# E-learning: Sustainability, environment and renewable energy, a multinational training pilot module at the postgraduate level

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# E-learning: Sustainability, environment and renewable energy, a multinational training pilot module at the postgraduate level

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## ABSTRACT

A Pilot Module will be implemented by 4 JELARE project's partners: Bolivia, Brazil, Guatemala and Latvia. A research was made by them in their own countries where a scarcity of multidisciplinary programs was detected at the Postgraduate level. The common characteristic was the need to modernize the curriculum by introducing a more diverse perspective. The student profile at the end should aim to provide skills to the private as well as the public, non-governmental and academic sectors. The pensum will consist of 13 courses inferred from an analysis of the competencies needed, along three modules: Sustainability, Environment and Renewable Energy (with courses such as Sociology of Development and Global Challenges, Environment and Sustainable Development, Energy Matrix Planning, Energy Economics, Policies and Regulations on Energy and Environment and courses mainly devoted to renewable energy and their management). The Postgraduate Program is to be implemented in 4 trimesters. On-line modalities will be introduced where self-study, cooperation and tutorial guidelines will be highlighted. The scheme will open activities by July 1st 2011; the institutional framework for implementation is being worked out among all interested partners at present.



**Index Terms:** Pilot Module, JELARE, Sustainability, Environment, Renewable Energy, curriculum modernization, multidisciplinary, student profile, competencies.

## BACKGROUND

In the international context, there has been a boost in the relevance of environmental and energy topics in academia, business as well as international governance. The rising awareness of the consequences of climate change, the green energy revolution or the increasing scarcity of water – the interrelation between economic growth and the environment and the challenge to reach a sustainable development that allows industrialized nations to follow their growth path and developing nations to reduce poverty and catch-up with the developed world have gained priority in the political agendas of most countries of the world community and have contributed to the creation of a booming technology market

Within the JELARE project, surveys were made on renewable energy and the labor market among universities as well as in firms belonging to the Public and Private Sectors. The conclusions suggested the need to generate teaching and learning pilot modules to strengthen and deepen the academic programs of the partner universities. One of the decisions that reached a complete consensus was the implementation of an Integral Postgraduate Degree on Renewable Energies (RE), in an e-learning modality.

All of the partner countries involved in this Pilot Module 1, as it is called, namely, Bolivia, Brazil, Guatemala and Latvia, are endowed with abundant natural resources and biodiversity, especially renewable energy sources. For this reason, it is necessary to strengthen these sectors with specialized human resources. However, there has been a deficit detected in the areas of energy and environment in all of the mentioned countries. If this gap between renewable energy and environment can be closed, it will allow developing capacities within the private sector and will entail strengthening research activities in higher education institutions as well as in governmental entities and international cooperation agencies. These countries lack consolidated educational programs within this field at a postgraduate level. There is also an information gap due to the lack of high education institutions exclusively dedicated to research, and of programs with abilities to produce the required knowledge for the definition of public policies, development strategies, technological adaptations and innovations within this field.

In general, many efforts related to the environment appear in local media, as confrontations between communities and hydro power plant projects. Frequently, these investments are marked as environment pollutants without deeply analyzing their character as alternative or "clean energies", which are a response to the use of fossil fuels. On the other hand, after examining the course requirements of the study programs that involve environmental, sustainability, climate change and renewable energy topics among others in different universities, it can be seen that there is a need to generate multidisciplinary contents to overcome the gaps between what is purely environmental and what is strictly mentioned as the electric or energy sector. In general, RE tend to concentrate in engineering programs and frequently they do not relate with environmental studies or other disciplines of human sciences or information technologies.

These observations may be extended to general multidisciplinary knowledge such as demographics, economics in addition to social, political and cultural sciences as they relate to development processes which tend to influence the energy mix. Also, the influence of public policies and the role of the public sector as coordinator between the private, public and civil society activities in the promotion of alternative energies, tend to be forgotten.

