. The 22 poster presenters then entertained us with an excellent series of flash presentations, and the posters were then judged over lunch.

In the afternoon, Charlotte Ashley-Roberts, the RSC Careers Advisor, gave a presentation on the topic of job searching, after which two very interesting talks were delivered by Stephen Preece, Chief Chemist of EDF, and Professor Upul Wijayantha of Loughborough University, who shared their career stories, along with some of the lessons they have learned along the way. Whilst this was happening, the judges deliberated over the prizewinners – a task made all the more difficult by the very high quality of all of the posters and flash presentations – and eventually came to a decision as to who would win the prizes. The prizes were awarded as follows:

1st Prize: Jo Humphrey, University of Bristol

2nd Prize: Dr Emma Goosey, MTG Research Ltd/University of Leicester

Joint 3rd Prizes: Sean Goodwin, University of Nottingham, Adam McSloy, University of Huddersfield, and Daniel Reid, University of Surrey

We are grateful for a grant from the RSC Environment, Sustainability and Energy Division which funded these prizes.

The Coal Research Forum also awarded a Prize for work in the area of fossil fuels to Marco Facciotti of the University of Southampton.

Congratulations to all of the prize winners from the Energy Sector Executive Committee!

Some of the prizewinners. From left to right: Jo Humphrey (University of Bristol), Marco Facciotti (University of Southampton), Dr Emma Goosey (MTG Research Ltd/University of Leicester) and Daniel Reid (University of Surrey).

The meeting then finished with a tour of the Roll-Royce Heritage Centre, where the delegates were able to see a selection of impressively large jet engines. We would like to thank the tour guides for taking the time to share their extensive knowledge with us. The Energy Sector Executive Committee would also like to thank Rolls-Royce for kindly agreeing to host the event and allowing us the use of their wonderful facilities, and all of the speakers who gave up their time to make the event a real success. We look forward to seeing another full house of young chemists at the 4th meeting in February 2016! More details on next meeting can be found in the 'Upcoming events' section and at: (http://www.rsc.org/events?MemberNetwork=26)

PhD THESIS AWARD COMPETITION 2014

Dr Oluwafunmilola Ola wins RSC Energy Sector Thesis Award

Back in march this year, the RSC Energy Sector was pleased to announce the winner of its PhD Thesis

Award Competition 2014. The award is given for an outstanding PhD Thesis completed at a UK university in the calendar year 2014 in the field of Chemistry for the Energy Sector and assessed by a panel of experts drawn from the RSC Energy Sector Committee.

The 2014 winner is Dr Oluwafunmilola Ola for her PhD Thesis entitled '*Effect of Metal Doping and Supports on TiO_2-based Catalysts for CO_2 Photoreduction'*. Her work explored the production of solar fuels from carbon dioxide, water and sunlight with a sol-gel derived TiO_2 photocatalyst. A key discovery was that methanol production rates from CO_2 using copper and cobalt doped TiO_2 on a quartz support was found to be 20 times higher than the conventional technique. Dr Ola completed her PhD studies at Heriot-Watt University under the supervision of Professor Mercedes Maroto-Valer.

Dr Oluwafunmilola Ola

Second and third places were also recognised as follows; 2nd place to Dr Hazel Reardon for her PhD entitled '*Structure and Characterisation of Novel Lightweight Energy Materials based on Group I and II Metal Compounds'* and 3rd place to Dr Ruth Downie for her PhD entitled '*Synthesis, Structure and Properties of Zintl-Type Thermoelectric Materials'*.

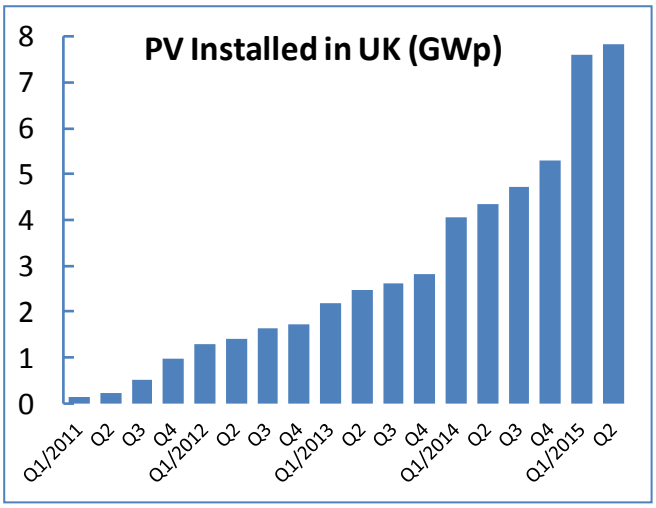
The purpose of the award is to spotlight UK PhD research in the energy sector. The competition is judged largely on the content and quality of an Executive Summary submitted by the candidate and considers the following criteria: (i) the level to which the work addresses a clear identified need in UK or global energy requirements, (ii) the level to which the work adds significant new understanding to an aspect of the energy sector and (iii) the level to which the work contributes to quantifiable environmentally sustainable energy provision.

