Institution: University of the West of Scotland (UWS)

Unit of Assessment: 15 General Engineering

a. Overview

The focus of this submission is the UWS School of Engineering's research in materials, manufacturing and management across construction, energy and environment in addition to research on the fundamental structure of matter. The most significant themes of research in this submission since 2008 have been the micromechanical/structural characterisation of construction materials (concrete and traditional geomaterials) and in nuclear physics (which relocated to Engineering in 2009, in order to enhance research synergies).

Recent strategic investment on the part of the University in the School of Engineering has seen research capacity broaden through the recruitment of new staff, and the incorporation of the fields of renewable energy and energy storage, water treatment, composite and smart materials, manufacturing and construction management. The established areas of concrete technology, heritage science/built heritage and fundamental investigations of the nature of atomic nuclei continue to be supported. Research activities are organised via the Institute of Engineering & Energy Technologies and in the Nuclear Physics Group. This submission comprises 13 academic staff (10 from the Institute of Engineering and 3 from the Physics Group; 1 professor, 1 reader and 11 lecturers), plus one additional (Hughes, non-returned) member whose work supports an impact case study. This is the first submission from UWS to General Engineering since 2001, and represents a significant step change for the institution as a pro-active growth agenda for research in engineering, aligned with the UWS strategic plan to enhance and increase research and knowledge exchange (KE) activity.

The researchers submitted here have benefitted from the support of the University's £3.8M academic development programme, and a close involvement with the Scottish Funding Council's pooling initiatives in Engineering (Glasgow Research Partnership for Engineering, GRPE) and Physics (Scottish Universities Physics Alliance, SUPA). Of the thirteen staff submitted eleven have been appointed since 2011; eight new lecturers and a professor in engineering, and two new lecturers in nuclear physics. Five of the lecturer appointments are early career researchers reflecting a drive to develop a vibrant research culture and significant momentum to compete for research funding. A new professor in Civil Engineering has also been appointed (Radosavljevic, starting early 2014). All staff participate in wide national and international collaborative networks in order to increase the reach and significance of our work. UOA 15 staff at UWS have been productive, publishing around 200 journal papers and garnering nearly 3000 citations, since 2008.

Research activity has been supported by £2.1M of external research funding from the research councils, industry (including KTPs), charities and the EU, in the areas of construction materials and nuclear physics. In addition UWS (in combination with the pooling and external funds mentioned above) have supported eight PhD completions, and a current cohort of twenty-three doctoral students (13 in Engineering and 10 in Physics).

b. Research strategy

The objectives for the Institute of Engineering & Energy Technologies and the Nuclear Physics Group are to increase the volume, quality and impact of research, with an improved international reach and significance beyond academia and for the benefit of society. The University's strategic plan 2008-15 prioritises increasing research and knowledge exchange capacity. This is achieved through targeting resources and developing units of improved scale. The School of Engineering has benefited from strategic investment that supports these aims and has increased the unit's capacity to produce excellent research with a focus on applied results and future impact. This is underpinned through the recruitment of both established research active staff (with expertise in a wide range of disciplines) and early career researchers with evident potential.

Research in Nuclear Physics is well established and was last submitted to RAE2008 under UOA 19 (Physics). General Engineering was submitted in 2001, but not in 2008, due to the loss of a critical mass of research active staff. Nevertheless, teaching provision in mechanical and process

engineering continued. Construction materials research was carried out within the Advanced Concrete and Masonry Centre (first submitted to Civil Engineering in RAE96 and also in 2001), continuing onwards to be submitted as part of UOA17 (Earth Systems and Environmental Sciences) in 2008. Subsequently, and with the advent of the new strategic plan (that also saw restructuring at UWS as a consequence of mergers with other institutions) we have significantly rebuilt capacity within Engineering. This growth is consistent with the University's strategy to become an academic institution with a significant profile and reputation for national and international excellence in applied research in strategically important academic areas.

A new research centre has been established under the leadership of Professor Olabi: the Institute for Engineering & Energy Technologies. Within this Institute, construction materials research continues to be a significant theme, and is now joined by research capability in renewable energy and energy storage, composite materials, manufacturing and engineering process management (including construction management) and water engineering. The well-established Nuclear Physics Research Group, now embedded in the School of Engineering, is led by Dr Smith. The strategy of the nuclear-physics group is to continue with fundamental nuclear physics research, but to exploit their expertise in radiation detector development by moving into more applied areas of nuclear research, linking more closely with School colleagues working in energy technologies.

