Institution: Robert Gordon University
Unit of Assessment: 15 General Engineering

a. Overview

This submission consists of staff from the Energy, Environment & Sustainability theme of RGU's IDEAS Research Institute. IDEAS is a multidisciplinary research-focused structure across five Schools, and staff in this unit are also based in the Schools of Engineering and Pharmacy & Life Sciences. Research is organised as two research groups.

Energy (Droubi, Faisal, Gunarathne, Hossain, Islam, Liu, Njuguna, Oluyemi, Steel)
This group solves problems related to Oil & Gas and Sustainable Energy. Its research builds on expertise in modelling of multiphase flows, hydrogen fuel cells and marine energy; condition monitoring using non-destructive testing and acoustic emission; and nanomaterials.

Environmental Technologies (Edwards, Lawton, McCullagh, Pollard, RobertsonJ, RobertsonP; Bahnemann, Moffat)
This group provides solutions to environmental problems through photocatalytic treatment of waste products and photocatalytic reactor engineering; sensors, tracers and taggants for environmental monitoring; and biotechnologies for algae detection and generation of bioproducts.

b. Research Strategy

Our vision is to undertake applied engineering research that provides innovative practical solutions to industry problems in the energy and environment sectors, focusing on strengths in our key thematic areas of Energy and Environmental Technologies, underpinned by rigorous research.

Achievements

- Research groups have been strengthened by building critical mass around two key thematic areas with a focus on energy and environment problems.
- Industrially-relevant research builds on strong links with industry developed through our presence at events, joint engagements in feasibility studies, knowledge exchange projects and joint research with industry, particularly in RGU's strategic priority area of Oil & Gas.
- Energy technologies developed for Oil & Gas are being translated to new technologies for Sustainable Energy applications.
- Environmental technologies are applied to solve Oil & Gas industry problems, but are now also underpinning new energy sources for the future.
- A portfolio of research and knowledge exchange projects, funded from a variety of income sources, are strengthened with four major EPSRC grants.
- High quality research students have been attracted through competitive scholarship schemes, resulting in growth in research student numbers and improvements in timely completion.

Implementation Strategy

In 2009 the University established three Research Institutes to exploit synergy from the research strengths across the University, to build critical mass, and to foster collaboration through multidisciplinary research contexts. Each Research Institute has a Director and Theme Leaders to promote, lead and direct research, with the aim of strengthening and deepening research. The Research Institute offers structure and support for researchers, and monitors key performance indicators related to funding applications and awards, publications and research students. Each Research Institute also hosts a Graduate School that builds a research community and environment, and ensures facilities for research students. This unit lies within the IDEAS Research Institute for Innovation, Design, and Sustainability, as its Energy, Environment & Sustainability theme. Together with IDEAS' two other themes, it is also involved in multi-disciplinary research in data analytics for Oil & Gas and sustainable housing.

The unit focuses on ensuring sustainable growth by carrying out research that is relevant to industry and attracts income from various sources including EPSRC, KTP and industry schemes.

To strengthen our links with industry we showcase research at exhibitions: All-Energy, Offshore Europe, ITF Showcase. We are part of university-industry research alliances including the Energy Technology Partnership (ETP), the Energy Institute, the National Subsea Research Institute (NSRI), the Sand Management Network, and the Horizon Scottish Sensors Systems Centre.

The Energy Group works on issues related to the Oil & Gas industry, exploiting its location at the centre of the UK oil industry. Research focuses on flow modelling, sand management, well surveillance and production optimisation (**Hossain**, **Oluyemi).** Since 2008, research in condition monitoring using non-destructive testing and acoustic emission techniques (**Gunarathne, Steel**) has been strengthened by bringing in two ECRs (**Droubi**, **Faisal**) with a focus on monitoring pipeline erosion and sand transport. Our materials research is developing novel membranes for gas separation, and this research has been exploited through the Gas2 spinout, included as an impact case study. This area has been strengthened through the appointment of **Njuguna** and his research on multi-functional lightweight composites and smart materials. Increasingly, technologies developed for Oil & Gas are being translated to the Sustainable Energy sector. Existing flow modelling research for Oil & Gas is transformed into interest in hydrogen fuel cell modelling (**Hossain, Islam**). Condition monitoring work has been adapted for offshore wind turbine failure analysis (**Steel**). The Energy Group also contains 5 research assistants/fellows, 1 KTP associate and 20 research students, and had 16 PhD completions during the period.

