

research

SHARING AND ENHANCING RESEARCH AT THE UNIVERSITY

MATTERS

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University of
Strathclyde
Glasgow

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INTRODUCTION

Welcome. It is with pleasure that I present this spring issue of *Research Matters* at such a pivotal time for the University. Our new Principal, lifetime Strathclyde Professor Jim McDonald, took the reins in March and has outlined a transformational vision to turn Strathclyde into Scotland's MIT.

At the heart of this vision is the University's world-leading research across all faculties, which makes the results of the latest Research Assessment Exercise (RAE) particularly encouraging. The RAE rated 50% of Strathclyde staff research output at world-leading (4*) or internationally excellent (3*) levels, confirming the University's strengths in its areas of strategic importance – namely engineering, science, business and social sciences.

The University is embarking on two key initiatives to capitalise on these strengths. The Research Excellence Framework will provide a useful tool in focusing our efforts and planning for the future, while the creation of a Knowledge Transfer Account will reinforce our many valuable links with industry. We look forward to seeing the fruits of these endeavours and sharing them in future issues of *Research Matters*.

Strathclyde is of course well-known for its emphasis on 'useful learning' and its outward focus, so I'm pleased to release *Research Matters* to an influential external audience of academics, stakeholders and potential research partners. A collaborative research venture spearheaded by Strathclyde has revealed the economic impact of HEIs in Scotland to be in the region of £2.4 billion (see p8-9). These compelling statistics make it even more crucial that our universities continue to celebrate and share their successes. With the global economy looking increasingly precarious, we have a key role to play in shaping a more sustainable future.

I do hope you enjoy the magazine and welcome your comments – please get in touch at research.matters@strath.ac.uk



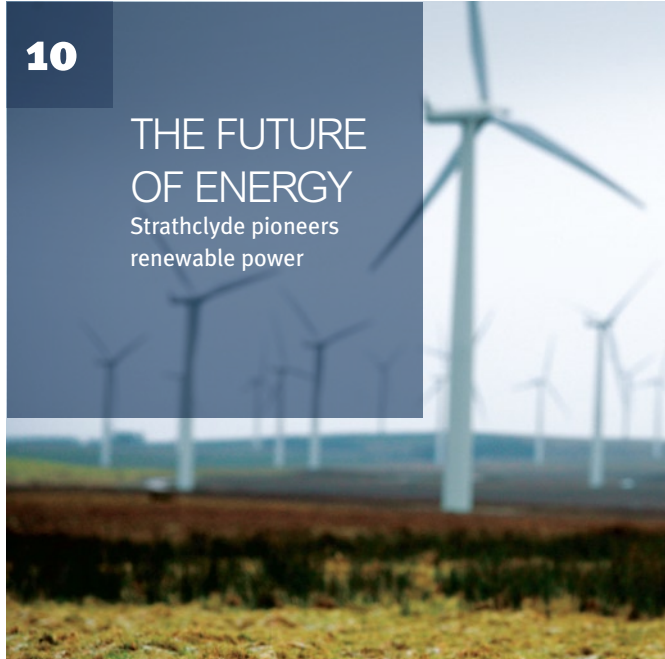
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Entrepreneurial philanthropy goes under the microscope

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SNAPSHOT

EGYPTIAN TRADITIONAL MEDICINE



Research Day 2009: The third annual celebration of University of Strathclyde Research will take place on 17 June. For information or to attend, visit www.strath.ac.uk/researchday

THE RESEARCHER

Following a decade of environmental research in her native Egypt, Nabila Saleem is studying for a PhD in the Strathclyde Institute of Pharmacy and Biomedical Sciences. Titled 'An ethno-pharmacological study of Egyptian Bedouin women's knowledge of medicinal plants', the research is two-pronged – aiming both to document the medicinal properties of plant species in the Egyptian deserts and to record the use of these plants by the indigenous tribes of the region.

Before her research brought her to Scotland, Nabila studied for an MSc in Environmental Science at Mansoura University in Aswan, Egypt and at the University of Glasgow through the active research Link supported by the UK Overseas DFID. In 2005 Nabila took part in a UNESCO investigation of the Siwa Oasis Conservation Area, which shed light on the culture and biodiversity of the North Sahara, and carried out research for the Egyptian Environmental Affairs Agency. Her interest in conservation continues in her current mission to protect the ancient plant remedies of Egyptian tribes.

RESEARCH OVERVIEW

For thousands of years, the nomadic Bedouin tribes of the Siwa Oasis, Sinai and Eastern Desert regions of Egypt have used native plants and trees as a source of food and medicine. The natural properties of the plants have a range of medicinal uses, from painkillers, antiseptics and antitoxins to treatments for ulcers and kidney stones. The plants are also frequently used to treat gynaecological issues – a crucial function given that Bedouin women are traditionally forbidden from accessing medical help.

Passed down through generations of Bedouin women, the plant remedies have rarely been formally recorded. This lack of documentation, coupled with the threat of climate change, means the medical potential of these plants could be lost forever. Nabila hopes to prevent this by formally recording the Bedouin women's knowledge of the plants and through a scientific investigation of their properties. By isolating those compounds found to have medicinal properties, she can determine how they function, highlighting potential pharmacological applications.

Nabila's research lays the groundwork for a programme that will balance the need to conserve the endangered plants with the Bedouins' need to harvest them for medicine. Protecting the plants is crucial not only to the welfare of the tribes people, but also to the biodiversity of the desert regions, which are home to more than 2,000 plants and more than 15,000 species of animals, insects, birds and fish.



Nabila Saleem is investigating the medicinal properties of Egyptian plants

SETTING

Nabila's research is sponsored by the Citadel Capital Scholarship foundation, with patronage from Egypt's Ministry of Environment and Unit of Environmental Studies and Development. Her work finds a natural home at the Institute, a leading, multidisciplinary centre for drug discovery and development, which draws together expertise in pharmacy, pharmacology, immunology, microbiology and biochemistry.