The 2015 competition is open now for PhD's completed in the year to 31 December 2015. Full details are available from www.rsc.org/energysector and on the Energy Sector MyRSC site.

SOLAR PV UPDATE

Dr Nigel Mason, PV Consulting Ltd

In our last newsletter I reported on the deployment of PV Solar in the UK to the end of the September 2014 that had reached 4.31 GWp. Statistics published (27 August 2015) by the Department of Energy and Climate Change (DECC) put the installed Solar PV capacity at 7.87 GWp at the end of July 2015 – over 80% increase in just 10 months! As the chart shows, there was a surge of PV installations in the first quarter of 2015 ahead of the April changes to eligibility rules for Renewable Obligation Certificates (ROCs). Electricity generated in UK from 8 GWp of solar PV capacity is equivalent to 2% of annual consumption.



11th PHOTOVOLTAIC SCIENCE, APPLICATIONS AND TECHNOLOGY CONFERENCE (PVSAT-11)

3-Day conference held at The University of Leeds, 15-17 April 2015

Hosted and underwritten by The Solar Energy Society (UK) and co-sponsored by the RSC Energy Sector, this was the 11th annual conference in the PVSAT series. The meeting attracted over 80 delegates who attended scientific presentations given by 8 guests and 30 contributory speakers and 18 poster presentations. Guest speakers included the Chief Scientist of the world's largest solar PV manufacturer, a world-expert on reliability and durability of PV modules from NREL in USA, a senior researcher from Fraunhofer ISE (Germany) where the world record 46% efficient concentrator solar cells have been developed plus other leading speakers in the field of organic PV, thin film PV and battery storage for PV systems. Many delegates remarked on the quality

and content of the programme and the relaxed and inclusive nature of the meeting.

PVSAT-11 was grateful for sponsorship provided by RSC Energy Sector, SHARP, PV Crystalox, IET Journals, Maney Publishing, Supergen SuperSolar and The University of Leeds. PVSAT-12 will be held at the University of Liverpool 6-8 April 2016.

ENERGY SECTOR MEMBER INTERESTS

In 2011 the RSC Energy Sector interest group conducted an on-line survey of its members (37% responded) to assist the committee to stage seminars and symposium that reflected its members' interests. Since that time the membership of the Energy Sector has far more than doubled and the committee feel it is time to refresh this study. We have attempted to identify our members' interests from the "Field of Employment" and "Type of Work" that members register or update at the time of RSC subscription renewal. Unfortunately, this only identifies the interests of 34% of our members. 66% of our members' *Field of Employment* are listed as; university, not in employment, government, other or undefined, and does not identify their primary interest. Categories under "Type of Work" are not helpful in this regard with the top four being; Research, Retired, Academic and Consultant. From the start of 2015 the RSC has added a third field to its data gathering of members entitled "Primary Occupation". This data is not yet available for analysis but is unlikely to be of much help as the category options include; Academia, Industry, Education, Government, Retired, Student etc., so do not identify areas of interest.
As a result of the above, the committee are exploring options for a new survey of Energy Sector members.

NEW RSC ENERGY SECTOR KNOWLEDGE-EXCHANGE BURSARY SCHEME

The Energy Sector is pleased to announce its Knowledge-Exchange Bursary Scheme. The Bursary provides up to £250 per application towards travel & subsistence costs for meetings, visits, seminars and conferences in the UK and internationally.

The Bursary is open to any RSC member working in the energy sector, from academia or industry, at any stage of their career. Applicants in the early stages of their career are particularly encouraged to apply. Successful applicants will be required to provide a short article for the Energy Sector newsletter outlining the benefits obtained through their award.

