Masters programme in Environmental Entrepreneurship

This unique 1-year MSc - the first of its kind in Europe - is an innovative collaboration between the Department of Civil and Environmental Engineering and the Hunter Centre for Entrepreneurship, with contributions from seven other departments: the Law School, Design, Manufacture & Engineering Management (DMEM), Mechanical & Aerospace Engineering, Economics, Naval Architecture & Marine Engineering, Human Resource Management, Management Science, and Department of Accounting & Finance. The course is about developing 'win-win' strategies, which simultaneously protect the environment and save money, in any kind of organisation.

Applicants are welcomed from all subject backgrounds: arts, social sciences, humanities, engineering, agriculture, law, science and business.

The course is accredited as meeting the requirements for Further Learning for a Chartered Engineer (CEng) for candidates who have already acquired an Accredited CEng (Partial) BEng (Hons) undergraduate first degree. See www.jbm.org.uk for further information.

**Key Delivery Team**

The delivery team comprises leading academics from ten different departments from the Faculty of Engineering, Strathclyde Business School and the Law School. A brief profile of the key academic team is provided below:

**Dr Elsa João** (Civil & Environmental Engineering; Portugal) is the Course Leader of the MSc in Environmental Entrepreneurship. She has expertise in the areas of Strategic Environmental Assessment, Environmental Impact Assessment, environmental analysis, Geographical Information Systems, environmental innovation and enhancement of positive impacts. Elsa contributes to the research of the sustainability category of the prestigious Scottish PLC awards and has contributed in the past to the research of the Scottish Green Awards. Elsa teaches the classes Client-Based Environmental Entrepreneurship in Practice and Qualitative and Quantitative Research Methods.

**Dr Paul Ferri** (Hunter Centre for Entrepreneurship; Scotland) has considerable academic teaching experience delivering entrepreneurship and business management modules at both undergraduate and postgraduate levels, from a practitioner perspective. Having run his own business in the professional audio-visual market for 27 years, Paul brings his considerable experience as an entrepreneur to the Hunter Centre. His research interests include the entrepreneurship and social capital nexus, entrepreneurial and sales education, new small business start-ups and self-sustaining social enterprises. Paul teaches the class New Venture Creation.

**Dr Erik Monsen** (Hunter Centre for Entrepreneurship; USA) is a Senior Lecturer of Technology Entrepreneurship with expertise on how to design better entrepreneurial organizations from the employee perspective. Trained as an Aerospace Engineer, he also has MBA in Entrepreneurship & Technology Management, and a PhD in Organization Management. Erik’s current research examines how and why employees act entrepreneurially, and scientists & engineers choose to commercialize their research. Erik teaches the class Entrepreneurship, Innovation and Commercialisation.
**Structure of the MSc in Environmental Entrepreneurship**

The MSc involves a curriculum of five core classes (totalling 50 credits) and a range of optional classes (70 credits). Students also undertake a dissertation (60 credits). The class Client-Based Environmental Entrepreneurship in Practice has been developed for this MSc. The class has no formal teaching and instead sees students carry out a project of interest to an organisation chosen by the student. The project has a four-month duration and is carried out between January & April.

**Compulsory Core Classes**

*Department of Civil & Environmental Engineering:*
- Client-Based Environmental Entrepreneurship in Practice
- Qualitative and Quantitative Research Methods

*Hunter Centre for Entrepreneurship:*
- Entrepreneurship, Innovation and Commercialisation
- New Venture Creation

**Optional Classes** (choice of 7 x 10 credit classes)

*Department of Civil & Environmental Engineering:*
- Air Pollution, Climate Change and Human Health
- Contaminated Land Management
- Environmental Impact Assessment
- Environmental Pollution Management
- Global Water Policy
- Independent Study in Collaboration with Industry
- Pollution & Rehabilitation of Degraded Ecosystems
- Science, Technology and Innovation Policy
- Sustainability & Strategic Environmental Assessment
- Waste Management and Landfill Design

*Department of Economics:*
- Environmental Economics
- Principles of Economic Appraisal
- Energy Economics

*Department of Mechanical & Aerospace Engineering:*
- Energy Resources and Policy

*Strathclyde Law School:*
- International Environmental Law
- UK and EU Environmental Law

*Department of Design, Manufacture & Engineering Management:*
- Sustainable Product Design and Manufacturing