Nabila's research is just one example of the world-changing work of the Institute. Its position as an international research leader was confirmed by the 2008 Research Assessment Exercise, which ranked 55% of the University's pharmacy output as world-leading or internationally excellent. The Institute has launched an £8m fundraising campaign to build new and improved premises for its work in developing new drugs and treatments for diseases including cancer, heart disease, malaria and schizophrenia. ■



Read more about the Strathclyde Institute of Pharmacy and Biomedical Sciences at www.strath.ac.uk/sipbs
Contact Nabila Saleem at nabila.saleem@strath.ac.uk

Taking the reins as Principal, lifelong Strathclyde Professor Jim McDonald sets out his ambitious plans to position Strathclyde as an internationally leading technological university

QUESTION TIME

RM After 35 years as a student, academic and Deputy Principal, how does it feel to be appointed Principal?

JM Very exciting. It's a real privilege because I'm a Strathclyder through and through. While I spent eight years in industry, throughout that time I was almost constantly a postgraduate student at Strathclyde. You might say there's been a virtually uninterrupted connection since I was 17.

RM What changes have you seen in your time at the University to date?

JM I have seen Strathclyde move from being a relatively young university – albeit with a history dating back to 1796 – to one that's now taken seriously nationally and internationally in terms of our academic outputs, our teaching programmes and the calibre of our students. In recent years Strathclyde has increasingly lived its strapline of 'useful learning', connecting research through knowledge exchange to make an impact on modern society. Reaffirming those core ambitions is something a new Principal should be thinking about, but hopefully it's all the more credible coming from someone who's been in Strathclyde for most of his professional life. I take the stewardship responsibility very seriously.

RM What have been the University's greatest recent achievements?

JM The position our business school has attained in terms of international leadership is something in which I have great pride. Our engineering faculty is the biggest and best in Scotland in terms of research

power, and rates top five in the UK for some of its disciplines. The science faculty is restructuring, with the emergence of the Strathclyde Institute of Pharmacy and Biomedical Sciences representing a major platform for us to achieve greater impact on the international research stage. In the social sciences area, both the Law School and English Studies department are performing at high levels of output, while education is a national leader. Those are some of the reference points I hold up as beacons to show that we have a lot to be confident in and much to aim for.

RM How can the University capitalise on these strengths?

JM Strathclyde needs to become an unambiguously recognised internationally leading technological university. This reflects the ambition of Sir Sam Curran, our first Principal. He, like me, wanted to see Strathclyde become Scotland's MIT. Within that agenda we have strengths in engineering, science and business, but I expect us to also have strong, appropriate social sciences, arts and humanities.

RM What are your immediate and long-term priorities?

JM The recent Research Assessment Exercise saw Strathclyde marginally exceed its anticipated performance at the highest level – both 3* (internationally excellent) and 4* (world leading). However, the overall distribution of performance is not what I will require in taking this University forward and we'll be taking more strategic decisions about the focus of our investment to re-profile Strathclyde. We're developing a Research Excellence

Framework, and while we will reflect on what we've achieved, it's time for us to grow our competitive edge. One important vehicle to enable us to achieve this is the creation of a Knowledge Transfer Account (KTA), which has been made possible by a £2.6 million grant from the EPSRC. One of only two KTA grants in Scotland, it will accelerate and enhance our links with industry.

RM How do you intend to develop the University's research strengths?

JM Our strategy statement talks about the University being research-led, and at one time that was aspirational. One of the things I intend to do in my term of office is to make it a reality. I'll seek to develop a high-quality research profile; I'll support the ambition for education programmes well-informed by research; and I'll strive to ensure the very highest levels of knowledge exchange. The University needs to be more focused to help our academic staff to structure strong research propositions that are attractive to funders and that produce the highest quality research outcomes and post-graduates. All our academic staff must include research activity in their portfolio.

There is a major opportunity to draw significant funding from European sources, funding councils, and industry and commerce. I'm already seeing major industries preparing for the economic recovery. The most innovative companies realise that commercial success comes from being differentiated in terms of products, systems and processes, and they know that they can do that more effectively by strategic engagement with university partners. Strathclyde is at the front of the pack in terms of the research and innovation offerings we can bring to our external partners.



RM How important is this collaborative approach to your ambitions?

JM Collaboration is crucial. We already enjoy major partnerships with other high-quality universities. Here in Scotland, our research pooling involvement is significant and is

enhancing greatly our ability to grow research and attract funding. Our global profile is expanding in China, India and Europe, with recent highlights that include research programmes involving CalTech, Stanford, MIT, Rice and Texas A&M in the US. What is fundamental to our success is the internationalisation

of Strathclyde. That means higher quality programmes embedding internationalisation in our values, and it means working with national and international partners that reflect our ambitions. It is appropriate for us to develop relationships with universities and other organisations that are both internationally leading and challenging.

Even in these difficult economic times, Strathclyde is attracting valuable, strategic collaborations with organisations that value innovation and high-calibre graduates. National and international government recognises the strategic place for higher education in developing sustainable economic growth, and Strathclyde's 'useful learning' values are more relevant now than ever. We have recently been successful in attracting major funding in support of our Knowledge Exchange activities. Our reputation for effective working with business, industry and the public sector demonstrates our great potential for pursuing 'excellence with impact'. As one of our history professors recently expressed it to me, Strathclyde is offering 'applied Enlightenment'.

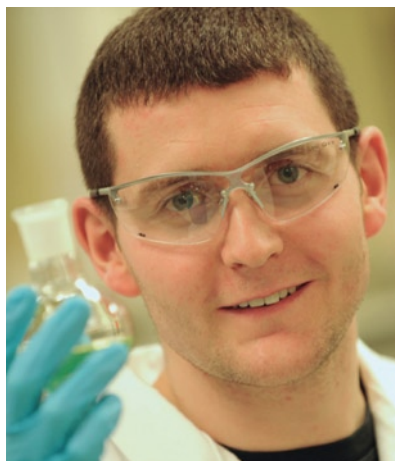
RM How would you describe your leadership style?