There is no closing date for applications: awards will be reviewed in the order they are received, on a first-come, first-served basis. Applications will be reviewed by members of the RSC Energy Sector Executive Committee, and the Committee aims to provide a response to applicants within 15 working days of the date of submission of each application, however on occasion responses may take longer. If your application is successful the RSC Energy Sector will reimburse the agreed travel and subsistence costs following submission of your receipts.

To submit an application, please download the bursary application form from http://www.rsc.org/Membership/Networking/InterestGroups/Energy/knowledge-exchange-bursary.asp and email it to: RSCenergysector@gmail.com.

WHAT'S GOING ON IN 'ENERGY'?

CALEDONIA CLEAN ENERGY PROJECT AT GRANGEMOUTH RECEIVES GOVERNMENT SUPPORT

A project worth more than £4m to research plans for a new coal power station was announced last March. The announcement comes after it was revealed the coal-powered station at Longannet was likely to close next year.

UK and Scottish Governments will provide £4.2 million (£1.7 million from Department of Energy and Climate Change (DECC) and £2.5 million from the Scottish Government) for industrial research and feasibility work for a proposed full–chain 570 MW Carbon Capture and Storage (CCS) coal-gasification power station located in Grangemouth, Scotland.

The proposed coal-gasification power plant will be fitted with CCS technology designed to capture 90% of CO_2 emissions which would then be transported via existing on-shore pipelines and existing sub-sea pipelines for permanent geological storage 2km beneath the North Sea. The funding will allow undertaking substantial industrial research and feasibility studies over an 18 month period with the ultimate objective of designing, siting, financing, and building their proposed Caledonia Clean Energy Project. The findings of the industrial research feasibility work will be shared across industry and

academia, increasing understanding of how to develop and deploy CCS at commercial scale.

NEW SCCS REPORT ON CO_2-ENHANCED OIL RECOVERY

The Scottish Centre for Carbon Capture and Storage (SCCS) launched last June the findings from its Joint Industry Project on CO_2-Enhanced Oil Recovery. This project, which was supported by Nexen, Shell, 2CoEnergy, the Scottish Government and Scottish Enterprise focused on addressing issues of major importance to project developers, who are looking to link CO_2-EOR in the North Sea with CCS projects.

The resulting report, '*CO_2 storage and Enhanced Oil Recovery in the North Sea: Securing a low-carbon future for the UK',* begins with a key findings section, and it was unveiled and its findings shared at a special event in London, where the new Chair of the Energy and Climate Change Committee, Angus MacNeil MP, gave a short introduction.

The report can be downloaded at:

http://www.sccs.org.uk/expertise/reports/sccs-co2-eor-joint-industry-project

MARKET ANALYSIS FOR MERCURY CONTROL

Once ratified, signatory countries to the new UN Minamata Convention, will need to install BAT/BEP (best available technologies and best environmental practice) on all new coal-fired plants and establish a national action plan on how to control emissions from existing plants. So, a market is emerging for specific control technologies which can reduce mercury emissions by 90% or more.

A new report from the IEA (International Energy Agency) Clean Coal Centre has been released in February, which summarises the various technologies available for mercury control, along with their reported efficiency, level of development and, where possible, an idea of relative cost. The technologies range from coal cleaning and blending options through the bolt on technologies such as the patented REACT, MerControl, NeuStream™ or Skymine™ processes. The potential market for such equipment is reviewed.

The report can be downloaded at:

http://bookshop.iea-coal.org.uk/

WORLD'S FIRST TIDAL LAGOON ENERGY PROJECT TO BE BUILT IN WALES

Plans to build a £1 billion tidal lagoon in Swansea have moved a step closer to becoming a reality after the UK Government granted the scheme planning permission.

If built, the proposed six-mile horseshoe shaped sea wall around Swansea Bay in Wales would feature 16 underwater turbines capable of generating around 500GWh per year of low carbon electricity - enough to power 155,000 homes for 120 years.

The project is scheduled to be built by British company Tidal Lagoon Power. This announcement is a significant step towards commencing construction with a number of major contractors named as preferred bidders. Not only could Swansea Bay lagoon save over 236,000 tonnes of carbon emissions each year but the construction of this "first of a kind" project could be the critical step to kick-starting a tidal lagoon industry. Six potential lagoon locations have been identified around the UK which combined could provide up to 8% of the UK's electricity and add up to £27 billion cumulatively to the UK GDP by 2027.

NEW OFFSHORE WIND FARM

Siemens has been selected by ScottishPower Renewables as its preferred turbine supplier for the East Anglia ONE offshore windfarm, in the biggest deal ever concluded for a consented project in the UK's wind energy sector.

