GREENMA - INTENSIVE COURSE PROGRAMME

University	Università degli Studi di Genova
Programme level	Intensive course
Status	Joint International Programme
Name of the course	Energy Saving for Environmental Protection and Control
Field and classification code	
Qualification	
Web-site	
Faculty	Chemistry, Engineering, Architect, Economy, Education Sciences and Sociology
Address	Via Balbi 5, Genova, Italy
Course length	6 weeks
Start date	28 August 2013
Professional recognition	The following subjects have been consulted for the designing of the Course programme: Ticasss.c.r.l. Innovative Technologies for Environmental Control and Sustainable Development a composed of research authorities and large, medium and small companies. Training requirements questionnaire have been adopted to collect desiderata from the Russian's teaching staff
Teaching organization	9 modules, front lessons, individual work, scientific supervising

Aims of the programme:

Recent public policies and financial incentives have created current and future job opportunities in sustainability industries. International agreements on CO2 diminution and European directives on the expansion of renewable energy generation ensure that the recent rapid growth in renewable energy installations will continue. Skills shortages in this sector are already being identified and the expected growth will only exacerbate the situation. Within the rapidly expanding European renewable energy industry, an urgent demand exists for more post-graduate trained staff, specialised in renewable energy technology. Acquire the foundational knowledge identified by top professional organizations in green energy industries. The intensive course in Energy Saving for Environmental Protection and Control is a program that proposes a multi-disciplinary educational approach to train next-generation managers and professionals interested in leading the change towards a sustainable future. Intensive course aims to build up the capacity of higher education institutions in the partner countries and the EU, in particular for international cooperation and for a permanent modernisation process.

Intensive course's final aim is the harmonization of academic approaches to Energy Saving for environmental protection and control by means of analysis and best practices, aimed at developing the new Master study programmes.

Programme languages: English

Teaching methods:

Frontal lectures, Laboratory practical, Continuous assessment, Examinations

Considering the above the programme will develop the following competences (or generic skills):

Students attending the course are young teachers, scientists, assistants, PhD who are continuing their professional path in University, managers / researchers of company or authorities inserted in the frame of existing agreements / partnerships. They will be prepared for rewarding academic and professional careers in subject areas such as renewable energy, environmental protection, sustainable development, climate change policy. Course aims to give them an in-depth knowledge of energy and resource-savings fundamentals, natural resources management, complex approach to innovations, monitoring techniques and environmental control of emissions, and work environments, aimed at evaluating the real environmental conditions and at preserving the environmental heritage.

Programme structure

The Course in Green Energy Management is a program starting at the end of August and concluding at the end of September 2013.

The program size is 25 credits ECTS.

Programme Outcomes:

The Intensive course equips students with the know-how, skills and competencies to train graduates in the next Master course which will be planned and held at Russian Universities. The course offers a versatile training programme, flexible and adaptive to labour market requirements, encompassing main disciplines in the fields of Energy Saving for Environmental Protection and Control. It has been enriched with subjects signalled directly by Russian Project's partners through a questionnaire. Potential job opportunities of further masters are numerous and varied and encompass public companies, medium and small firms, start-up enterprises, agencies and governmental organizations and NGOs. The following professional outline can be designed: expert in renewable energy and energy management, environmental monitoring, also in the sphere of the safety-environment-quality functions, in firms and public bodies.

Modulo 1	
Title	Standardization of the skills of students coming from different backgrounds
Credits	2 ECTS
Module leader	Luca Antonio Tagliafico, full professor Applied Industrial Physics - ING-IND/10. Energetics and applied thermodynamics (MMe-EA) Environmental applied physics and Technical plants (MEd)
Study terms	
Aim of the module	This module introduces students to the field of thermodynamic Basic concepts of thermodynamics; irreversibility; Review of basic laws of thermodynamics and their consequences; Concept of Energy and Entropy; Energy for closed system; Entropy generation; entropy balance for closed system; behaviour of gases; Equations of state. Review of the basic laws of conduction; Review of convection and radiation heat transfer laws, Natural and forced convection; Heat transfer in turbulent flow
Lectures	16 hours
Laboratory works	
Individual work	34 hours

Learning outcomes:

Knowledge understanding:

To be able to state the First Law and to define heat, work, thermal efficiency and the difference between various forms of energy

To be able to identify and describe energy exchange processes (in terms of various forms of energy, heat and work) in aerospace systems.