JM I'd say it's communicative. I think I'm known as someone who builds high-quality teams and empowers them to deliver against well-defined objectives. People who work with me tend to stay with me because I'm a great believer in giving them opportunities to develop their careers. It's also very important to me that in addition to being Principal, I maintain my involvement in research, ensuring that my academic staff are confident that I understand what a research-led institution is all about.

RM What is the best piece of career advice you've been offered?

JM When I was a young lecturer, a former Principal of this University told me to select the very best people, give them the plan, give them the resources they need, then keep your hands off them. I am also a great believer in the importance of personal integrity and transparency in all that you do. ■

i CorporateComms@strath.ac.uk



Strathclyde researcher wins prestigious chemistry prize

Allan McPherson, a PhD student at the University of Strathclyde, has won one of the UK's most prestigious prizes in chemistry.

The Pfizer Prize only accepts entries from scientists of the very highest calibre, and Allan beat off stiff competition from more than 120 researchers to win the award.

The prize recognises Allan's work in developing new chemical reagents and catalytic methods which would enable scientists to prepare, in labs, inaccessible natural compounds. These compounds could be used in treatments for cancer, infectious illnesses and harmful bacteria.

Described by Allan's supervisor, Professor Billy Kerr, as "contested by scientists at the very top of their game", the Pfizer Prize is considered the most prestigious of its kind. Allan said: "I'm honoured to have won such a high-profile award. To have been declared the winner against such a high calibre of competition is a great accolade."

i For more stories like this, visit www.strath.ac.uk/features

University studies property bridging finance

The University of Strathclyde has partnered with Glasgow-based Munro Bridging Finance (MBF) to research a neglected area of finance.

The study will examine the UK's little-understood business-based property bridging finance market, which is currently under-researched despite representing a significant part of the UK lending market.

During the knowledge transfer project, the University and MBF will investigate the types of loan available, market size and key players, as well as security and risk assessment.

Concentrating primarily on short-term finance provision to developers of residential and commercial property rather than to homebuyers, the study will also examine why major clearing banks are themselves reluctant to market bridging finance products to developers.

i Contact research supervisor Dr Andrea Coulson at a.b.coulson@strath.ac.uk

Research round-up

BUILDING BRIDGES

Strathclyde is to lead a new collaborative project involving the Universities of St Andrews, Heriot-Watt and Glasgow, together with Stanford University and the California Institute of Technology. The Stanford-Scotland Photonics Innovation Collaboration has won funding of £1.6 million over three years from the Science Bridges awards, announced by Research Councils UK. The project will capitalise on leading research in the photonics sector and bolster existing links between Scotland and the US.

BOOST FOR SPACE RESEARCH

Strathclyde is to open a new Advanced Space Concepts laboratory in the Department of Mechanical Engineering. A €2 million grant from the European Research Council has funded eight new members of staff for the lab. The lab will support the University's existing space research, such as an investigation of the orbits of very large, and very small, spacecraft and a Knowledge Transfer Partnership with Clyde Space to develop advanced, low-cost, micro-spacecraft.

i Read more about Strathclyde research at www.strath.ac.uk/research

Strathclyde physicist develops mini magnetosphere

Bob Bingham, a Professor in Plasma Physics at Strathclyde, has helped to develop a mini magnetosphere which could make it possible to travel to Mars.

Currently, the deadly radiation caused by highly-charged, ionised solar energetic particles makes missions to Mars too dangerous to pursue. Planet Earth is protected from these particles by the magnetosphere, a giant magnetic 'bubble'. Bob and his colleagues at the University of York, Instituto Superior Técnico in Lisbon and the Science and Technology Facilities Council's Rutherford Appleton Laboratory in Oxfordshire, have developed a portable magnetosphere which scatters solar energetic particles away from spacecraft.

It was previously thought that only a very large magnetic bubble could work as a protective shield, but using nuclear fusion research, the research team has shown it is possible to create a portable magnetosphere. "A small 'hole' in the Solar Wind is all that would be needed to keep the astronauts safe," said Bob.

i Contact Professor Bob Bingham at r.bingham@rl.ac.uk



Reaching out to business

The 2009 Strathclyde Expo event attracted hundreds of people from across Scotland. Held on 20 February in Glasgow's Royal Concert Hall, Expo '09 highlighted the many ways in which the University can help businesses grow.

The event, opened by Secretary of State for Scotland Jim Murphy, showcased the wide range of support, advice, research, consultancy and training opportunities offered to the business community by the University.

University staff were on hand to offer advice about technology licensing opportunities, funding for research projects and student and postgraduate placements to help solve specific business issues. The event also included an exhibition and a series of workshops on how businesses can gain support and advice from the University throughout and after the economic downturn.

"The University is committed to working with the business community and the Expo offered a great platform to showcase the kinds of support we can offer," said Alasdair Mackay, Head of the University's Business Development Service at Research and Innovation. "It was fantastic to see so many people at the event and the feedback we have received has been tremendous."

i For businesses and organisations unable to attend the Expo, the team at Strathclyde Links is always available: www.strath.ac.uk/strathclydelinks

New hope for arthritis sufferers

Scientists at the Strathclyde Institute of Pharmacy and Biomedical Sciences are conducting research into a novel drug that could correct a range of auto-immune inflammatory diseases.

The drug harnesses the anti-inflammatory properties of ES-62 a molecule secreted by parasitic filarial nematode worms. Institute researchers are working in partnership with the University of Glasgow to create a synthetic derivative of ES-62.

The applications of ES-62-derived drugs are potentially enormous. By 'fine-tuning' specific types of inflammation with cocktails of several

ES-62-derived drugs, the team hopes it could one day offer effective treatments for a range of auto-immune inflammatory diseases.