*Department of Accounting & Finance:*
- Sustainable Transformation and Accountability

*Department of Human Resource Management:*
- Business Systems

*Department of Management Science:*
- Foundations of Operational Research & Business Analysis

*For students interested in renewables, it may also be possible to choose these classes if students have right background:*

*Department of Naval Architecture and Marine Engineering:*
- Renewable Marine Energy Systems

*Department of Mechanical & Aerospace Engineering:*
- Electrical Power Systems
- Energy Modelling and Monitoring
SUMMARY CLASS (MODULE) DESCRIPTIONS

Compulsory Core Classes

Client-Based Environmental Entrepreneurship in Practice (Dr Elsa João, Civil & Environmental Engineering/DLCS) - This class, only offered to the students in the MSc in Environmental Entrepreneurship, is a client-based project work, where students carry out a project of interest to a client while at the same contributing to environmental entrepreneurship in practice. The aims of each project are defined in terms of progressive risks in effecting a solution. The first aim has a high chance of success and low risk of failure; the second aim is more challenging but capable of solution given initiative and energy on the part of the students; and the third aim can have a 'blue skies' element, a real research challenge and consequently a high risk of failure but success will demonstrate exceptional competence and initiative.

Entrepreneurship, Innovation and Commercialisation (Dr Erik Monsen, Hunter Centre for Entrepreneurship) - This class attempts to bridge the gap between researchers, technologists and the mainstream customer and to provide engineers and scientists with a better understanding of what it takes to create and grow technology-based businesses. The class provides students with an appreciation of the intrinsic value of entrepreneurship, innovation and commercialisation activities to business. It also provides students with a better appreciation and understanding of management in a complex, uncertain, and interdisciplinary high-tech business environment. Students acquire a set of frameworks to better understand and more successfully engage in high-tech business opportunities.

New Venture Creation (Dr Paul Ferri, Hunter Centre for Entrepreneurship) - This is a highly interactive class exploring the multidisciplinary process for creating a new venture. The class takes students through the entire pre-start up process from opportunity recognition through accessing resources, writing a business plan and pitching it to an audience. The class will use a variety of teaching and learning approaches including group work, discussions and case studies designed to maximise participation and interaction. The class is assessed through coursework including presentations, business plan reports and contributions to class discussions. [This class is part of the Spring School and runs intensively during one week of the Spring break.]

Qualitative and Quantitative Research Methods (Dr Elsa João, Civil & Environmental Engineering) - Students will acquire familiarity with, and practice of, contemporary research techniques, and examine different ways of, and gain experience in, presenting research results. An examination of the methodologies used in environmental research and an evaluation of their application to different kinds of research problems will be undertaken. The class discusses the key principles, and practical exercises, on both quantitative and qualitative research methods, including survey methods, interviewing techniques, use of census data, statistical methods and policy analysis. The class also includes a discussion on ethical issues. Finally, there is dissertation-related teaching on choosing a research question and a research method, and writing a research proposal.

Optional Classes (in alphabetical order)

Air Pollution, Climate Change & Human Health (Dr Iain Beverland, Civil & Env. Engineering/Environmental Health) – The class provides students with knowledge & skills applicable to atmospheric pollution impacts, ranging from local to global scales. This includes a focus on the assessment & management of impacts on human health through effective interface between the public health sciences of environmental epidemiology and environmental toxicology; and environmental engineering approaches to manage environmental risks.

Contaminated Land Management (Dr Christine Switzer, Civil & Environmental Engineering) – Within the background of land redevelopment (residential, industrial/commercial and gardens/parks), this module aims to provide insights into the remediation of contaminated land, including the regulatory framework and risk assessment, sampling & analysis, and various remedial techniques for contaminated land.

Electrical Power Systems (Dr Nick Kelly, Mechanical & Aerospace Eng) – This class aims to provide students with an understanding of the operation of modern electrical power systems along with the techniques to undertake a basic technical analysis of key electrical devices and systems. Students learn the basis of operation of modern electrical power systems incorporating renewable energy technologies and the consequences for the environment and energy security. The class covers complex numbers and fundamental analysis techniques such as Kirchoff’s current and voltage laws to solve power flow problems.