The Joint Postgraduate Program called "Sustainability, Environment and Renewable Energy", which will be conducted in cooperation among mentioned partner countries of the JELARE Project, may contribute to the formation of qualified human resources in an area which is relevant for socio-economic development, ranging from the dependence reduction of imported liquid fossil fuels to the fostering of rural development, the creation of local jobs and the diversification of the economy. The Programme will also build human resources capacities with the ability to generate knowledge and information at the academic level which eventually will improve political decision processes as well as technological adaptations and innovations.

As the Postgraduate program is executed successfully in its first version, there is a possibility to extend it to a two-year Masters Degree program that might combine specific competencies within disciplines such

as economics, business administration, sociology, law and engineering with the inclusion of the environmental topic as a transversal concern of all modules. These educational efforts are designed in line with the model of education aimed at the development of competencies, i.e. skills that go beyond the acquisition of subject-related knowledge. The required competencies can be divided into three main areas: Projects/Economics, Technology/Engineering and Environment/Sustainable Development. It is this multidisciplinary approach, the one that will enable the graduates to meet the challenges of the public sector as well as the demand of NGOs, the international cooperation and private businesses.

**A) What does the professional graduated from the Postgraduate Degree in Sustainability, Environment and Renewable Energy may be asked to perform?**

The observations aim to highlight the following dimensions asked by the market:

**Research.**

The graduated professional should have acquired capacities in research and analysis.

**Diagnostics in the area of energy generation.**

Therefore, the postgraduate degree should have as its objective the formation of professionals specialized in resource evaluation, design, technical and economic viability analysis, optimization and management of Renewable Energy technologies.

**Environmental Impact Evaluation.**

The graduates should understand and have knowledge of how to apply the fundamentals of Environmental Impact Evaluation, the general concepts that rule this matter, and the management of its main tools.

**Preparation and evaluation of Public Policies.**

The professional should know the main concepts regarding Public Policies, the relation with the legal system of the host countries and the global covenants regarding environmental protection. Furthermore, he should be aware of the fiscal and legal instruments and any other norm applied in the partner countries and elsewhere.

**Preparation of strategic plans in the area of renewable energy.**

This is an ability to generate strategic plans that should encompass the integral aspects of the renewable energy subject, where socioeconomic, environmental, legal and other disciplines are more than necessary elements for an adequate planning that contains elements such as energy planning, energy economics, environment, etc., aiming to achieve a desirable energy matrix within a determined period of time.

**Project management, including renewable energy firms.**

Such scheme should provide professionals interested in the postgraduate degree with the managerial tools that will allow for the administration, planning, organization and management of projects and firms in the preparatory phase, pre-investment and investment process. The graduates should be capable of conducting programs, projects, plans, etc. in the energy sector in an integral manner.

**Updates regarding new technologies.**

Any professional should have information regarding new technologies that are being continually developed within the sector of energy utilization of natural resources, including those that involve information technologies that give access to this knowledge.

## CHARACTERISTICS AND PROFILE

This section will examine the added value of the degree, the general and specific objectives, the professional profile and the requirements needed to access the degree as well as the procedures for enrolling in the career.

### A) Added Value of the Degree

This degree pretends to be an exchange of experiences in the field of E-learning between the universities: UNISUL in Brazil; the Bolivian Catholic University; Galileo University of Guatemala; and Rezekne University of Latvia which are part of the consortium of universities of the Joint European-Latin American Universities Renewable Energy Project, JELAR. They are mostly financed by the European Union within the Alfa III Program. Such exchanges, based on the experiences and developed technology of these higher education institutions, may strengthen the online

teaching already being practiced in many of these universities and extend this expertise to those that do not have this technology.