The Environmental Technologies Group focuses on environmental problems associated with contaminants and waste management, particularly those relevant to the Oil & Gas industry and marine environments. Robust in situ passive sampling devices enable reliable monitoring of organic contaminants and trace metals, and provide novel passive sampling applications (**Pollard, Moffat**). A novel compact in situ fluorosensor to detect methylene blue dye effluents has the potential to become the industry standard test (**Pollard**). Photocatalytic reactors for the treatment of waste water and for aquaculture (**RobertsonP, Lawton, McCullagh**) now provide photodynamic methods for fish farming **(Lawton**) and smart antibacterial coatings (**RobertsonJ**)**.** Photocatalytic technologies for treatment of cyanotoxins in water, pioneered by RGU, continue to be recognised as leading-edge (**RobertsonP**). Pulsed LED irradiation systems for photocatalytic reactors is a recent development (**RobertsonP**). Robust methods of algae detection and the removal of highly toxic cyanobacteria by biodegradation results in an understanding of novel bacteria and the role of microbial response to aquatic pollution (**Lawton, Edwards**). A new EPSRC grant extends this research to renewable bioenergy solutions (**Lawton**, **RobertsonP**). The Environmental Technologies Group has 5 research fellows, 1 KTP associate and 11 research students, and had 14 PhD completions during the period.

Future Strategy

Engineering research will continue to build on our strength and take advantage of opportunities in Oil & Gas, Renewable Energy and the Environment. We shall seek to exploit technologies that enable translation between Oil & Gas and New Energy; e.g. converting technologies developed for Offshore Oil & Gas to Offshore Wind Energy. We shall continue research in managing aging assets, enhanced oil recovery and improved monitoring and management of oil production but will also develop technologies for challenging environments in the depleted North Sea and Deep Water areas. New nanomaterial expertise will be applied to high performance materials for offshore structures, deep sea features, and turbine blades. Synergy between modelling and nanotechnologies research will develop materials for New Energy such as electrodes for fuel cells. We shall continue to exploit our environmental expertise to deal with environmental challenges of the Energy industry. The application of photocatalytic technologies beyond water treatment will be a priority, including reactor development for CO_2-conversion and bioethanol production. Our involvement in a proposed Oil & Gas Innovation Centre based in Aberdeen, and our membership of the CENSIS Innovation Centre, provide effective industry-led initiatives on which to build our applied research in the key Energy industries.

c. People, including:

I. Staffing strategy and staff development

The staffing strategy aims to maintain a balance of research staff at different stages of their career. Our submission contains 4 ECRs, 4 independent researchers, 3 Readers, 4 Professors and 2

Honorary Professors. We have recognised research achievements through promotion (**Hossain** to Reader), and have replaced nurtured ECR talent (Pancholi and LiuC to Newcastle) with established talent (appointing **Njuguna** at Reader). Career progression during the period includes **Oluyemi**, **McCullagh**, and **RobertsonJ** moving from ECR to independent researcher. We have also actively sought new staff as ECRs including **Droubi**, **Faisal**, **Islam** and **Liu**. Since RAE 2008, this unit has seen successful IP exploitation and two key staff now focus on commercial exploitation, while another has been promoted to a senior University management position.

Membership of the IDEAS Research Institute entitles staff to an explicit research allowance in their workload. Three levels of membership (20-60%) depend on the nature and extent of their research, but an ECR joins IDEAS as a probationary member with additional time (30%) for two years to help them build independent research. This structure enables researchers to gain from the experience of peers and more senior researchers, and encourages members to take research leadership roles; **Hossain** is an IDEAS theme leader (previously held by **Pollard**), **Lawton** was Graduate School Leader 2010-13, and **Oluyemi** is School Research Coordinator. A mentoring scheme is in place where ECRs are guided by more senior staff. This is evident in co-authored papers (**Islam** and **Hossain**; **Faisal** and **Steel**) and joint grants (**McCullagh** and **RobertsonP**).

Membership level is reviewed annually based on achievement through publications and citations, research funding, and research student progression and completion. This is undertaken as part of the annual Employee Performance Review that allows staff to discuss their activity with more senior mentors, to identify individual development needs, and to plan to provide these. The University also has a programme of bespoke events to support research. A three workshop series over several months, "*Angels' Nest to Dragons' Den*", targets research proposal writing, with a review of proposals, followed by financial planning, and finishing with a Dragons' Den type presentation of the research idea. A research project management workshop provides guidance on good practice throughout a project's lifetime.