William Harnett, Professor of Molecular Immunology at Strathclyde and overall leader of the ES-62 project, said: "We will be focusing on mechanisms of combating hyper-inflammation that have developed naturally and with apparent acceptance by humans during their co-evolution with parasites."

i Contact Professor William Harnett at w.harnett@strath.ac.uk

Strathclyde team takes economic perspective on climate change

Economists at Strathclyde have embarked on a pioneering project to capture the carbon footprint of national and regional economies.

The research, funded under the Economic & Social Research Council's (ESRC) Climate Change Leadership Fellowship programme, could lay the foundations for countries across the world to measure the effects of their sustainability policies.

Dr Karen Turner, a Senior Lecturer in Strathclyde's Department of Economics, is working with colleagues in the energy modelling team at the Fraser of Allander Institute to investigate the impacts of regional and international trade on greenhouse gas emissions. She will further examine how policies could be designed, and coordinated, between regions and countries to meet the challenge of climate change.

The first step is the creation of accounting and modelling frameworks that will allow policy-makers to estimate the pollution content of trade flows between regions, thus allowing for the analysis of sustainability policies.

"In order to tackle climate change, we need to be able to measure the effects of policies and ensure we're moving in the right direction. Our research is about helping to lay the foundations for that to happen," said Karen. "This is a fantastic opportunity to begin to look at climate change from an economic perspective, and we're delighted the ESRC is funding this work."

i Contact Dr Karen Turner at karen.turner@strath.ac.uk

What next for the ECONOMY?

Three key pieces of research by Strathclyde Business School offer new perspectives on the economy, both home and abroad



The true wealth of nations is their people

Groundbreaking research by the University of Strathclyde has revealed the significant impact that diseases such as HIV and malaria have on foreign direct investment (FDI) in developing nations.

Rodolphe Desbordes of the Department of Economics and Celine Azemar of the University of Glasgow compared FDI data from 70 developing countries over a 20-year period in a bid to explain why Sub-Saharan Africa attracts so little FDI. The research provides clear evidence that insufficient standards of health and education have the biggest influence on investment.

Whereas the average FDI to GDP (gross domestic product) ratio between 1984 and 2004 was 1.8% in South-East and East Asia and 1.72% in Latin America and the Caribbean, this dropped to less than 1% in sub-Saharan Africa. Despite their wealth of natural resources, these countries failed to attract foreign investors because they lacked good public governance. Strong FDI relies on the adoption of a liberal democratic regime, improvements in the health and education of the population, better macroeconomic policies and higher security of property rights and contracts. The study also concluded that:

- Only improvements in public governance will raise the FDI to GDP ratio sustainably – economic growth alone is not effective
- A country with a liberal democratic government attracts twice as much FDI as autocratically-governed countries
- Raising life expectancy or education by one year increases FDI inflows by 3% and 16% respectively

If poor health is largely to blame for the FDI deficit, the spread of infectious disease in sub-Saharan Africa is particularly harmful. The study revealed that if malaria and HIV did not exist, yearly FDI inflows would have been one third higher in 2000-2004.

The impacts of the research are far-reaching, says Rodolphe. “Our results could potentially influence policy-making in developing countries,” he says. “Many developing countries grant fiscal and financial incentives to foreign investors when they would be better advised to focus on the overall improvement of the country’s public governance. Those Governments must invest in the health and education of their population.

“On the flip side, our study reminds foreign investors of the importance of a healthy workforce, and gives aid agencies another argument in favour of dedicating international resources to the fight against malaria and HIV/AIDS. In their quest for economic growth and FDI, the countries of Sub-Saharan Africa must not forget that the true wealth of nations is their people.”

i For more information, contact Rodolphe Desbordes at rodolphe.desbordes@strath.ac.uk

World leader

The Strathclyde Business School (SBS) has been reaffirmed as a world-leader in the UK’s 2008 Research Assessment Exercise. Analysis of 97 submissions placed SBS at number one in Scotland by a significant margin and seventh in the UK as a whole, with over 65% of work judged to be world-leading or internationally excellent.

 Association of MBAs



 EFMD EQUIS ACCREDITED

Forecasting a way forward for Scotland

Scotland is in a recession that could be as severe or even more severe than that of the 1980's, according to Strathclyde's highly-respected Fraser of Allander Institute for Research on the Scottish Economy (FAIRSE).

The latest FAIRSE Economic Commentary – published in February with the support of PricewaterhouseCoopers – presents a central forecast for Scotland bracketed by 'optimistic' and 'worst' projections. In the central case, the Institute predicts that GVA (gross value added) will fall by around 2.6% in 2009 and by 1.21% in 2010 before the first signs of recovery begin to appear in 2011.

Current headlines predicting rising unemployment were borne out by the Commentary. Currently sitting at just over 5%, the number of unemployed will rise steadily to almost 8% before levelling out at 7% throughout 2012.

In reviewing the causes of the global slowdown and the effectiveness of global, UK and Scottish policy responses, the Commentary describes the UK Government's fiscal stimulus as "possibly too little, too late" and identifies a catch-22 situation as the UK's loosening of monetary policy struggles to convince troubled banks to lend.

In addition to the outlook and appraisal of the economy, the Commentary also includes detailed forecasts of the Scottish economy, a review of Scottish Business Surveys and an overview of the Scottish labour market. In the Economic perspectives/policy section J & M Cuthbert contribute 'A recommendation on how the method of setting water prices in Scotland should be changed' and N Kay offers a critical review of 'Scottish Ferry Policy'.



Visit www.strath.ac.uk/frasercommentary for copies of the current and previous Commentaries. A podcast review by Professor Brian Ashcroft can be downloaded at www.strath.ac.uk/frasercommentary/podcastsreports

Universities can help build a more solid future

Early findings from the biggest ever study into the social and economic impacts of higher education institutes (HEI) have confirmed the significant contribution the sector makes to regions throughout the UK.