Compared with the situation in 2008, there has been a significant increase in research in the engineering disciplines. In addition, the synergies established with environmental sciences at UWS, have continued as important cross school linkages (e.g. in the areas of water treatment, climate change adaptation, use of waste streams in construction). Strong links also exist within the School of Engineering, with the Institute for Advanced Technologies, that pursues research on sensor technologies and thin films (submitted to UOA 13). The two institutes and the Nuclear Physics group together comprise the School's research activity. The synergies between the groups are strongly exemplified in the sharing of infrastructure, for example for materials characterisation (e.g. mechanical, compositional, microscopy).

The vision for the future of the Institute for Engineering and Energy Technologies involves pro-active engagement across the following substantially interlinked themes.

Materials and mechanics: (Murmu, Wu, Xia) composite materials, magneto-rheology fluids, magnetostrictive materials, foam materials, micromechanical characterisation, modelling of structural and thermal behaviours, design of sensors and actuators, optimization of vehicle damping systems and energy absorption systems.

Energy and environment: (Altaee, Olabi, Mirzaeian) hydrogen fuel cells, biomass generation, energy storage systems, optimization of renewable energy parts and systems, membrane separation technologies for wastewater and desalination treatments.

Construction: (Hughes, Tennant, Radosavljevic, Zhu) concrete (SCC, HPC, incorporating recycled materials), microstructures and micromechanics of cementitious composites, traditional mortars, stone, advanced multifunctional surface consolidants and self-cleaning treatments, construction management, supply chain management, BIM

Engineering process management: (Vichare, Anvari) information modelling and machine tool testing and verification, dissimilar- hybrid welding, lean manufacturing and supply chain management.

The **Nuclear Physics Group** will, over the next five years, maintain established research programmes in fundamental nuclear physics, studying the sizes and shapes of atomic nuclei, primarily using gamma-ray spectroscopy. This will include maintaining our ongoing programmes at JYFL, Finland (Smith), Argonne National Laboratory, USA (Smith), ISOLDE at CERN (Scheck), ILL, Grenoble (Simpson and Scheck), and RIKEN (Simpson). The Group will also work with collaborators in SUPA to develop expertise and equipment for the Scottish Centre for the Application of Plasma Based Accelerators (SCAPA) with a view to leading a future laser-induced nuclear-physics programme led by Dr Spohr, to exploit our knowledge of radiation detection and

measurement in collaborations with industry and in applied nuclear-physics research.

c. People

i. Staffing strategy and staff development

Since 2008 Engineering has seen a significant increase in the numbers of REF-returnable, research-active staff that add considerable research breadth and scope. The £3.8M UWS Academic Development Programme has driven an increase from 5.7 staff returned at RAE 2008 (Hughes and Zhu, UOA 17, Smith, Chapman, Spohr, Liang, Maier, UOA 19), to a cohort of 13 staff now submitted. Two professors have been appointed, one in Energy Systems (Olabi) and the other in Construction Management (Radosavljevic, starting 2014). The appointment of 8 engineering lecturers since 2011 (Altaee, Anvari, Mirzaeian, Murmu, Tennant, Vichare, Wu, Xia) amounts to 18% of new appointments at this level in UWS, attesting to, and signalling the institution's intent for research activity into the future. The new staff (including 5 Early Career Researchers) have been appointed in mechanical and thermal engineering, energy systems, construction management and desalination/soil treatment. In addition, before the period of assessment, Glasgow Research Partnership for Engineering (GRPE) SFC Pooling funds supported the appointment of a lecturer in Micromechanical Characterisation (2007, Zhu). The Engineering Institute also hosted three post-doctoral Research Assistants. In the Physics Group, two new lecturers (Simpson, Scheck) have recently been appointed with matching funding from the SFC's pooling initiative (Scottish Universities Physics Alliance, SUPA). The Nuclear Physics Group now comprises Dr Smith (group leader), Dr Spohr, Dr Simpson and Dr Scheck (ECR). Professor Chapman remains active within the group with Emeritus status. Since 2008, the Physics group has been supported by nine post-doctoral Research Assistants (six STFC, one Carnegie Trust, two internally) and two Technicians.