PhD supervision training, led by **Lawton,** comprises an initial training for new supervisors continued through 3-yearly CPD. This workshop provides updates to understand processes and the opportunity to share supervision experience and best practice. Regular research away days, including research retreats at Goodenough College's Burn House, provide opportunities for focused sessions such as EU and EPSRC funding. An Engineering seminar programme includes external speakers, but also provides staff and students the opportunity to showcase their research.

RGU is actively committed to the Concordat to Support the Career Development of Researchers. In engaging in this important initiative the University has initiated and promoted a number of activities for training research staff across all different levels from research students through to professorial-level staff. Research staff development has been one of the University's strategic staff development priorities since 2006. Research Assistants and Fellows are generally employed on a fixed term contract if their funding is grant related, but some are on permanent contracts if the project is for a lengthy period or they have 4 years service. All staff regardless of employment status have full employment rights once they have the relevant qualifying service.

In line with the Athena SWAN Charter, RGU as a strong commitment to advancing women's careers in STEM subjects. Almost 30% of this submission, and 50% of the submitted professors, are women. RGU gained Charter Membership in 2012 and will submit for a Bronze University Award in 2014. **RobertsonJ** and **McCullagh** were selected to join RGU's Self Assessment Team, responsible for completing the application and delivering the action plans.

RGU is an Equal Opportunities employer and this is embedded in all our HR policies and processes. We have a number of family friendly policies that include generous maternity pay and leave above the statutory provision. RGU has a flexible working policy that allows staff with enough service to apply for flexible working. All staff have permanent contracts and all but two are full-time.

c. II. Research students

The IDEAS Graduate School is actively involved in student recruitment, quality of supervision, pastoral care, progress monitoring, and dedicated research student support.

Recruitment

The unit is successful in winning PhD scholarships from research pools: five studentships through the Northern Research Partnership (NRP) and two from the Energy Technology Partnership (ETP). In addition to topping-up these partially funded scholarships, IDEAS provides 2-3 new fully-funded studentships each year to this unit. The IDEAS studentship projects are chosen strategically, targeting supervisory teams comprising an ECR and experienced supervisor. Specific research student projects have also been funded externally, including an Australian Endeavour Scholarship and an EPSRC Industrial Case studentship. All of these competitive PhD scholarships allow us to attract highest quality applicants through effective advertisement and personal networks.

Over the years, strong links have been developed with African oil producing countries such as Nigeria, Algeria and Libya, and a significant number of these research students come with government scholarships. We are a major destination for Petroleum Technology Development Fund (PTDF) sponsored PhD students from Nigeria. We also attract a large number of self-funded international PhD students.

Training and Support

Supervisory teams include a Director of Studies and one or more second supervisor, and may contain an industrial adviser. Three research degree coordinators provide independent advice and pastoral care to students, and guidance to supervisors.

All PhD students follow the PgCert Research Methods course during the initial 15 months of their studies. This structured training covers all aspects of research including literature analysis, design of experiments, dissemination, time management, and personal development plans. A formal induction, together with the PgCert, introduces them to a broad research community. A team building research retreat encourages a cross-disciplinary experience. Other development includes training as ad hoc tutors, developing funding applications, and viva preparation.

All PhD students in this unit are accommodated in the IDEAS Research Hub. Students are clustered into groups of 6-10 according to research topic, within this open-plan research space. Co-location with Computing encourages cross-discipline discussions and provides a wider peer network, to build a strong research culture. Engineering seminars and group meetings embed them in their local research community.

Progress Monitoring

The quality of research is assured through a number of processes. Students register for MRes/PhD within the first 3 months, formally establishing a supervisory team and setting objectives. Students achieve transfer to PhD after assessment by an independent examiner and a research coordinator. The transfer assessment comprises a viva and a report containing a critical analysis of literature, research objectives, progress to date, and research planning.

Students' progress is monitored through an annual review involving self-reflection on progress and planning, and a commentary on these by the supervisory team. An interview with an independent research coordinator allows students to discuss any issues, and enables timely remedial action when necessary. Better monitoring and intervention have led to increased timely PhD completions - up 30% since 2008. The IDEAS Graduate School Board and University Research Degrees Committee monitor registrations, transfers, annual reports and examinations.