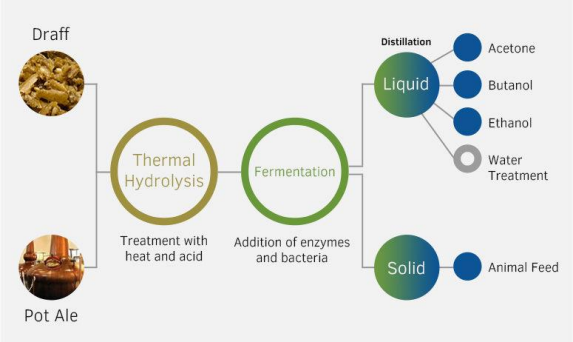
The project is ScottishPower and Iberdrola's third offshore windfarm and, when completed, will be able to power around 500,000 homes. The turbine agreement, which will be the largest individual contract placed as part of the £2 billion project, will see up to 102 of Siemens' 7 megawatt (MW) turbines supplied. As part of the turbine agreement, Siemens will use their new facility in Hull for manufacturing the wind turbine blades for this project. East Anglia ONE aims to create around 3,000 jobs in total, with up to half of these jobs supporting the turbine contract.

More information available at:
http://www.scottishpowerrenewables.com/news/pages/scottishpower_renewables_and_siemens_agre

e_uks_most_significant_wind_power_deal_for_east_anglia_one_offshore_turbines.asp

CELTIC RENEWABLES PLAN TO BUILD A NEW BIO-FUEL PLANT

Celtic Renewables, an Edinburgh-based company, has been recognised as Europe's most innovative bio-tech SME after producing the world's first advanced biofuel (biobutanol) from whisky production by-products.



Celtic Renewables is widely regarded as one of the most innovative biotechnology companies in the UK, producing environmentally and commercially sustainable "drop-in" advanced biofuel (biobutanol) from the two billion litres of liquid effluent and 750,000 tonnes of barley residue produced annually by the £4 billion malt whisky industry. It has developed partnerships with Tullibardine Distillery and Europe's biotech flagship BioBase Europe Pilot Plant, where it has piloted its biofuel production process with a £1 million grant from the Department for Energy (DECC).

The company – a spin-out from Edinburgh Napier University's Biofuel Research Centre led by Prof. Martin Tangney – is currently bidding for a share of a £25 million fund for advanced biofuel development from the UK Department for Transport to build its first commercial scale demonstration facility in Scotland.

SCOTTISH ENERGY NEWS RESEARCHER OF THE YEAR AWARDS

On May 14 the Green Investment Bank in Edinburgh welcomed the Heriot-Watt's Energy Academy and Fergus Ewing, the Scottish Minister for Business, Energy and Tourism, as hosts of the first Heriot-Watt Scottish Energy News Researcher of the Year Awards 2015, supported by Scottish Energy News.

Winners of Scottish Energy News Researcher of the year Awards

The awards celebrate outstanding achievements of individuals or companies that have been working on energy or energy-related research for less than 10 years. The six winners for this prestigious award were: Dr. Tony Gutierrez of Heriot-Watt University (award category Energy and Marine Environment), Dr. Jennifer Roberts of Strathclyde University (award category Energy, Infrastructure and Society), Dr. Cairong Jiang of St. Andrew's University (award category Energy and Fossil Fuels), Mark Crouch & Jacobs (award category Energy and the Environment), Mr. David Townsend of Town Rock Energy Ltd. (award category Energy Entrepreneurship), and Dr. Jin Xuan of Heriot-Watt University (award category Energy Materials and Storage).

ALL ENERGY EXHIBITION AND CONFERENCE

All-Energy is the UK's largest renewable energy event, allowing the entire spectrum of the renewables industry to showcase their energy solutions.

The free-to-attend annual conference and exhibition brings together the UK's largest group of buyers from the bioenergy, solar, offshore and onshore wind and wave & tidal sectors, as well as those involved in energy storage, transmission and onsite generation.

Since its launch in 2001, All-Energy has provided the industry suppliers, experts and thought-leaders from the renewable energy supply chain the opportunity to connect with new customers, increase their sales opportunities and expand business networks in this fast-changing marketplace.

The event moved to Glasgow in 2015, following 14 years in Aberdeen and was held at the Scottish

Exhibition and Conference Centre (SECC) on 6-7 May 2015.