Energy Economics (Prof Peter McGregor, Economics, Strathclyde Business School) - Energy resources (such as crude oil, natural gas, coal, biomass, wind and sunlight) can be harvested and converted into useful forms to produce energy commodities (such as petroleum and diesel fuel, natural gas, and electricity) that can be used to provide energy services for human activities. The class begins by studying the forces that generate both demand for and supply of energy
resources and energy commodities. It considers what factors determine the way those commodities are transported to users, and how residuals are disposed of. It investigates the roles of alternative market and regulatory structures on these activities, the impacts of such activities and their environmental consequences. The class identifies criteria required for the efficient provision and use of energy commodities and resources and reasons why efficiency is rarely achieved. The class adopts a practical, applied orientation throughout. Applications include the evaluation of renewable energy projects and the economic analysis of nuclear power.

Energy Modelling and Monitoring (Dr Paul Strachan, Mechanical & Aerospace Eng) – This class aims to impart an understanding of the theoretical and operational principles underlying simulation modelling of energy supply and demand systems and their environmental impact. The emphasis is on practical computer lab-based modelling exercises. The class teaches how to generate and adapt computer models, undertake simulations and analyse predicted performance for a range of technologies. Students learn how to write technical reports that demonstrate an understanding of the main factors that influence the energy and environmental performance, and the capabilities of the modelling programs used in the class to predict performance.

Energy Resources and Policy (Professor Joe A Clarke, Mechanical & Aerospace Eng) - Against the background of international commitments on atmospheric emissions, diminishing fossil fuel resources and the liberalisation of energy markets, this class examines sustainable options for energy production, supply and consumption. The aim is to give students an understanding of current trends, and to enable a critical evaluation of emerging ideas, technologies and policies.

Environmental Economics (Roger Perman, Economics, Strathclyde Business School) - The main objective of this class is to provide a grounding in the economics of the environment. It demonstrates what economic analysis can contribute to discussions about the use of our natural capital (or environmental resource) base, and to discussions about policy responses to environmental problems. A key element of the economic approach to environmental policy is 'value for money' - designing policy interventions that give the greatest environmental improvement for any particular budget outlay. But economic analysis also deals with questions about sustainability (and so impacts on future generations) and equity between different individuals, groups, and countries. This class pays particular attention to international environmental problems. Such problems have been high on the agenda for environmental policy interventions since the Rio Summit of 1992, yet are ones that seem to be the most difficult to make progress with. We examine why this has been the case, making use of the growing literature on international environmental agreements. The class adopts a practical, applied orientation throughout. Applications include transport policy, water quality and availability, global climate change, and loss of biological diversity.

Environmental Impact Assessment (Dr Elsa João, Civil & Environmental Engineering, Faculty of Engineering) - This class provides an introduction to the methods used to predict environmental impacts, and evaluates how these may be used to integrate environmental factors into decisions. The class draws principally on the UK planning context of environmental impact assessment of individual projects (project EIA), but also takes account of EIA experience in other countries and international organisations.

Environmental Pollution Management (Dr Iain Beverland, Civil & Environmental Engineering/Environmental Health) - The class develops in-depth knowledge & skills regarding the science, engineering & management of environmental pollution control approaches to protect public health. The class achieves these aims through research-led teaching at the interface between public health and environmental engineering, with a particular focus on methodologies based on risk-centred approaches. Lecture sessions are complemented by industrial & government case studies in contemporary air quality management practice.

Global Water Policy (Professor Bob Kalin, Civil & Environmental Engineering) - This class explores the issues relating to overall global water policy and its interaction with other global issues; the impact of Climate Change and economic development on water resources and availability; the different implementation issues based on regional case studies; and the role of stakeholders on the acceptance and achievement of policy objectives.

Independent Study in Collaboration with Industry (Dr Richard Lord, Knowledge-Exchange Director, Department of Civil and Environmental Engineering), Graduates increasingly need highly developed transferable professional skills to prepare for and to gain future employment. This module will allow students carrying out placements and projects with industry to develop and refine professional skills while gaining credits in the process. One of such projects will be the small or medium sized enterprise (SME) Carbon Audit that students carry out with training from Carbon Trust. A placement type project activity is another possibility, by individual agreement. Approval of students being able to take this module would be done on case-by-case basis by MSc course leaders as an individualised learning contract. Students will be selected by competitive application and CV. [Students doing the SMS Carbon Audit will be asked to pay between £100-£250 – exact figure, which depends on subsidy and number of students taking part, to be determined later.]