The recent recruitment policy emphasises research activity and productivity, especially the potential to fulfil REF selection criteria. The University also works to implement the principles of the Concordat for the Career Development of Researchers. A performance development review process for staff emphasises roles and output achievements and allows staff to prioritise support needs. This process also facilitates workload management, and recognises the circumstances of early career researchers, with managed teaching workloads (typically under 40%) to integrate new staff, whilst allowing research activity to both continue and develop in tandem. For established staff, the approach is also flexible, recognising and encouraging improved research metrics, such as grant success, postgraduate supervision and publication activity, tailored to individual achievements and potential.

For all staff and postgraduate students there are ample development and CPD opportunities. The UWS Innovation and Research Office (IRO) delivers dedicated programmes for the support of ECRs combined with follow up peer support from more experienced staff. Support for grant-search is tailored to facilitate first-grant applications, and there has been a long tradition at UWS of involvement of postdoctoral staff in funding application development. The Engineering and Energy Technologies Institute has also developed a research seminar series, requiring all research active staff to contribute. The unit provides support for staff for the development of publications and grant applications through mentoring, workshops and peer review. New staff have been prioritised for assistance in capital equipment and for new PhD Studentships funded from internal sources. For all staff, RAs and students there is a wide range of career development training courses and workshops. RAs typically undertake one-to-one mentoring from their line manager, and also from other group members. Nuclear Physics PhD students are required to take 20 hours of training in generic (transferrable) skills from the SUPA Graduate School within the first two years of their studentship.

The University advances strong equality of opportunity policies for all staff. UWS has a proud tradition of extending access to education for all, regardless of background. The University works to make this inclusivity applicable to everyone, for students and staff alike, and to create a tolerant and diverse community. A very high proportion the UOA's staff originate outwith the UK, demonstrating that we are a diverse group, though only one member of this UOA is female. The University is committed to achieving Athena SWAN accreditation in 2014.

Every member of staff can apply for promotion in an annual open cycle at which staff are invited to

demonstrate they meet promotion benchmarks. The University has a regular cycle of sabbatical opportunities, and welcomes staff secondment to industry or external organisations. Research exchanges are encouraged, examples include staff working with the Czech Academy of Sciences (2010/11 R. Soc. Edinburgh) and the CSIR-Central Building Research Institute, Roorkee, India (DST-UKIERI, 2013-15). UWS supports the appointment of academic visitors by awarding formal Visiting Scholar status to encourage researchers into the university community, for example, from the Czech Academy of Sciences, Adam Mickiewicz University Poland, Institute of Advanced Studies, Lucca, Italy and the appointment of a visiting professor in Nanotechnology in Construction materials from Spain (Professor Porro, Technalia, Bilbao). In 2014/15 the UOA will welcome visitors from the Central Building Research Institute, India. The Nuclear Physics Group hosted Dr Wilson (ANU, Canberra) and Dr Palffy (MPI, Heidelberg) funded through the SUPA Distinguished Visitor Scheme. Our most high-profile visitor has been Professor Nazarewicz (UTK Tennessee & Oak Ridge National Laboratory) a Carnegie Trust Centenary Professor in our group for 2008. Professor Nazarewicz was subsequently appointed as Visiting Professor the Nuclear Physics group. Professor Nazarewicz is one of the most high profile theoretical nuclear physicists in the world; (h-index 70, more than 16000 citations).

ii. Research students

Support for funding research students has come from university and external sources, the research councils, SFC research pooling, government and industry sources. Currently there are 23 research students supervised from within the institute (21 FT, 2 PT), and two co-supervisory arrangements with another institute within UWS. We have close relationships with several German fachochschule; five research students being registered from them and co-supervised with German colleagues. Co-supervision has also extended through the suppport of SFC pooling within the GRPE and SUPA. The engagement of external supervisors, from collaborating institutions in academia, industry and the third sector are encouraged, especially where funding support is secured from these partners.

Since 2008 there have been 8 PhD completions within the UOA. In Nuclear Physics there have been 17 students, 12 funded by STFC; five PhD students have completed and two have enrolled after the census date. UWS has a policy to increase the total number of research students across the University to over 500 by 2015, through the investment of £1M per annum. This is being made possible through the increase in research active staff that has increased the pool of available supervisors. The research student population looks set to increase substantially in the near future, as new early career staff engage with supervisory opportunities as a primary means to develop research. The emphasis however in our UOA is to target external support, and external partnerships. For example current studentships have benefitted from support from Historic Scotland, the British Geological Survey University Collaboration Scheme (a highly competitive NERC-BUFI award) and industry partner Hoover.