The event welcomed an attendance of 8,250 delegates, representing a significant increase of 20%. The event hosted 450 exhibitors as well as visitors from over 50 countries, and is proud to remain the focal point of the industry's calendar.

In 2016, All-Energy will again be working closely with Glasgow City Council and 50+ key media and supporting organisations representing both traditional sectors of renewables, in addition to sustainability, community energy, energy for farming, grid, facilities management and more.

AQUISTORE, CANADA'S FIRST CO_2 STORAGE PROJECT, OFICIALLY OPENS

Aquistore, the world's first commercial post-combustion carbon dioxide (CO_2) capture, transportation, utilisation and storage project from a coal-fired power station, officially opened 29 May in Estevan, Saskatchewan, Canada. In addition to being a storage demonstration project, Aquistore is also a critical scientific research site and industrial laboratory with an extensive suite of monitoring tools to gather, analyse and interpret data on the safe and effective storage of CO_2 to reduce greenhouse gas emissions. More than 17 international organisations from seven different countries have partnerships or research projects with the project, which are expected to generate valuable research on CO_2 storage.

The US$45 million independent research project is located in the Williston Basin, approximately two miles from the carbon capture facility at the Boundary Dam Power Station. While the majority of the CO_2 captured at Boundary Dam is transported via pipeline to the Cenovus oilfield for enhanced oil recovery (EOR), a portion is also transported to Aquistore, where it is safely and permanently stored 2.1 miles underground in a deep saline aquifer in the Winnipeg and Deadwood formations. Over the initial six month injection period, Aquistore intends to inject up to 1,000 tonnes of CO_2 per day for scientific research and secure, permanent storage. The project has the potential to store close to a million tonnes of CO_2 per annum, the equivalent of taking 250,000 cars off the road.

Further information about Aquistore and its role in carbon storage is available at http://aquistore.ca/

LAUNCH OF SHELL'S QUEST CCS PROJECT

Shell has celebrated the official opening of the Quest carbon capture and storage (CCS) project in Alberta, Canada, and the start of commercial operations there. Quest is designed to capture and safely store more than one million tonnes of carbon dioxide (CO2) each year – equal to the emissions from about 250,000 cars. Quest was made possible through strong collaboration between the public and private sectors aimed at advancing CCS globally.

As part of its funding arrangements, Shell is publically sharing information on Quest's design and processes to further global adoption of CCS. Quest draws on techniques used by the energy industry for decades and integrates the components of CCS for the large-scale capture, transport and storage of CO_2. CCS is one of the only technologies that can significantly reduce carbon emissions from industrial sectors of the economy. Speaking at the official opening, Shell's Chief Executive Officer Ben van Beurden said: "Quest represents a significant milestone in the successful design, construction and use of carbon capture and storage (CCS) technology on a commercial scale. Quest is a blueprint for future CCS projects globally. Together with government and joint-venture partners, we are sharing the know-how to help make CCS technologies more accessible and cost-effective for the energy industry and other key industrial sectors of the economy."

Quest will capture one-third of the emissions from Shell's Scotford Upgrader, which turns oil sands bitumen into synthetic crude that can be refined into fuel and other products. The CO_2 is then transported through a 65-kilometre pipeline and injected more than two kms underground below multiple layers of impermeable rock formations. Quest is now operating at commercial scale after successful testing earlier this year, during which it captured and stored more than 200,000 tonnes of CO_2. Quest was built on behalf of the Athabasca Oil Sands Project joint-venture owners Shell Canada Energy (60 per cent), Chevron Canada Limited (20 per cent) and Marathon Oil Canada Corporation (20 per cent), and was made possible through strong support from the governments of Alberta and Canada who provided C$865 million in funding. Collaboration is continuing through Quest between Shell and various parties in an effort to bring down costs of future CCS projects globally. This includes cooperation with the United States Department of Energy, and the British government on research at the Quest site. "The

secondment from the UK's Energy Technologies Institute to the Quest CCS project is an example of British and Canadian cooperation in cutting-edge low-carbon technologies," said Howard Drake, British High Commissioner to Canada. "This research-focused partnership will help to develop CCS expertise on both sides of the Atlantic in an effort to advance the innovative solutions demonstrated at Quest." Support from the local community was essential to building Quest. Shell initiated public consultation in 2008, two years before submitting a regulatory application.'