International Environmental Law (Dr Francesco Sindico, Law School) - This module will discuss the international legal frameworks applicable to deal with transboundary and international environmental problems, looking at the effectiveness of international litigation in dealing with global environmental challenges and analyzing the relationship between legal rules and governance structures related to non-environmental fields (e.g. international trade and investment). Climate
change will be used as a key case study, but other global environmental problems, such as loss of biodiversity, fish stocks depletion, transboundary water pollution & over-exploitation (both surface and groundwater) will also be looked at.

**Pollution and Rehabilitation of Degraded Ecosystems** (Dr Charles Knapp, Civil & Environmental Engineering) – This class introduces key principles of ecology and explores the ecosystems problems caused by pollutants, both atmospheric and aquatic, with regard to toxicity, bioaccumulation and ultimate disruption. Approaches to remedial clean up are described in relation to current legislation.

**Principles of Economic Appraisal** (Roger Perman, Economics, Strathclyde Business School) - Appraisal and value of capital investment projects is a key element of strategic decision making by managers in both public and private sectors. But economic appraisal has a much wider scope than conventional capital appraisal, as it can encompass the wider external or social implications of capital projects, and it can be used to appraise programmes and policies, not just standalone projects. This class provides participants with the foundation knowledge and skills to undertake economic appraisal in its various forms and contexts – both from the point of view of a single project and when making choices among a multiple set of options. The class deals with a variety of forms of economic appraisal: cost-benefit analysis (CBA), cost-effectiveness analysis (CEA); and multi-criteria analysis (MCA). The class also deals with special issues that arise in public or social appraisal. Applications include the appraisal of a traffic project, a cost-benefit analysis of a renewable energy project, and value-for-money choices in health care provision.

**Renewable Marine Energy Systems** (Professor Nigel Barltrop, Naval Architecture and Marine Eng) - This class provides students with an understanding of the ways in which the maritime environment can offer a significant contribution, in a sustainable manner, to global energy demands. Students undertake engineering assessments of the design and operation of marine energy generating systems. Students gain an appreciation of the nature of the sea and the statistics of wind, waves and currents and learn to use a variety of MathCad mathematical models of tidal, wind and wave energy device. The class assesses the relative merits of different marine energy systems based on engineering, environmental, political, social and economic issues.

**Science, Technology and Innovation Policy** (Dr Girma Zawdie, Civil & Environmental Engineering) - This class introduces students to the sources, principles and main features of the substantive laws of the UK and the EU relating to the environment, as well as key international law. It also introduces the various UK and EU regulatory agencies, their respective functions and powers, and methods of administrative regulation and enforcement.

**Sustainability & Strategic Environmental Assessment** (Dr Elsa João, Civil & Environmental Engineering) - This class allows students to develop theoretical and applied understanding of key principles of sustainability and Strategic Environmental Assessment (SEA). SEA is a significant appraisal and decision-aiding tool that evaluates the environmental impacts of policies, plans and programmes, such as a transportation policy or a local development plan.

**Sustainable Product Design and Manufacturing** (Dr Winifred Ijomah, DMEM) - One of the major challenges of modern industry is to address the need for sustainable product development and manufacturing. International legislation and increasing costs of fiscal instruments such as the landfill tax now aim to force producers to reduce the environmental impacts of their products and processes. Accelerating globalization and industrialization continues to exacerbate complexity of sustainability. Whilst manufacturers are constantly required to lower their costs and maintain their competitiveness, legislations require them to look at lifecycle costs. This module addresses these global concerns by studying lifecycle considerations for a sustainable and profitable product development and manufacture. The latest environmental legislation will also be studied along with product development concepts and strategies that will enable industry to meet these increasingly severe competitive, environmental and legislative pressures. The associated practical, hands-on sessions maximize the usefulness of the skills acquired in real-life operational industry setting.

**UK and EU Environmental Law** (Professor Mark Poustie, Law School) - This class introduces students to the sources, principles and main features of the substantive laws of the UK and the EU relating to the environment, as well as key international law. It also introduces the various UK and EU regulatory agencies, their respective functions and powers, and methods of administrative regulation and enforcement.