Likewise, an educational component will be generated that will provide knowledge to the people interested in it in E-learning modality. Participants will be exposed to the curriculum of a Postgraduate Degree in "Sustainability, Environment and Renewable Energy" which can be eventually extended afterwards, to a Masters program. On the other hand there will be an analysis of the factors that influence the supply and demand of energy within industrial societies and developing countries which are eager to produce and consume energy that respect a sound environment. The integral and interdisciplinary characteristics of the Postgraduate degree may allow professionals to obtain a wider knowledge which will enable them the transit throughout several positions in various fields of work. This characteristic makes the described degree additionally attractive.

**B) General Objective**

The general objective of the E-learning Pilot Module entitled "Postgraduate Degree in Sustainability, Environment and Renewable Energy" is to increase the capabilities of the partner universities in virtual education and to implement a postgraduate multidisciplinary study program related to environment and renewable energies in these universities and in other entities and individuals which eventually might become partners.

**C) Specific Objectives**

1) Develop a postgraduate program within the field of sustainable development, environment and renewable energy.

2) Develop virtual educational material of high quality related to these topics.

3) Implement this postgraduate program in "Sustainability, Environment and Renewable Energy" jointly in an E-learning modality among the Bolivian Catholic University, the Universidade do Sul de Santa Catarina of Brazil, the Galileo University of Guatemala and the Rezekne University of Latvia.

4) Conduct an evaluation of the first version of the postgraduate program in order to improve it, assure its sustainability and eventually extend it to a Masters Degree program.

**D) Expected Products**

At the end of the proposal implementation, the following products are expected:

1. A joint study program consisting of an international postgraduate degree in "Sustainability, Environment and Renewable Energy", implemented by Universidade do Sul de Santa Catarina in Brazil, the Bolivian Catholic University and the Galileo University of Guatemala with some support of the Rezekne University.

2. 13 online study courses developed.

3. At least 30 graduates at a Postgraduate level, 10 for each of the participating universities.

**E) Professional Profile and Requirements to enroll**

The professional graduated in the Postgraduate degree in "Sustainability, Environment and Renewable Energy" will be capable of developing projects that care for and promote renewable energy sources and the environment in an integral manner. He will also be capable of generating policies that could contribute to the protection of natural resources. These capabilities will be assets that will enable him to perform as a consultant for agencies related to the environment, natural resources, renewable energies, climate change, etc. In this sense, the following characteristics are required from the students, to truly take advantage of the program:

- Understand the need for a rational and efficient use of all types of energy, fossil or renewable, in order to achieve a more sustainable human development.

- Awareness of the current and future situation of the energy market in a regional and international context as well as the consequences of the limits, conflicts and impacts of fossil energy over the environment and sustainable development.

- Establish a clear perspective of the possibilities and economic viability of renewable energies, relating the set of acquired multidisciplinary knowledge (social, instrumental and technological) to the environment and sustainable development.
- Detect environmental threats at the national and global levels.
- Have the basic knowledge to develop a professional activity within the field of installation, operation, management and maintenance of renewable energy systems, with a basic formation regarding the different technologies of these systems.
- Know the normative and regulatory frameworks of renewable energies and environment.
- Be aware of the criteria of energy savings and efficiency to be able to face, during the exercise of his/her professional duties, the improvement of the already existent energy installations based in the use of fossil fuels.
- Know the needed sources of information to realize a permanent and continuous updated knowledge as well as specific tools for this information search. The objective is to create capabilities for professionals who are in a condition of finding the best responses to the problems they face, adapted to their own reality.
- Openness to integrate energy efficiency, renewable energies and energy management, from the perspective of the sustainability and environmental approach in an integral way that is capable of incorporating other fields of knowledge.

The aforementioned criteria will be the topic of a personalized interview with each student and will serve as a guide to identify the student's potential and his/her capability to develop the competencies he wishes to learn.