To be able to explain at a level understandable how various heat engines work (e.g. a refrigerator, an IC engine, a jet engine).

To be able to explain at a level understandable the concepts of path dependence/independence and reversibility/irreversibility of various thermodynamic processes, to represent these in terms of changes in thermodynamic state, and to cite examples of how these would impact the performance of aerospace power and propulsion systems.

Practical skills:

To be able to apply ideal cycle analysis to simple heat engine cycles to estimate thermal efficiency and work as a function of pressures and temperatures at various points in the cycle.

Graduate or transferable skills:

To be able to apply the steady-flow energy equation or the First Law of Thermodynamics to a system of thermodynamic components (heaters, coolers, pumps, turbines, pistons, etc.) to estimate required balances of heat, work and energy flow.

Modulo 2	
Title	Mass and energy balances
Credits	3 ECTS
Module leader	Renzo Di Felice, Full Professor of Applied Chemical Kinetics at the University of Genova (Italy) since 1992. He obtained a Ph. D. and D. Sc. (Eng) from the University of London (U.K.) in 1988 and 1997 respectively, both in the field of Chemical Engineering. Visiting Associate Professor at the National University of Singapore (Singapore). He is a member of the American Institute of Chemical Engineers (U.S.A.), of the Institutions of Chemical Engineers (U.K.) and of the Italian Association of Chemical Engineering (AIDIC) for which he is nationally responsible of the Chemical Reaction Division
Study terms	
Aim of the module	This module introduces students to the problems involving material and energy balances. Batch and continuous reactive systems in the steady and unsteady states. Introduction to phase equilibrium for multicomponent systems. Examples drawn from a variety of chemical and biomolecular processes.
Lectures	24 hours
Laboratory works	
Individual work	51 hours

Learning outcomes:

Knowledge understanding

Basic engineering calculations: convert units quickly and accurately; define, calculate and estimate properties of process materials such as fluid density, concentrations, pressure, etc.

Physical chemistry: perform pressure-volume-temperature calculations for ideal and non-ideal gases; perform vapor-liquid equilibrium calculations for systems containing one condensable component and for ideal multicomponent solutions; calculate internal energy and enthalpy changes for process fluids undergoing specified changes in temperature, pressure, phase, and chemical compositions; incorporate such calculations into mass and energy balance problems.

Practical skills

Material and energy balance calculations: draw and label process flow sheets from verbal descriptions of processes; carry-out degree-of-freedom analyses; write and solve mass and energy balance equations for single unit and multiple unit processes with and without chemical reaction.

Graduate or transferable skills

Difference between transient and steady-state processes and make simple mass and energy balance calculations for transient processes; work effectively in teams and know your classmates; produce a written report on the design and analysis of a large scale process addressing a technical problem of national importance.

Modulo 3	
Title	Non-renewable energy sources: measures for energy saving in production processes
Credits	2 ECTS
Module leader	Pietro Zunino, Full Professor.
Study terms	
Aim of the module	This module cover the following topics: Global Primary Energy Reserves & Commercial Energy Production, World Primary Energy Demand, world's Available Non-Renewable Energy Sources, Relationship between Non-Renewable Energy Sources & Technology Development, Environmental Impact of Non Renewable Energy Sources, Greenhouse Gas Effect, Global Primary Energy Consumption, Energy Consumption & Economic Growth, Global Energy Intensity, Major Energy Source Exporting & Importing Countries – Coal, Oil and Natural Gas
Lectures	16 hours
Laboratory works	
Individual work	34 hours

Learning outcomes:

Knowledge understanding

Students learn about non-renewable energy sources, like fossil fuels, and brainstorm ways to conserve them. The discussion includes nuclear power and energy efficiency. Participants will learn techniques for integration of existing non-renewable resources, both on a large production scale and a smaller scale for use in commercial, public, and private structures.