**Waste Management and Landfill Design** (Dr Tara Beattie, Civil & Environmental Engineering /Environmental Health) - This class covers organizational and regulatory aspects of waste management practice in the UK: legislation, composition of domestic and industrial wastes, storage, collection, reception, and disposal of solid wastes, clinical wastes, sewage sludge disposal, recycling and recovery.
Environmental Chemistry  
Fundamentals of Environmental Forensics  
Geographical Information Systems (GIS)  
Housing Policy & Law  
Introduction to Health & Safety  
Public Health Studies  
Principles of Environmental Microbiology  
Strategic Construction Procurement  
Transport, Development and Sustainability  
Water and Environment Management

**Reading**

Each class (or module) will provide reading and you do not need to read before the course starts. However, if you are interested, relevant textbooks for the MSc as a whole are:


**Career Prospects for the MSc in Environmental Entrepreneurship**

The environment is the new entrepreneurial frontier. There is growing worldwide demand for technologies and products that address climate change, promote sustainability and improve environmental quality. This innovative MSc in Environmental Entrepreneurship, the first of its kind in Europe, has been designed to respond to the urgent need for a new generation of environmental entrepreneurs. The course aims to create:

- Environmental Entrepreneurs with the skills that will allow them to launch new ventures, products, and technologies that address society’s environmental and natural resource problems.
- Environmental Intrapreneurs who can develop ‘win-win’ strategies, which simultaneously protect the environment and save money, in any kind of organisation.

The course develops both environmental and entrepreneurship skills relevant to a wide range of employers, from large multi-national companies to small and medium enterprises, from government agencies to Non-Governmental Organisations (NGOs). Students graduating from this course can follow a very broad range of careers and all sorts of organizations, such as in manufacturing, food industry, tourism, engineering, retailing, business, energy and technology sectors, and in local or central government. Graduates may also follow a consultancy path or choose to start their own business.

For students wanting to start their own business, The Strathclyde Entrepreneurial Network (SEN) group - designed to support Strathclyde alumni with new business creation and business growth - gives practical help to graduates from this MSc in relation to innovative ideas in the area of environmental entrepreneurship. Check here for further information: [http://www.strath.ac.uk/sen/](http://www.strath.ac.uk/sen/)

This MSc meets the needs of graduate students from a science, engineering, technology or business background who want to contribute to environmental improvement, and want to learn how to identify and evaluate business opportunities. This MSc is not only for those graduates who see their future in small and medium sized enterprises but also traditional graduate employment in large companies who need employees who not only can think entrepreneurially, but can also make a positive contribution to environmental issues. The course also aims to develop management, consultancy, engineering and technology professionals who have reached a stage in their careers when they are seeking or achieving increasing responsibility, or would like to a refocus their career on environmental entrepreneurship.

The MSc in Environmental Entrepreneurship is about using the environment as a business opportunity and this course teaches how to identify, assess and shape environmental ideas and insights into real business opportunities. Addressing environmental problems requires ingenuity. Entrepreneurship places emphasis upon the range of skills and understanding needed in order to make something of value actually happen – whether this is establishing a new enterprise, transforming an existing business or ensuring someone achieves positions of leadership in a corporate setting. Environmental entrepreneurship can take place through new product design, new technologies, and new organizational arrangements.
The 1-year MSc course is offered to students from all disciplinary backgrounds and employment situations, and provides a unique educational career opportunity. No engineering or science background is expected. We have had students from the following backgrounds:

- Biotechnology, Genetics and Chemistry
- Business Studies and Business Management
- Civil Engineering
- Commerce
- Computer Studies
- Finance
- Geography
- Industrial Engineering
- Hispanic Studies and Languages
- Management Studies and Social Policy
- Marketing
- Mechanical Engineering
- Political Studies and Public Administration
- Sociology
- Urban Land Economics

For More Information about the MSc Environmental Entrepreneurship

Detailed class descriptions can be provided upon request. For more information please check www.strath.ac.uk/civeng/pg/ or contact the Department - E: civeng-pgt@strath.ac.uk

The Department of Civil and Environmental Engineering is highly interdisciplinary. Academic and research staff, from 13 different countries, originate from a range of different fields including civil engineering, environmental engineering, geology, microbiology, chemistry, mechanical engineering, geography, economics and maths. We have 36 members of academic (26) and research (10) staff, of whom 14 are women (39%).

Celebrating over 125 years of Civil Engineering at Strathclyde

The Department of Civil and Environmental Engineering is marking the 125 year birthday of the department in 2014. This coincides with the department move to brand new offices and facilities, including a £6M investment in state of the art integrated environmental and civil engineering labs.

http://www.strath.ac.uk/civeng/