In 2012/13 a cross-University Graduate School was established to increase engagement with and between students, to improve opportunities for credit bearing educational development and to drive forward an agenda of engagement with other Graduate Schools across Scotland and beyond. A comprehensive programme of student support is offered for generic and specialist research skills training. An annual research student conference is organised, where there is engagement from external partners from industry who also assess outputs. Each student is also supported by dedicated funding for personal development (minimum of £1k), including a conference fund for external international dissemination. A robust programme of progress monitoring is also in place, with reporting required at 6 month intervals and a significant transfer assessment midway through each project, leading to registration for the PhD. Each student is assigned an internal assessor who independently monitors progress at milestones. Students are encouraged to engage in teaching activities, and we have a good record of student involvement in assisting in conference administration and delivery when hosting scholarly conference events. Students are also encouraged to publish in journals with the mentoring of supervisors and other academic staff. Specialist training in academic writing is also made available to students (and staff).

Staff can undertake specialist training in research degree supervision, and are obliged to attend regular refresher workshops. Staff are closely involved with recruitment of research students,

organising interviews, supported by the Innovation and Research Office to ensure quality assurance in selection procedures, equal opportunities and appropriate finance procedures to ensure smooth starts. Students are guaranteed stable desk space and a computer. Recruitment is approached through external advertisement, and administered through the Innovation and Research Office centrally. Discipline specific networks are exploited, for example through professional bodies and increasingly through professional online avenues by individual supervisors seeking candidates.

A benefit of SUPA membership is active participation in the Scotland-wide SUPA Graduate School. Smith has been a member of the SUPA Graduate School Management Committee since 2008, as both UWS and Nuclear and Plasma Physics theme representative. PhD students in nuclear physics are exposed to a vibrant and dynamic research culture and are engaged in a larger research community as a result of access to a wide range of postgraduate lectures delivered by the SUPA Graduate School. In this regard, UWS PhD students receive the same training as students at the more traditional, established universities in Scotland. Interaction between PhD students at UWS and at other Scottish institutions has improved considerably as a result.

d. Income, infrastructure and facilities

Income for both groups submitted in the UOA over the period has been £2.1M (HESA returned), from the research councils, charities, government, industry and the EU. In engineering notable successes include winning funds as partners in two EU-7th FP projects (CODICE and HEROMAT, Zhu and Hughes £450k) and two AHRC Science and Heritage Programme grants (Hughes £125k). Construction materials research also attracted £53K of KT and industry funding and a further £40k of public sector (Historic Scotland) support. In addition the UOA benefitted from a continued spend in the period from SFC engineering pooling funds to support a lecturer in Micromechanical characterisation. A further benefit of SUPA membership is support for new staff members: Smith was appointed in 2006 on a contract that was 58% SUPA funded for five years; Scheck and Simpson have been appointed on contracts that are 33% SUPA funded for four years.

Research in the Nuclear Physics Group is predominantly funded by STFC. Since the start of 2008 the group has been awarded £1.12M from STFC as Standard, Consolidated, Project (AGATA and NuSTAR) and Travel Grants (to Smith, Chapman, Andreyev). The Nuclear Physics Group has an excellent record in securing beam-time at large international facilities both as spokespersons for and as members of international collaborations. Beam-time at these facilities is awarded on a highly competitive peer-review basis. Since 2008, members of the UWS nuclear physics group have been awarded beam-time, as spokespersons, at Argonne National Laboratory (Chicago), Oak Ridge National Laboratory (Tennessee), JYFL Jyväskylä (Finland), CERN (Geneva), Legnaro National Laboratory (Italy), Instutit Laue Langevin (Grenoble), and RIKEN (Japan). The value attached to beam-time is not insignificant. For example, values are estimated to be: at Legnaro National Laboratory £305 per hour; at JYFL £610 per hour; at Argonne National Laboratory £1087 per hour. Dr Smith acted as spokesperson for two weeks at Legnaro (November 2008, March 2010), three weeks at Argonne (August 2009, November 2012) and four weeks at JYFL (June 2009, October 2011, and August 2013) giving a total beam-time value of around £1.06M. This is only considered here for Smith; similar amounts of beam-time have been awarded to the other group members.