A Graduate School Research Degrees Review (2013) involving external reviewers commended CPD supervisory training and the annual research review process. A 90% response in PRES 2013 demonstrated clear evidence of the University outperforming national benchmarks for students' perception of induction, progression monitoring and assessment; development of research skills; and students' understanding of responsibilities. PhD graduates have moved to postdoctoral research, lectureships, and positions in the Oil & Gas industry (e.g. BP, Aker Solutions).

d. Income, infrastructure and facilities

Infrastructure & Facilities

RGU is investing significantly in its three Research Institutes since they started in August 2009. For IDEAS this is almost £7.5 million core funding: REG (~£1.2 million pa), Knowledge Transfer Grant

(~£120k pa) recognising joint industry funding, and a contribution towards members' salaries (~£550k pa). In addition IDEAS receives PhD fees and a 50% share of research overheads.

This unit is well supported with specialist equipment. The University has invested significantly in capital equipment during the period (£400+k) including: a UPLC-qTOF ultra performance liquid chromatography-quadrupole-time-of-flight mass spectrometer (£215k); an environmental incubator for controlled growth of algae (£16k); purification and evaporation systems (£45k); multiphase flow loops for fractured reservoir systems (£40k); a new data acquisition system for an X-ray photoelectron spectroscopy (XPS) machine (£27k); a lifetime spectroscopy attachment for a steady-state fluorescent spectrometer (£15k); and a high energy UV excimer laser (£39k).

The Energy group benefits from computational fluid dynamics software (Ansys Fluent/CFX; COMSOL), an IBM Blade server to support large scale modelling, NDT and Acoustic Emission systems, a Particle Image Velocimetry (PIV) system, a wind tunnel, micro-hydro and heat exchanger rigs, a 12m wave tank, and software for the analysis and design of marine energy devices. Surface characterisation facilities include X-ray diffraction, scanning electron microscopy, atomic force microscopy, X-ray photon electron spectroscopy, and membrane reactors.

The Environmental Technologies group has access to optics/lasers, photocatalytic reactors, instrumentation and sensor development facilities, advanced analytical facilities including GC-MS, UVF, high spec IR/VIS/UV fluorescent spectrometer. State-of-the-art analytical and microbiology facilities offer large-scale growth of algae (~400 L/month). RGU's investment in the UPLC-qTOF, Flash purification and evaporation system has been essential to develop biotechnologies research.

In July 2013, this unit moved into Riverside East, a new state-of-the-art £120 million building on RGU's Garthdee campus. The staff, research students and labs for this unit are now, for the first time, located in a single building. The move also opens up collaborative and multidisciplinary opportunities across IDEAS, including data analytics and sustainable housing research, and with the other Research Institutes, notably Energy Management in Aberdeen Business School.

The University's Research and Enterprise Services supports the submission of research proposals and the management of research projects. The KTP North of Scotland Office, shared between RGU and Aberdeen, increases our engagement with knowledge exchange activities. Good links through Interface provide opportunities for feasibility studies with companies. Good dissemination of research outputs is achieved through RGU's OpenAir open-access institutional repository.

Research Funding Portfolio

The financial data presented in REF4 shows a diverse portfolio of funding but with a significant focus on industry-funded projects and joint projects with industry. In addition, the unit has financial returns of £1.1 million from the NRP Northern Research Partnership and the Horizon Scottish Sensors Systems Centre. Research awards are almost £5 million over the period, with awards valuing £1.7 million in 2012/13. The complete 2012/13 research portfolio has an award value of £3.6 million, contains four significant EPSRC grants, industry focused projects including three KTPs, two EU projects and major ongoing non-EU industry funding from Enzo Life Sciences. Recent major awards confirm a growing research funding trajectory.

The Research Council portfolio includes four current projects. **Lawton** has recently secured £1+ million EPSRC funding for "*Photocatalytic bioethanol production*" (EP/K036769/1) in collaboration with St Andrews through the Supergen Bioenergy Programme with RobertsonP as co-investigator. The project proposes a cost effective, low environmental impact approach to produce bioethanol from cellulosic waste by photocatalysis combined with fermentation in a single reactor. This project builds on **RobertsonP**'s joint EPSRC/NSF grant (EP/H004130/1) with CalTech and St Andrews for photocatalytic hydrogen and carbon dioxide conversion. An EPSRC project (EP/I004041/1) with **McCullagh** as PI and RobertsonP as co-investigator, in collaboration with Aberdeen, Queen's Belfast, Strathclyde and St Andrews, developed photocatalytic reactors for pharmaceutical synthesis. **Lawton** is also an investigator on a large £1+ million EPSRC Water for All project "*Bio-desalination: from cell to tap*". This project, in collaboration with Glasgow, Imperial and Sheffield, develops techniques for removing salt from seawater using biological mechanisms.