Coordinated by Strathclyde, the three-year, £3m Economic and Social Research Council venture brings together experts from 17 institutions to build a national picture of the economic impacts of HEIs. Nine individual research projects are investigating fields such as knowledge exchange, innovation, students and graduates as catalysts for growth, regional competitiveness, community engagement and regional transformation.

The University of Strathclyde project, run in partnership with the Universities of Glasgow, Southampton and Glamorgan, seeks to establish the overall impact of HEIs. While this research focuses on all areas of the UK, the study of the Scottish economy is most advanced.

Researchers Katerina Lisenkova, Kristinn Hermannsson and Professors Peter McGregor and Kim Swales conducted an input-output analysis for 2006, which revealed that the GDP impact of Scottish HEIs totalled some £2.4 billion – equivalent to 3.3% of Scotland's GDP that year. Furthermore, HEIs and their students support 61,000 full-time jobs either directly or through knock-on effects. The University of Strathclyde itself contributed £225 million, and the impact of its student population a further £6 million, ranking it third in Scotland in terms of its economic impacts.

"Even a reallocation of Scottish government expenditure in favour of HEIs would have a modest beneficial impact on the demand side of the economy and stimulate output and employment, since HEIs source more of their inputs locally than other public services," says Peter. "Given the current

recession, the need to stimulate economic activity in regional economies is more pressing than ever. However, in the longer term it is the supply side impacts of HEIs that are critical."

Of the £2.4 billion that HEIs contribute to the GDP, £699 million comes from sources outside Scotland as research grants and tuition fees from international students. With 12% of Strathclyde's student population coming from overseas, it's in a particularly strong position to drive economic growth.

Strathclyde's research also highlights the impact of HEIs on the supply side of their host regions, through the skills of their graduates and the impact of knowledge transfer or exchange. Researcher Cher Li and Professor Robert Wright estimate that Scottish graduates earn 58% more than non-graduates. If the graduation rate is maintained at the current highest rate of 37%, this could deliver up to a 7.8% increase in GDP in the long term. Cher Li and Professor Richard Harris of the University of Glasgow further found that domestically-owned firms achieve significantly higher productivity as a consequence of sourcing knowledge from HEIs.

Adding to research into the economic impact of HEIs, Ursula Kelly and Emeritus Professor Iain McNicoll are investigating their wider social, cultural and economic value to society. "Universities can help build a more solid, sustainable future," says Ursula. "But it is more important that funders and policy-makers can see hard evidence of how this value is created. Our work explores how all aspects of universities' contribution can be valued."



Read more about the HEI impact study at www.impact-hei.ac.uk

STRATHCLYDE PIONEERS SUSTAINABLE ENERGY TECHNOLOGY

RAE results have ranked the University of Strathclyde top in Scotland for engineering 'research power' and now the University is bringing its engineering prowess to bear in pan-European research programmes to deliver second-generation sustainable energy solutions



Professor Bill Leithead of the Department of Electronic & Electrical Engineering is leading Strathclyde research into wind renewables

Centuries on from the golden age of Clyde shipbuilding, Glasgow is once again at the forefront of engineering. Not only is Strathclyde developing novel solutions to the challenges of alternative energy sources such as marine turbines and fusion energy, it is also a key partner in a £1.1 billion wind energy research programme funded by the Energy Technologies Institute (ETI).

With Government targets aiming to deliver 15% of UK power from renewable sources by 2020, the ETI funding acts as a catalyst to drive research and development across the UK. Of the four new wind energy projects announced by the ETI in January, Strathclyde is at the heart of two – Projects Nova and Helm Wind.

“These are very exciting projects to be involved in,” says Professor Bill Leithead of the Department of Electronic & Electrical Engineering, who is leading the research. “With our partners, we will be designing very large offshore wind turbines, which will be built and deployed in sufficient numbers to meet the ambitious offshore targets.”

A DESIGN CHALLENGE

These offshore targets aim to balance urgency for the development of wind technology with the need to address public concerns. “A lot of people object to locating wind farms on land, which makes it very difficult to get through planning,” says Bill. “The Government is focusing on offshore developments such as these to get around public acceptance issues, but it is then faced with a new set of challenges – namely the cost. The immediate challenge in designing the technology lies in not only getting the cost of the hardware down, but also making the technology more reliable to keep maintenance to a minimum. Accessibility for maintenance in locations like the North Sea is very restricted, so technical issues need to be dealt with proactively.”

Projects Nova and Helm Wind each take a different approach to resolving these issues. Project Helm Wind is a feasibility study being conducted by Strathclyde alongside industrial partners E.ON Engineering, Rolls-Royce and BP Alternative Energy which will deliver a concept design to overcome the issues of reliability and maintenance. Project Nova, on the other hand, involves the creation of a completely unique type ▶

“THIS IS NOT A PAPER STUDY – WE WILL BE DESIGNING, BUILDING AND DEPLOYING PROTOTYPE MACHINES BY 2013”

Snapshot

■ At the EU summit in Brussels in December, EU leaders agreed that by 2020, **20% of Europe's energy is to come from renewable sources.**