The overview of the non-renewable energy sources

The Demand and supply scenario

Relationship of the non-renewable energy sources and economic development

The mix of renewable and non-renewable energy sources

Energy pricing

Practical skills

Understand the sources and types of energy used within the workplace, community facility and home

How to overcome the barriers to energy efficiency adaptation

Identify energy demand and supply efficiency opportunities in the workplace

Develop solutions to improve energy efficiency productivity

Graduate or transferable skills

Modulo 4	
Title	Renewable materials energy sources: measure for energy savings in production processes
Credits	4 ECTS
Module leader	Alberto Traverso, Assistant Professor of Energy Systems, Ph.D. in Fluid Turbo-machinery in 2004 from the University of Genoa, Italy. He teaches Dynamics and Control of Energy Systems and Advanced Energy Systems. He wrote almost 100 scientific publications and authored about 8 patents in the energy system and technology field.
Study terms	
Aim of the module	This module introduces the students to the field environmental impact of energy systems. The Life Cycle Analysis methodology will be presented and explained, as well as the carbon emission trading scheme already in place in Europe. Biomass energy will be presented as an example of carbon free technology with excellent life cycle analysis features.
Lectures	32 hours
Laboratory works	
Individual work	68 hours

Learning outcomes:

Knowledge understanding

Identify and list past and current incentives for using renewable energy, including tax credits, grants, cost savings, and more.

Identify the scientific methodologies to account for the environmental impact of energy systems, including carbon emissions.

Cite current applications within the energy industry.

Describe the technological components of biomass combustion and boilers.

Practical skills

This module will help students understanding the various energy efficiency opportunities available, as well as preparing to build the business case to drive initiatives across organisation with tangible business benefits.

Compare and contrast the scientific, technological, and business components of renewable and non-renewable energy sources. Enables participants to review, analyze, and evaluate opportunities in the rapidly expanding market for renewable energy. In addition to gaining a working knowledge of the scientific, technological, and business aspects of sources of sustainable energy

Graduate or transferable skills

Modulo 5

Title	Regulatory schemes
Credits	2 ECTS
Module leader	Francesco Munari, full professor Full Professor of International Law at the University of Genoa, where he teaches International Law and European Community Substantial Law. He is the author of articles, books and contributions inter alia in the fields of public and private international law, EC law, antitrust and regulated markets, transportation and maritime law, and environmental law. He also practices as counsellor and attorney-at-law in the field of business, commercial and corporate law. He graduated from the University of Genoa Law School and the University of Milan (D.R.).
Study terms	
Aim of the module	This module introduces students to the field of
Lectures	16 hours
Laboratory works	
Individual work	34 hours
Learning outcomes: Knowledge understanding Study international and European environmental regulations from the perspective of permitting and operational compliance. Students get an overview of the key program elements that environmental managers, regulators and consultants need to know. Discussions cover environmental permitting, industrial operations and compliance auditing, reporting obligations and clean-up responsibilities and other programs necessary for a complete understanding of the multimedia environmental regulatory framework. Practical skills Graduate or transferable skills	

Modulo 6	
Title	Renewable energy sources
Credits	3 ECTS
Module leader	Marco Fossa
Study terms	
Aim of the module	This module introduces students to energy storage and conversion with special emphasis on renewable sources. Fundamental energy conversion limits based on physics and existing material properties. Material resources analysis and Life Cycle Assessment of products and services
Lectures	24 hours
Laboratory works	
Individual work	51 hours
Learning outcomes: Knowledge understanding This module provides a solid foundation in the key energy technologies (wind, solar, bioenergy, hydropower).Students will learn the connection between energy use and sustainability, how current energy use is contributing to global climate change, the difference between renewable and non-renewable	

energy sources, how to identify and distinguish between different forms of renewable energy, and understand the advantages and disadvantages of different renewable energy sources. Practical skills Students acquire skills in the analysis of energy transformation and materials transformation processes using various resource accounting approaches. Explore Life Cycle Assessment (LCA), including advanced LCA methods. Examine resource accounting at multiple scales, including carbon, water, nitrogen, and ecosystem services. Graduate or transferable skills

Modulo 7	
Title	Fundamental issues for application of MEEP
Credits	3 ECTS
Module leader	Enrico Dassori, full professor
Study terms	
Aim of the module	This module introduces students to good design of all building types, relevant building science, detailing, measures of energy efficiency performance, rehabilitation and retrofits, design construction dynamics and post occupancy evaluation.
Lectures	24 hours
Laboratory works	
Individual work	51 hours
Learning outcomes: Knowledge understanding The module provides up-to-date knowledge and skills for those involved in the design, field review and construction of residential, public and commercial buildings. The program is of interest to not only architects and engineers, but also building officials, intern architects, engineers-in-training, technologists, and others Practical skills Definitions and categories of MEEP are analysed and their applications/uses is explained. Criteria for assessment of MEEPs and issues related to indices derived from MEEP Graduate or transferable skills	