The unit has been highly successful in KTP grants with the Oil & Gas industry. Two KTP projects with Opus Plus capture the complementary expertise of the two Energy and Environmental

Technologies themes: **Hossain** developed the Mare's Tail® coalescer, a next generation technology to increase the removal of oil from produced water (£130K); and **Lawton** tested pollutants and contaminants in oil (£135K). Two KTPs developed environmentally friendly fluids for the Oil & Gas industry: **McCullagh** investigated environmentally benign liquids for the dissolution of calcite deposits in well bores with Dynamic Equipment Company (£148k); and **Pollard** developed an enhanced and environmentally friendly well construction fluid with Cabot (£146k). **McCullagh** also had two linked KTP waste treatment projects with Sureclean: to integrate their solid and liquid waste treatment facilities (£136k); and to develop a polymer treatment for the remediation of oily wastewater (£124K). A new sustainable energy KTP project with Richard Irvin (£131k) models energy demand in a house with a view to taking a new-build home towards energy self-sufficiency. Another sustainability KTP with Gas2 (£126k) developed an inorganic membrane that optimizes the production of Syngas. It contributes to an Impact Case Study in REF3.

Industry funding continues to grow. **Lawton**'s research on developing high value products from algae has received £400k+ non-EU funding during 2008-12 from Enzo Life Sciences, through a rolling programme of significant ongoing awards during the period totaling almost £800k. The Sand Management Network brings in UK industry funding of almost £135K over the period. Joint projects with UK industry include three renewables projects through the Energy Technology Partnership; and two membrane projects through the Innovative Technologies Facilitator for Oil & Gas and the Carbon Trust. Commercialisation activities include two Proof of Concept projects funded by Scottish Enterprise: Genespark: Nanotechnology-based Biosensing Platform (**Pollard**) and Smart Self-Sterilising Coatings for Food Preparation Surfaces (**Robertson P&J, McCullagh, Pollard**).

Several EU projects have focused on building networks with SMEs. An FP7 project "*SalinityScan*" (FP7-SME-2010-1 262646) developed a subsea sampling and analysis system capable of monitoring the salinity of the water fraction in the multiphase flow from oil wells (**Oluyemi**). RGU's role in this project is RTD Performer (€100k), with Fraunhofer IGB and Teknologisk Institutt, with four SMEs in Norway, France, and Spain. **Lawton's** research exploiting the diverse metabolism of cyanobacteria stemmed from a successful EU-funded industrial collaboration with WAE (Wilhelm Aquaculture Enterprises) in The Netherlands. This project provided a low cost robust photocatalytic treatment to remove taste and odour compounds from aquaculture systems which can be easily retrofitted to current recirculation systems used extensively in fish rearing systems (**Lawton**).

Future plans include the Environmental Technologies group building on its Research Council success by expanding the portfolio through new grants, but also translating the research into industry partnership projects, and engagements with environmental bodies. The Energy group will continue to target joint projects with the energy industry. Participation in the new CENSIS Innovation Centre for sensors and imaging systems, and the proposed Innovation Centre for Oil & Gas, offer further opportunities for joint projects with the Oil & Gas and Renewables sectors. The significant body of ECRs will be encouraged to apply for smaller industry linked funding such as innovation vouchers to undertake joint feasibility studies with industry that then lead to follow-on engagements such as KTP projects. The Innovation Centres and Energy Technology Partnership also offer a variety of types of joint industry projects. EU Horizon 2020 promises further opportunities for joint industry projects.

e. Collaboration and contribution to the discipline or research base

Academic Collaboration

A joint EPSRC/NSF project (EP/H004130/1) with Michael Hoffmann (Caltech) and John Irvine (St Andrews) is highly influential research on photoreactor engineering for solar hydrogen generation and CO_2 conversion to fuel products (**RobertsonP**). This built on a joint EPSRC project (EP/I004041/1) of **McCullagh** and **RobertsonP** with Howe (Aberdeen), Mills (Queen's Belfast), Parkinson (Strathclyde) and Walton (St Andrews). These collaborations have now extended to include renewable bioenergy solutions for the future, in a new major EPSRC SUPERGEN Bioenergy project (EP/K036769/1) led by **Lawton** and **RobertsonP** with Irvine (St Andrews).