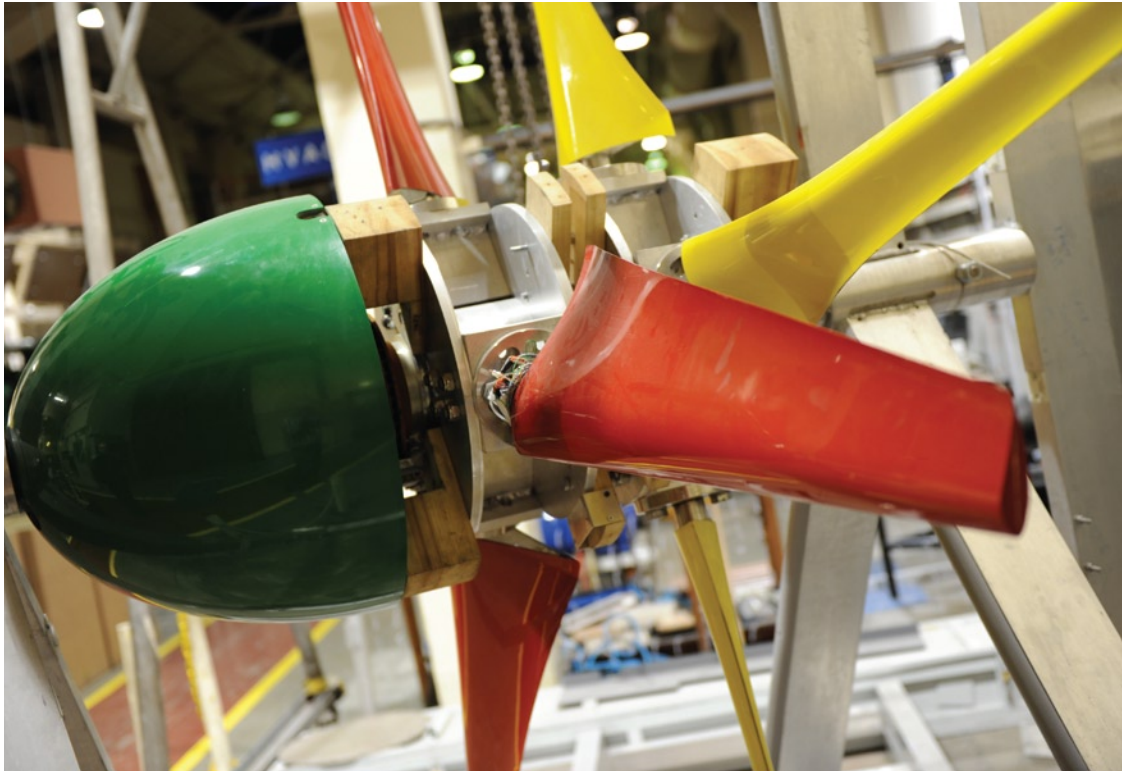
■ **UK targets are set at 15%** (on grounds that the 20% figure is an average for the EU as a whole).

■ The Department for Energy and Climate Change estimates that just **1.8% of Britain's energy currently comes from renewable sources** (as of December 2008).

■ As one of the most advanced technologies, **it is hoped that wind turbines will deliver the majority of Britain's renewable energy by 2020.** To remain on target would require a ten-fold increase in wind energy production by 2012.

Cutting costs:

The marine turbine developed by engineers at Strathclyde has dual, contra-rotating rotors supported by a flexible mooring system, resulting in greater stability and lower maintenance costs



► of wind turbine, featuring a pair of large vertical wings. Where conventional turbines rotate on a horizontal axis, the vertical axis of the Nova turbine is expected to deliver greater stability and simpler maintenance access. "It's a very radical and novel design, one that has never been built on this scale before," says Bill.

"There are big challenges associated with both projects. The turbines have to meet stringent Government requirements and yet they have to be novel, cost-effective and reliable. That's where the University's research and development is required and that's what makes this so exciting. This is not a paper study – we will be designing, building and deploying prototype machines by 2013."

TOMORROW'S LEADERS

Strathclyde's ETI funding comes just weeks after the Engineering and Physical Sciences Research Council (EPSRC) awarded the University more than £5 million to establish a Doctoral Training Centre (DTC) in wind energy. This is no small achievement, given the competitive nature of higher education funding. "Of the 44 DTC centres being funded by EPSRC, only three are at Scottish universities, so Strathclyde's success is a real mark of distinction in our research efforts," says Bill. "This is a massive opportunity to create something really effective."

“
WE KNOW MORE
ABOUT ENGINEERING
FOR OUTER SPACE
THAN WE DO ABOUT
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THE WAVE AND TIDAL
ENVIRONMENT
”

Emulating European models, Strathclyde's DTC funds PhD scholarships to run over four years, instead of the traditional three, with a strong training element to broaden students' appreciation of the context of their work. The EPSRC award will fund 50 studentships, split into five intakes of 10. Bill and his team are currently busy recruiting "the very best students", as well as creating and publicising the Centre itself.

In the longer term, Bill has big ambitions for the DTC. "We have the DTC, the ETI-funded projects and I'm

chair of the Supergen Wind Projects. When all those activities are added together, it gives the University critical mass. My personal objective over the next few years is to consolidate our activities into a UK centre of excellence in wind energy."

HARNESSING TIDAL POWER

However, the challenge of delivering the nation's renewable energy does not just lie in wind power. "For the Government to achieve its targets it needs to have a balanced energy portfolio – it can't put all its eggs in one basket," says Cameron Johnstone of the Energy Systems Research Unit (ESRU) in the Department of Mechanical Engineering. "Tidal power is in a strong position to contribute to that portfolio."

Indeed, the enormous potential of marine power is as yet untapped. "We know more about engineering for outer space than we do about engineering for the wave and tidal environment," says Cameron. "Yet marine has phenomenal resource associated with it. One study suggests that the raw resource that exists in the seas is five times higher than our level of electricity demand, but the challenge lies in capturing and converting that resource and delivering that energy to the marketplace. With further research and development, by 2030 I'd imagine around 20% ►

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FUSION: THE NEW RENEWABLE

It's carbon-free and provides potentially limitless energy, so why have most of us never heard of fusion energy? In the wake of a €900,000 grant, Strathclyde's Dr Allan Whiteford presents the case

IN LAYMAN'S TERMS, HOW DOES THE FUSION PROCESS WORK?

There are two main types of nuclear process. Fission involves splitting a nucleus to release energy, whereas in fusion, energy is created by fusing two nuclei together. If you use elements that are heavier than iron, for example the uranium used in conventional nuclear power stations, you get fission. Fusion involves elements that are lighter than iron. Although both processes have nuclear energy at their core, in all other respects they are completely different.