The School of Engineering has extensive facilities for the characterisation of materials and structures, from the nano to the macro scale. Facilities comprise a fully equipped manufacturing workshop, rapid prototyping, assembly and welding and petrographic section sample preparation. Uniquely for Scotland, the UOA possesses a MTS Nanoindenter, which has contributed to EU 7thFP project results and provided extensive data on the microstructure of cement, concrete and biomaterials. Access to further characterisation facilities (XRD, SEM, AFM etc.) occurs through the sister Institute of Advanced Technologies within the School. In 2008 the School also opened a £2.1M engineering centre focused on automotive engineering, at Hamilton Campus. The facilities allow staff to engage with professional consultancy services in the characterisation of materials (metals to construction materials) and the manufacturing of components and devices.

Recognising the step change in staff research capacity generated by recent recruitment, the School of Engineering has invested over £1m on research infrastructure since 2008 and a further

investment of £200k is planned. From 2012 the following facilities were established: a Biomass laboratory (with anaerobic digestion, homogenizer, hollander beater, combustion gas analysers); a membrane separation laboratory for desalination and wastewater treatment, and an energy storage laboratory with environmental and vacuum ovens, environmental furnace with variable gas inputs and BET, for the preparation of porous gels and carbon.

The UOA will increase research funding through targeting external sources, building upon underpinning University and Institute funds and support mechanisms. We aim to pursue activities in collaboration with external partners to lever increased funds. All staff are well networked externally; joint research activities, with UK and international partners are underway and can be developed further with appropriate focussed actions. The UOA will support larger and better targeted proposals for funding to the research councils (including special programmes), the Technology Strategy Board and EU Horizon 2020. Knowledge exchange activity with industry, the public and 3rd sectors is also vital for the UOA's research to increase its reach and significance. The UOA will utilise the University's Innovation and Research Office's support mechanisms for developing industrial contacts and for sourcing funding schemes. A good example of KE strategy is current involvement of construction theme staff at an advanced stage with a proposal for the Construction Scotland Innovation Centre, a SFC funded pan-Scotland industry led initiative that will deliver significant economic impact and stimulus for innovation through dedicated knowledge exchange funding. The key objective in the Nuclear Physics Group is to expand, by encouraging and supporting larger collaborative proposals via SUPA (SCAPA), UK research council initiatives, and European Horizon 2020 funding.

e. Collaboration or contribution to the discipline or research base

Staff in the UOA are active in professional networks and collaborations with a wide range of academic and non-academic beneficiaries and stakeholders worldwide. Staff are involved with conference organisation, journal editorships and technical committee work, in addition to memberships of appropriate professional institutions. The School of Engineering has close formal links with German fachochschule, universities in Russia, India, China and Nigeria. Research collaborations are being developed with these partners.

Within the Institute of Engineering and Energy Technologies, notable collaborations are within EU projects, working closely with academia, research institutes and industry. For example the HEROMAT 7thFP project involves collaboration with universities in Serbia and Russia (Novi Sad, Northern Arctic), ZAG, Slovenia, CNR-ISTM Perugia, Italy and SMEs in Serbia, Slovenia and the UK. A previous EU project (CODICE) saw involvement with BASF, that led to further direct funding from BASF of research activity at UWS. In addition Drs Hughes and Zhu are members of RILEM, and have participated in international committee work since the '90s. A team from the construction group are travelling in January 2014 to begin a 2 year exchange with the Indian Central Building Research Institute, Roorkee (DST-UKIERI) on nano-engineering of cementitious materials. Hughes is a visiting lecturer at the Centre for Sustainable Heritage, UCL. Prof Olabi is a member of COST Action 542 and sits on the management committee of the European Experimental Mechanics Society.

Within the Engineering Institute staff collaborate with over 30 academic institutions, including (non-exhaustively) the Universities of Loughborough, Strathclyde, Glasgow, Oxford, Queen's Belfast, Heriot Watt, Newcastle, Kassel, TU Delft, Bonn, Eduardo Torroja, Bari, Alabama, Virginia Tech, British Columbia, Trinity Dublin, Beihaang and Tsinghua, China, Ceara, Brazil and institutions such as Historic Scotland, British Geological Survey, National Trust for Scotland, Czech Academy of Sciences, Tecnalia, Spain, Changung Institute of Technology, China. Recent industrial collaboration in KE and other research activities has been with BASF, Italcementi, Bikain, Econotherm and more than ten additional companies.