More details can be found at:
http://www.shell.com/global/aboutshell/investor/news-and-library/2015/shell-launches-quest-carbon-capture-and-storage-project.html

UK GOVERNMENT CANCELS £1bn FOR CCS COMPETITION

On 25th of November, HM Government announced the decision to withdraw 'ring-fenced' funding from the £1bn CCS Commercialization Competition. The unexpected decision shocked members of industry, business, investors and academia that had committed and focused on developing and proving that CCS could prove vital in meeting UK carbon targets.

EDITORIAL

An insight into eTL technologies

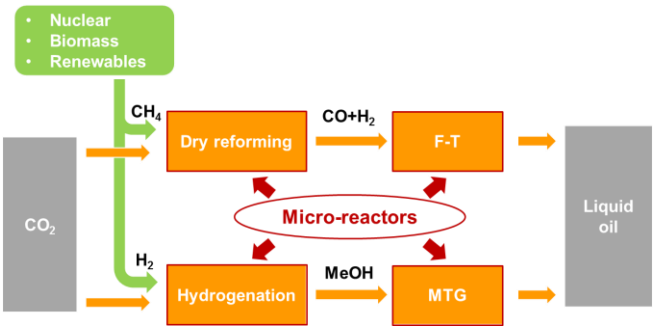
Dr Jin Xuan, Assistant Professor – 'Energy materials and Storage' Award winner of The Heriot-Watt Scottish Energy News Research of the Year Awards

Carbon dioxide (CO_2) is the main greenhouse gas responsible for the global climate change all over the world. How to reduce CO_2 emission is a main agenda in many countries. Emission-to-liquid (eTL) conversion is a promising technology to reduce carbon emission. In eTL process, the CO_2 will be consumed and reduced to liquid organics through chemical, electrochemical or photochemical reactions. It achieves dual benefits as it directly reduce the CO_2 emission level and at the same time produce useful liquid fuels compatible to the current energy infrastructure (such as methanol, ethanol, gasoline).

Current, the eTL process is still not widely implemented due to the associated issues of high cost, low efficiency and low sustainability. This is mainly caused by severe and complex reaction conditions. The partnership will undertake new research into increasing the efficiency of CO_2 conversion to liquid fuels.

A partnership between Heriot Watt, Yale and the Chinese Academy of Sciences, one of 14-new partnerships created by the Global Innovation Initiative , a program funded by the U.S. and UK governments to foster multilateral research (http://www.iie.org/en/Who-We-Are/News-and-Events/Press-Center/Press-Releases/2015/2015-05-25-Global-Innovation-Initiative-Announces-New-Partnerships), will work together along with industrial partners, the Lu'an Group and Shell, to solve the problems with coupled approaches at multi-scales in a multidisciplinary way.

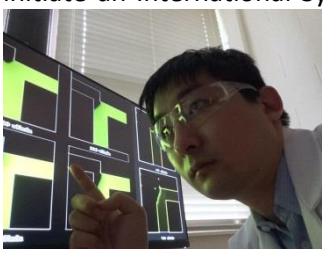
We propose innovative and collaborative research at both catalyst and reactor levels to increase the efficiency of CO_2 conversion to liquid fuels. Hydrogenation of CO_2 is of paramount significance as it converts emitted CO_2 to valuable products such as methanol which can be a direct fuel for fuel cells or further transformed into hydrocarbon fuels.



Efficient CO_2 to methanol conversion desires highly active and selective catalysts and effective reaction heat management. Our approach combines efforts at material and reactor levels. We will grow copper/zinc oxide nanocrystals on graphene or carbon nanotubes to synthesize novel hybrid catalysts with exceptional activity and selectivity as well as excellent thermal conductivity. Fundamental structure-property correlations of the hybrid materials will be investigated. Using the hybrid materials as catalysts, microfluidic reactors will be designed and built to manage heat transfer and increase reaction efficiency. Multiscale material-reactor interactions will be studied to reveal the synergetic mechanism. The goal of the project is to combine innovations of materials

synthesis and reactor engineering to realize high-performance catalytic reaction systems that can recycle carbon emission and produce fuels.

The three project partners have an ambition to initiate an International Synergetic Innovation Center for ETL Technology. The Innovation Center will act as a catalyst to bid for major research funds and participation in academic and industrial collaborations. Exchange students/staff from China will be arranged for 6-12 month visits to UK and US partner universities. Annual symposium on ETL are planned to be held in the USA. The academic team will work closely with the industrial partners (Shell, Lu'an and others) to encourage international academic-industrial knowledge transfer. It is hoped that based on the new findings and technologies delivered by the project, pilot/industrial scale profitable ETL systems can be built by industrial partners to promote the global low-carbon energy infrastructure.