WHAT ARE THE MAIN ADVANTAGES OF FUSION ENERGY?

Not only is fusion carbon-free, but it runs on deuterium and tritium (isotopes of hydrogen), which can be easily extracted from seawater – therefore it is potentially limitless. The fuel will last for millions of years.

GIVEN ITS HUGE POTENTIAL, WHY HAS IT NEVER BEEN USED AS AN ENERGY SOURCE BEFORE?

It's a very difficult process. Because nuclei repel each other, we need to work at a temperature of 100 million degrees to make them fuse. That's hotter than the sun. This brings further engineering challenges in terms of containing the energy and plasma. We use magnetic fields to achieve this but the plasma cools immediately if it escapes and the whole process then comes to a stop.

SO MORE RESEARCH AND DEVELOPMENT IS REQUIRED TO MOVE THINGS FORWARD?

Yes. Fusion gets a bad name because scientists have been saying since the 1950s that it will be working within 30 years! None of the challenges are insurmountable – we could have fusion working much sooner, but that would require massive investment. The only way forward is to continue in multinational collaborations. The creation of an international experimental reactor called ITER in the south of France is helping to push things forward.

WHERE DOES THE EUROPEAN COMMISSION GRANT COME IN?

We supply atomic data and modelling for the fusion programme to our worldwide partners. Atomic physics dictates how fast the plasma will cool through the emission of light, so we provide estimates of allowable impurities to allow the fusion reactions to be sustained. Atomic physics is also key to many fusion diagnostics – it allows you to look at the light coming from the plasma via a spectrometer and gain valuable insight about what the plasma is doing. This work is an extension of the ADAS (Atomic Data and Analysis Structure) project, which was also started at Strathclyde, by Professor Hugh Summers. Strathclyde is the world leader in this area, and the grant enables us to maintain our expertise by funding two new researchers to work in fusion labs around Europe.

ARE THERE ANY SAFETY OR HEALTH CONSIDERATIONS?

Not really – if the technology goes wrong the plasma cools almost instantly, so problems such as a meltdown or nuclear explosion

don't apply. There also are no dangerous waste products. The only by-product from the fusion process is helium. We basically put seawater in and get helium balloons for children back out! Although the power station itself has a limited amount of radioactivity, decommissioning only takes 10-15 years and all the radioactive material is safe to recycle within 100 years.

IS IT AN AREA THAT IS MISUNDERSTOOD?

There is a sense that nuclear equals bad, but in most cases people – and that includes politicians, environmentalists and many researchers – simply aren't aware of fusion. I suppose we've been too busy researching it to publicise it. I don't think this area get the attention it deserves, but I imagine every researcher feels that way! Fusion might be less demonstrated than wind and marine energy, but it has even bigger potential. We need to make it work.



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► of our electricity will come from wet renewables.”

There are several advantages to tidal energy that many other renewables cannot deliver, such as reliability. “We can never predict when it’s going to be windy, but we can predict about 100 years in advance what the tidal condition will be,” says Cameron. “Plus, tidal is the only renewable energy to provide firm power that doesn’t involve a combustion process. This means it offers the Holy Grail – a predictable, secure and clean energy supply. Another advantage is that tidal energy is never simultaneous. It circulates around the mainland with a time lag between each site coming into full power production. What that means is that if we take three strategically located sites with a two-hour time lag between them, we can achieve an almost constant power delivery.”

ENGINEERING SOLUTIONS

Despite these obvious strengths, traditional approaches to harnessing tidal energy have proved costly and inefficient. “Up until now, the approach has been to take a wind turbine and mount it underwater on the seabed,” says Cameron. “Yet a wind turbine is designed to work in a very different environment, resulting in a number of maintenance problems.”

Cameron and the ESRU team hope to change all that, having designed and tested a second-generation technology with the potential to revolutionise the tidal energy industry. Currently, marine turbines are elevated from the seabed on solid platforms. This allows them to operate at optimal depth – away from both the boundary layer, where the water flows across the seabed and creates turbulence, and the surface, where wave interaction can cause structural failures. So, in a 30m water column, the technology should be positioned so the centre of the turbine is around 13m deep for highest energy flow velocity. The challenge facing engineers lies in elevating the turbine from the seabed without compromising its stability. Creating a secure structural support for first generation technologies can account for 40% of project costs.

Instead of using a single rotor supported by a rigid structure, engineers at Strathclyde have developed dual, contra-rotating rotors supported by a lower cost flexible mooring system – something Cameron



Cameron Johnstone and colleagues in the Energy Systems Research Unit have developed novel second-generation marine turbines

“OUR TECHNOLOGY IS DURABLE AND ROBUST. AS SUCH, IT COSTS 40% LESS THAN CONVENTIONAL MARINE TURBINE TECHNOLOGY”

likens to a ship dropping anchor. The technology is kept in position by a combination of the single point mooring and the contra-rotating rotors. By positioning two rotors together, each turning in opposite directions, the engineers can achieve a balancing of forces that lends the technology greater stability.

It also increases the relative shaft speed, allowing engineers to eliminate the gearbox and operate the technology by direct drive into the generator. Since gearbox failures are the most common technical problem

in turbines, this significantly reduces maintenance requirements. Another innovation of the second-generation turbine is that its electrical components are sealed in resin but open to the water, so the sea provides a natural coolant. “It’s about keeping the design as simple as possible and using the natural environment to best advantage,” says Cameron. “Our technology is durable and robust. As such, it costs 40% less than conventional technology.”