Research in nuclear physics is generally carried out at international user facilities in large international collaborations. The Nuclear Physics Group at UWS has a significant number of collaborators, which are too numerous to list in full here. The UWS group is a member of the

AGATA Collaboration (Smith is a member of the AGATA Collaboration Council) which consists of over 40 institutions from 12 countries. Smith is a member of the UK AGATA Management Board, along with physicists from Liverpool, Manchester, Surrey, York, and DaresburyUWS is also a member of the NuSTAR collaboration, specifically with an interest in the construction of an array of $LaBr_3$ scintillator detectors for fast timing; Smith is a member of the UK NuSTAR Management Board, and are members of the EXILL (Exogam at ILL) collaboration and the ISOLDE (CERN) Collaboration. Some of the most prominent individual collaborating institutions are Argonne National Laboratory, Washington University (St Louis), Legnaro National Laboratory (Italy), University of Padova (Italy), JYFL (Finland), ISOLDE (CERN), TU Darmstadt (Germany), and ILL (Grenoble).

The research environment in physics and engineering at UWS is greatly enhanced by our participation in the SFC Physics pooling initiative SUPA, since 2005 and the GRPE, since 2007. This has provided funds, studentships and infrastructural support for analytical facilities and also graduate school activities. It has involved close collaborative working with partner universities.

The collaborations mentioned above, particularly with research users in industry, the public and 3rd sectors, are central to the research directions followed by the staff in this UOA and inform them closely. Several of the research topics in the UOA, such as in concrete, energy systems and structural mechanics of graphene are of global environmental and economic significance. Interdisciplinary research in the UOA is pursued by Dr Zhu, who has worked extensively with Glasgow University School of Geographical and Earth Science, on the micromechanical properties of marine shell ultrastructures. Hughes (see impact case study) has also developed research in Heritage Science with humanities disciplines (anthropology, archaeology and architecture with AHRC funding) and also at the interface with climate change looking at adaptive capacities and risk assessment for cultural heritage with environmental sciences at UWS.

Staff regularly review for the leading journals in their fields. Prof Olabi acts as a subject editor (Energy) and Dr Zhu is a member of an editorial committee (J. Innovative Engineering). Staff also participate in funding bid reviews for the UK and overseas research councils (EPSRC, AHRC, EU countries). Dr Hughes served as a panel member for the AHRC Commissioning Panel for "Arts and Humanities Approaches to Researching Environmental Change", a cross-Council Living with Environmental Change Programme, in 2010. Dr Smith of the Nuclear Physics Group serves on the STFC Nuclear Physics Grants Panel, since 2010. Established staff are frequent external examiners for doctoral projects in the UK and overseas (e.g. India, Ireland, Finland and Spain).

In 2008, the UWS Nuclear Physics Group organized a major international conference "*Nuclear Structure at the Extremes*" with 30 invited international speakers including Akito Arima (from Tokyo, former Minister of Education in Japan), Juha Äysto (from JYFL, Finland) and Achim Richter (from TU Darmstadt). attended by 120 delegates. In 2011, collaborating with Edinburgh University Dr Smith organized the 16th UK Postgraduate Nuclear Physics Summer School, at the University of St Andrews in August/September 2011 with lecturers from the USA, Australia, and Europe attended by 50 European nuclear-physics PhD students. Since 2008, we have also held four one-day international workshops e.g. "*Superheavy Nuclei*" and "*Nuclei as Open Quantum Systems*" attracting around 40-50 delegates from the UK and Europe.

In 2013 Dr Hughes hosted the "*3rd Historic Mortars Conference*", in Glasgow, that attracted 120 delegates from all over the globe to present 100 papers. Dr Hughes also bid successfully to host the 13th quadrennial ICOMOS "*Congress on the Conservation and Deterioration of Stone*" in 2016. Drs Hughes and Zhu are frequent session chairs for conferences and have given several keynote presentations within their subject. Prof Olabi is a founding organiser of the international conference on "*Sustainable Energy and Environmental Protection*" (www.seepconference.co.uk), hosted previously in Dublin, Bari, Maribor, and for 2014 in Dubai.