Dr. Jin Xuan is developing novel visualization techniques to study the CO_2 reaction and transport in microreactors

Should you want to know more about the project and/or initiative please do get in touch in the following email address: j.xuan@hw.ac.uk

UPCOMING EVENTS

Next Generation Materials for Solar Photovoltaics 2016

Symposium to be held at The Royal Society of Chemistry, London on 13 Jan 2016

Hosted and underwritten by the RSC Energy Sector interest group, this will be the second symposium staged on the topic of Solar Photovoltaics (PV) and will cover recent advances with a focus on materials for organic, inorganic and hybrid thin films. The meeting will comprise 6 guest and 6 contributory speakers plus poster presentations. Confirmed guest speakers include; Prof Susanne Siebentritt (U Luxembourg), Prof Henry Snaith (Oxford), Dr Nigel Pickett (CTO Nanoco), Dr Akshay Rao (Cambridge), Dr Moritz Riede (Oxford) and Dr Jurjen Winkel (Eight19). Details at http://www.rsc.org/events/detail/19252

RSC Energy Sector Early Career Chemist Symposium

Burlington House, London on 16 Feb 2016

All chemists working in the energy area in the early stages of their careers are invited to attend the Early Career Energy Sector Chemists Symposium at The Royal Society of Chemistry, Burlington House, London, W1J 0BA on 16th February 2016, from 10:00 to 16:00.

The top 30 abstracts, as judged by an Energy Sector Technical Review Committee, will be invited to give a short elevator pitch presentation and present their poster at this event. Prizes will be awarded for the best presentations/posters. For RSC members the prizes will consist of a 1st Prize, (£250), a 2nd Prize, (£100), and 3 x 3rd Prizes of £50 each. For RSC members and non-members working in the fossil fuel area the Coal Research Forum will also be awarding up to 3 x £100 prizes. The event is open to all early career chemists, regardless of age and is free to attend.

If you would like to apply to take part in the competition please download the application form (http://www.rsc.org/events/detail/19859/early-career-energy-sector-chemists-symposium-2016).

Completed forms must be returned by 31st January 2016. There are a limited number of travel and subsistence bursaries available which can be applied for by early career RSC members. Please check above link to download relevant form to apply.

International Conference on Hybrid and Organic Photovoltaics (HOPV16)

Swansea University's Bay Campus, 28 June – 1 July 2016.

For the first time Swansea will be hosting the well-established HOPV conference. The conference will cover technologies such as perovskite, organic, dye-sensitized and quantum dot photovoltaics with related topics including material synthesis and processing, scale up, commercial development and material and device stability.

Invited speakers include Prof Michael Graetzel (EPFL), Prof Jenny Nelson (Imperial), Prof Ayodhya Tiwari (EMPA) and Prof Christoph Brabec (Univ Erlangen). The conference will be located at Swansea University's new Bay Campus, set on a 65 acre site

located right on the beach on the eastern approach to Swansea, Wales. A workshop, arranged by SPECIFIC, on printed photovoltaics will be held on the 27th June before the conference starts.

Carbon Capture and Storage Faraday Discussion

Sheffield, UK, 18 – 20 July 2016

The aim of this Faraday Discussion is to bring together researchers from the chemical sciences community who are working on new potential carbon capture materials and processes, physical properties of CO_2 and gas mixtures, and carbon dioxide utilisation with researchers from energy and process engineering who are looking at incorporating new technologies into viable carbon capture and storage processes.

In order to encourage undergraduate or postgraduate students to attend the Discussion, a reduced conference fee (to include a set of pre-prints but not the final Discussion Volume) is available. This fee applies to those undertaking a full time course for a recognised degree or a diploma at a university or equivalent institution.

Registration for Carbon Capture and Storage: Faraday Discussion is now open. For more information, please visit the event website: http://www.rsc.org/ConferencesAndEvents/RSCConferences/FD/CCS-FD2016/Index.asp

NPC 2016 - 20th International Conference on Water

The Brighton Dome, Brighton, 2-7 October 2016

The Nuclear Institute is delighted to welcome the International Conference on Water Chemistry of Nuclear Reactor Systems back to the UK in 2016. The 20th Nuclear Plant Chemistry Conference, NPC 2016, will be held in the historic coastal resort of Brighton. This Conference will share the latest developments in the chemistry and radiochemistry of nuclear power plants, covering technological improvements, research & development and operating experience. In addition to the traditional topics of chemistry in BWR and PWR systems, NPC 2016 will look at chemistry issues for new nuclear power plants and alternative reactor designs. The conference will also feature the biennial Workshop on Radiation Chemistry and Electrochemistry, on 7 October.