Modulo 8	
Title	Case histories, in the following fields: Green building, green house
Credits	3 ECTS
Module leader	Massimo Capobianco, Full Professor.
Study terms	
Aim of the module	This module introduces students to the field of Control and reduction of CO2 emissions in the civil sector: the Sustainable Energy Action Plan (SEAP)
Lectures	24 hours
Laboratory works	
Individual work	51 hours
Learning outcomes: Knowledge understanding CO2 emissions in urban areas. Control and reduction of CO2 emissions in the civil sector. Fields of action: Buildings, Transports, Industrial sector, Renewable energies, District Heating and Cooling, Green procurement, Urban planning. Covenant of Mayors. Goals of the Covenant of Mayors and relative commitments. Baseline Emission Inventory. Evaluation of the BEI. The BEI for the city of Genoa What is the Sustainable Energy Action Plan (SEAP). SEAP- short term and long term actions The SEAP for the city of Genoa: Building and lighting, Transportation, Local Electricity Production, District Heating and Cooling, Combined Heat Production, Urban planning, Actions on districts, Public procurement, Participation and Sensitization. Practical skills Management of the SEAP. EU tools for the SEAP management Indicators of efficiency and effectiveness. Assessment of intermediate results Dynamic updating of the SEAP SEAP in relation with EU energy policy towards 2020. Beyond the Covenant of Mayors: new perspectives in EU energy policy. Graduate or transferable skills	

Modulo 9	
Title	Energy economics and Didactic Methodologies and techniques
Credits	3 ECTS
Module leader	Angelo Gasparre, PhD, is a Researcher at the Department of Economics and Business Studies of the University of Genoa, Italy where he teaches Business Management and Organization Theory. He has been a Visiting Research Scholar at the College of Business, Department of Economics and Finance of the University of Wyoming, USA and at the Environmental Finance Center, Center for Environmental Policy and Management of the University of Louisville, USA).
Study terms	
Aim of the module	This module introduces students to the field of economics implications: fundamentals of energy market (power, natural gas and CO2), corporate

	social responsibility, green supply-chain, thermo-economics, green marketing and sustainable consumption. This module introduces students to the field of teaching and didactic methodologies. Module's aim at supplying theoretical-methodological knowledge and operational skills in the training sector. The module also aims to give adequate acquisition of the most recent methods of teaching will be shown to the teaching staff.
Lectures	28 hours
Laboratory works	
Individual work	51 hours

Learning outcomes:

Knowledge understanding

Examine the paradigm of sustainability in the context of environmental, economic and social forces that shape emerging policies and management decisions.

Investigate the possibility of creating a common set of sustainability principles.

Understand how these principles affect diverse global demographic groups and create challenges for local and regional managers.

Learn basic information, concepts, methods and tools for assessing, implementing and managing sustainability initiatives to build a foundation for a sustainable future

Get the fundamentals of economics applied to the thermodynamic field (thermo-economics), and the basics for investment analysis in energy systems.

To understand the fundamentals dynamics of energy markets. Particularly, electricity market is introduced and some insights are given about natural gas and CO2 markets, highlighting the respective influences that they have. Introduction of the "merit order" concept and of the "short run marginal cost" logic.

exchange the experiences in the field of developing new didactic methods for teaching adults as well as new didactic methods for experimental fields of education between the academic environment, training staff

To know and to use the more appropriate didactic methods;

To know and to use different methods to promote: acceptance, contact and dialogue, valorization of differences, comparison, interaction and effective management of conflicts.

To analyze critically didactical proposals and projects aimed at promoting intercultural education.

To elaborate effective educational projects to promote intercultural education.

Practical skills

To be able to understand which energy price is to be expected according to the changes occurring to the energy sector. Encourage the scientific and teaching staff to make use of new techniques and tools during the educational work with students, because they may significantly increase the efficiency of the classes. We also encourage the staff to create and use its own innovative teaching curricula. We will show, how the aspects of "training method" can be applied to the didactics in higher education, adapting them effectively to the academic ground

Graduate or transferable skills

N.B. 30 hours of lectures will be held by foreign professors, coming from GreenMA project's partners. Some modules will be appointed to teachers of City University of London and Universidad de Alicante; these teachers will carry out specific teaching mobility of one week to Genoa and to Gliwice, during which at least 16 hours per mobility will be carried out.

The hours of internships individual works and final thesis, will be carried out in Russia.