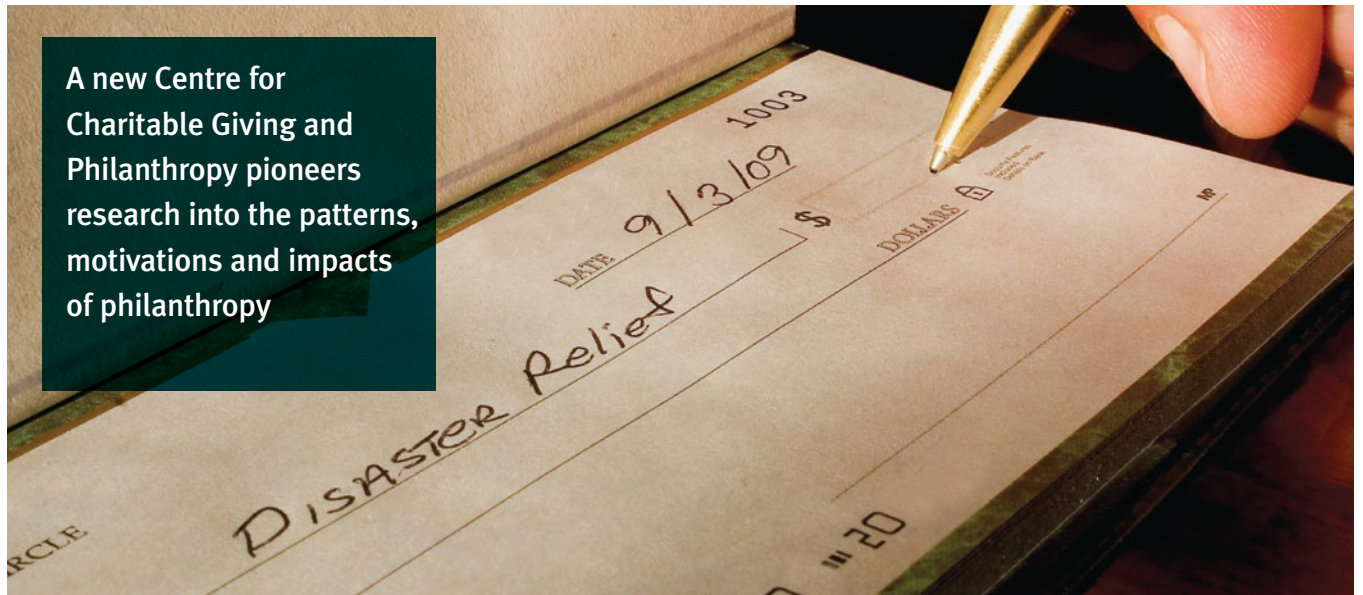
The Strathclyde turbine can be located anywhere there is good tidal resource, and while conventional technology is limited to water no deeper than 30m, the second-generation solution can be deployed in any depth of water. “You simply increase the length of the mooring, like flying a kite,” says Cameron. “Our technology can be deployed and retrieved within minutes instead of hours, saving valuable time.”

Cameron and his team have already tested their creation off the coast of Islay, and are now seeking funding to form a spin-off company. It is hoped that the commercial system could be up and running within two years, delivering a powerful new tool to the renewable energy industry. ■



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A new Centre for Charitable Giving and Philanthropy pioneers research into the patterns, motivations and impacts of philanthropy



What motivates PHILANTHROPISTS?

Entrepreneurship and philanthropy. One is the ambitious pursuit of business success, the other an act of often-selfless benevolence. The two should not make comfortable bedfellows, and yet the business world has produced a number of successful entrepreneurs willing to invest their time and money in good causes. Even looking beyond individual generosity, the number of businesses undertaking corporate social responsibility programmes has grown exponentially.

But what motivates individuals and businesses to engage in acts of philanthropy, and how can these endeavours be best supported and encouraged? These questions and more are being addressed by the newly-established Centre for Charitable Giving & Philanthropy (CCGAP), the UK's first independent, multidisciplinary and academically-based research centre of its kind. CCGAP aims to build a better understanding of charitable giving and philanthropy that is of relevance to donors, charities and policy-makers.

Established by the Economic and Social Research Council in collaboration with the Office of the Third Sector, Carnegie Trust and the Scottish Government, the Centre has received £2.2 million to fund a five-year programme of research.

The programme comprises three key research strands: institutions of philanthropy and giving data, led by Cass Business School and the University of Edinburgh; charitable giving and social redistribution, led by the Universities of Kent and Southampton; and individual and corporate giving, led by the Hunter Centre for Entrepreneurship at Strathclyde Business School.

The Hunter Centre has been awarded £500k for its share of the research programme, and has put together an Entrepreneurial Philanthropy Research Group, made up of Jillian Gordon, Professor Charles Harvey, Kay Henderson and Dr Eleanor Shaw, the principal investigator. The team aims to produce empirical evidence of contemporary approaches to and involvement in entrepreneurial philanthropy, which will inform theory, policy and practice.

"There is a particular pattern of philanthropic behaviour in entrepreneurs," explains Eleanor. "They not only give money, but also tend to give their expertise (human capital) and their contacts (social capital). They are interested in active, sustainable giving."

Although Scotland has produced notable philanthropists such as Andrew Carnegie and more recently Sir Tom

Hunter and Sir Tom Farmer, Eleanor and her research team believe the real extent of entrepreneurship is not yet known. "We want to look behind the headlines and find out who is involved and why," Eleanor says. "By adopting a critical perspective, we hope to provide a neutral account of the types of entrepreneurs who get involved in this activity, the extent of their active involvement and the impact of their philanthropy both on those who receive their involvement and upon themselves."

The research group hopes that their evidence base will ultimately deliver more sophisticated policies to support would-be philanthropists, and CCGAP itself will have a practical function in offering help and advice to those who wish to give back to society but require expert guidance. This is a timely move given the turbulent nature of the global economy. "Some emerging research suggests that people are actually more inclined to give, and to give more, in periods of recession," says Eleanor. "We are finding a collective social conscience in response to a perception of previous greed, and the result appears to be greater willingness to look after society." ■

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