Lawton's involvement in the "Water for All" Grand Challenge sandpit led to a collaborative EPSRC project (EP/J004871/1) with Amtmann (Glasgow), Templeton (Imperial), and Biggs (Sheffield). This project produces drinking water by exploiting the diverse metabolism of cyanobacteria.

A multiple collaboration, with Sri Jayewardenepura University (Sri Lanka), Hawkesbury Institute for the Environment (Sydney), and James Hutton Institute (Aberdeen) on the removal of cyanobacterial peptides by biodegradation (**Edwards, Lawton**) is funded by the Leverhulme Trust and SGM International Development Fund.

Hossain's collaboration with Loughborough (Malalasekera) and Leeds (Mahmud) has resulted in further development of models for NOx emission prediction and combustion-radiation interaction in turbulent non-premixed combustion**.**

The Northern Research Partnership (NRP) is a major research pool comprising RGU and the Universities of Aberdeen and Dundee, and is part of the Scottish Research Partnership. This initiative provides an NRP reader and two lecturer posts, and 5 PhD studentships for this unit. Cross-university joint PhD and research projects have developed links with oil industry partners.

User/Industry Collaboration

The Energy Technology Partnership (ETP) provides three Renewables PhD studentships, jointly supervised with Strathclyde and St Andrews, and sponsored by two SMEs and a multi-national materials manufacturer. The Sand Management Network, a collaboration of 20 partners (including Shell, BP, Schlumberger) provides close links between the Energy Group and relevant Oil & Gas industries. Most recently the Energy group has close involvement in a proposed joint industry-university multi-partner £10 million Oil & Gas Innovation Centre to be established in Aberdeen.

Pollard's long-term collaboration with Marine Scotland and SEPA develops reliable monitoring of organic contaminants and trace metals **(Pollard, Moffat).** Joint research with Aachen's Institute for Environmental Research develops novel passive sampling applications **(Pollard, Moffat).** Applied research with DGIST Korea pioneers the use of simple, novel, compact, in situ fluorosensors with potential to become the industry standard test **(Pollard)**. **Robertson** and **Bahnemann** work closely with Sachleben Chemie on new photocatalyst materials.

Lawton and **Edwards** have a long-term on-going collaboration with Enzo Life Sciences to develop high value products from algae. Taste and odour compounds produced by cyanobacteria cause significant problems in aquaculture and potable water. A successful EU-funded industrial collaboration with Wilhelm Aquaculture Enterprises (Delft) developed simple, scalable photo-catalytic reactors for improving water quality (**Lawton**), and collaboration with Healy Associates and Agdia led to increased use of on-site toxicity testing (**Lawton**). These advances underpinned Lawton's contribution to the EPSRC "Water for All" sandpit and its resulting project.

Leadership Roles

- EU COST Actions: 540 PHONASUM, Chair (**Bahnemann**), Director of Short Term Scientific Missions (**RobertsonP**); ES1105 CYANOCOST, Cyanobacteria & Cyanotoxins Lead (**Lawton**)
- Chair of OSPAR Environment Assessment and Monitoring Committee and UKMMAS Science Alignment Working Group (**Moffat**)
- Member of Beijing Detao Masters Academy (**RobertsonP**)
- Presented evidence to the Scottish Parliament's Economy, Energy and Tourism Committee's Energy Inquiry on 2 March 2009 **(RobertsonP)**

Fellowships, Awards and Invited Keynote Lectures

- RCUK Academic Fellowship 2005-2010 (**Njuguna)**
- DSc (Ulster) "*Applications of Engineering for Environmental Sustainability*" (**RobertsonP**)
- Best Knowledge Transfer Partnership for Scotland 2010 (Gas2 KTP)
- EATON Corp Awards for thermoplastic engine components R&D in 2010-11 (**Njuguna**)

Advisory Board Membership

- Board Member of EJIPAC European Japanese Initiative on Photocatalysis (**Bahnemann**)
- Science Board member of EPSRC SUPERGEN Hydrogen and Fuel Cell Hub (**Hossain)**
- Member of Strategic Research Agenda working group of EU NanoSafety cluster (**Njuguna**)
- Editorial Board membership of Central European Journal of Engineering (**RobertsonP)**

Fellows of Learned Societies: The Energy Institute (**RobertsonP, Steel**); The Royal Society of Chemistry (**RobertsonP**); Biomedical Science (**RobertsonJ**).