For more information: www.npc2016.net

11th European Conference on Coal Research and Its Applications (ECCRIA)

University of Sheffield, UK, 5-7 September 2016

The purpose of this conference is to bring together researchers in universities and participants from industry who are also carrying out research or are interested in the application of the research in industry.

Papers are invited which describe current academic and industrial research into both high and low rank coals and their applications: Improving efficiency and reducing emissions for clean coal technologies in conventional combustion power generation, including issues associated with co-firing coal with biomass and wastes, ash and slagging issues; Advanced power generation, (APG), including enabling technologies, industrial combustion, gasification, and new materials for APG; CO_2 – pre and post-combustion capture, transport, storage and utilisation technologies, including oxyfuel combustion and chemical looping, coal characterisation and plant diagnostics; All emissions issues, including alternative NOx reduction techniques to meet 2016 NOx limits, SOx, particulates and trace elements; Policy studies, including legislation towards power from coal, government policy, legislative framework, both UK and international; Carbonisation and other metallurgical uses, coal-derived products, coal preparation and handling, underground coal gasification and coal bed methane, and all other coal conversion processes, including coal to liquids.

Research students are strongly encouraged to submit papers, attend and give presentations – there will be a reduced fee for students.

For further details, please see the conference website: www.maggichurchouseevents.co.uk/crf

13th Greenhouse Gas Control Technologies (GHGT) Conference

Lausanne, Switzerland, 14-18 November 2016

The GHGT conference series has long been established as the principal international platform for presenting and discussing developments in greenhouse gas mitigation technologies.

Technical themes to be addressed at the conference are: Advances in capture technology development; Developments in CO_2 geological storage; Developments in other storage options for CO_2; CCS for industrial sources (non-power); CO_2 transport and infrastructure development; Towards negative CO_2 emissions; CO_2 utilisation options; Demonstration projects and major national and international CCS research, developments and demonstration programmes; CCS technology assessment, cost and system integration; Perceptions of CCS and education activities; Energy, climate change and CCS policies; Legal and regulatory aspects of CCS and long term liability of CO_2; Abatement of non-CO_2 greenhouse gases from geological activities.

The call for papers opened on the 1st September, deadline for submission is the ***10th February 2016.***

For more information please visit conference website: http://www.ghgt.info/ghgt-13

COMMITTEE MEMBERSHIP

CHAIR

Mr. Richard Wain FRSC
Engineering Specialist - Chemistry & Corrosion
Rolls-Royce PLC.
E-Mail: Richard.Wain@rolls-royce.com

TREASURER

Dr Stuart Norman CChem MRSC
Storage Technologies Consultant
E.ON UK plc
E-Mail: Stuart.Norman@eon.com

SECRETARY

Mr Michael Harrington CChem CSci MRSC
Chemistry Engineer
Nuclear New Build, EDF Energy
Email: michael.harrington@edf-energy.com

NEWSLETTER EDITOR

Dr. Susana García MRSC
Assistant Professor
Heriot-Watt University
E-Mail: s.garcia@hw.ac.uk

The Energy Sector Group is an Interest Group of the Royal Society of Chemistry.

Our mission: to provide a forum for members to access knowledge and express views on chemical, legislative, educational and other matters relating to energy and to promote the interests, both within the RSC and externally, of the members.

For more information see:
http://www.rsc.org/Membership/Networking/InterestGroups/Energy/

The next Energy Sector Newsletter will be in June-July 2016. All Newsletters are in electronic format sent to your email address. Please note that if you have opted out of receiving RSC emails then you will not be able to receive our electronic Newsletter and so need to contact the RSC to change your preferences.
If you would like to continue receiving a hard copy of the Energy Sector Newsletter, please contact the Newsletter Editor confirming your postal address.

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Robert Buchan Chair
Heriot-Watt University

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PV Consulting Ltd.

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International Energy Agency - Clean Coal Centre

Mr. Paul Brack AMRSC
PhD Student
Loughborough University