**F) Requirements for enrollment (regarding the enrollment procedures)**

1. Graduation at a bachelor's or licenciatura's level in related areas.
2. Knowledge and experience in the study areas.

3. Be willing to learn about the needed tools for E-learning through a personalized interview.

4. Showing interest in the E-learning modality.

## GENERATION OF THE CURRICULUM BASED ON THE REQUIRED COMPETENCE

The required competencies to enroll in the Postgraduate Degree of "Sustainability, Environment and Renewable Energy" have been taken from a study conducted by many countries belonging to the European Union. Afterwards, this study was extended to Latin American countries to tune up the competencies and homologate them[1]. The concept of competence outlined for Europe and afterwards applied to Latin America, is the following:

> "Competencies represent a dynamic combination of knowledge, comprehension, capabilities and abilities. To foster them is the purpose of educational programs. Competencies are formed in several course units and are evaluated at different stages. They can be divided according to the area of knowledge (specific of a field of study) and generic (common for different courses)."[2]

A test identifying competencies was undertaken by multiple careers in this extend study that included the majority of the universities of Latin America. The following ones have been selected for the postgraduate degree, considering only those that were closer to our goals:

### A) Generic Competencies

1. Capacity for abstraction, analysis and synthesis.
2. Social responsibility and commitment to citizenship.
3. Ability to use of information and communication technologies.

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[1] See Pablo Beneitone (Argentina), César Esqueitoni (Ecuador), Julia González (Spain), Maida Marty Maletá (Cuba), Gabriela Sufi (Argentina) y Robert Wagenaar (The Netherlands), Eds., Reflections and perspectives of Higher Education in Latin-America, Final report Tuning-América Latina, 2004-2007 (Spain: Universidad de Deusto-Universidad de Groeningen, Project financed by the Program Alfa of the European Commission, 2007. This research reached (182) universities of almost all of Latin-America. Its objective as stated by its text: "is to identify shared competencies, that can be generated at any title and that are considered important for certain social groups." (page. 15). Available in: http://tuning.unideusto.org/tuningal/index.php?option=content&task=view&id=217&Itemid=246

[2] Tuning Report, p. 37

4. Commitment to look after the environment.

5. Commitment to socio-cultural environment.

**B) Specific Competencies.**

6. Improve and innovate administrative processes using information and communication technologies for the process which allow for its formulation and optimization.

7. Awareness about the responsibilities regarding the environment and the values of urban and architectural heritage as well as the capability of knowing and applying research methods to resolve creatively the demands of the human habitat, in different scales and complexities.

8. Ethical commitment regarding the discipline, manifesting a social consciousness of solidarity and justice, and respect for the environment.

9. Provide advice regarding the use of natural resources in the formulation of development policies, norms, plans and programs, interacting in interdisciplinary and Trans-disciplinary areas.

10. Development of the professional activity within a framework of responsibility, legality, security and sustainability, when planning, executing, managing and supervising projects and services focused in the knowledge, use and exploitation of renewable natural resources.

11. Suggest solutions that could contribute to sustainable development, planning, research design and execution on the topic underlined.

In Appendix 2, there is a list of 11 characteristics that resume the concept of competence. They served the purpose of selecting the courses to be offered. The concept of competence will be continuously used to ensure the excellence of the program while the initial selected matrix of course might be improved over time. They will also serve as guidelines for evaluating the implementation of the postgraduate degree as a whole in order to define later, in the year 2011, if the pilot module might be extended to a Masters program for the second year. Appendix 2 shows an elaboration of how the selected courses adjust to the competence concept.

The courses which finally are part of the Postgraduate Degree had a prior elaboration in each university with regard to the extent that these

competencies had an incidence over the chosen courses. It was also considered the installed capacity of each institution for delivering this learning offer. The next step was a meeting of all participating universities to choose those courses from the total sample which finally would constitute part of the online Postgraduate Degree. For this purpose a meeting was held in Florianópolis, Brazil. The result of this meeting mainly consisted in a definition of program's objectives, the selection of the courses, a division of labor among universities and a schedule of activities which should culminate on July 1st of 2011, the date of the Postgraduate Degree's Program launch.

## DESCRIPTION OF THE CURRICULUM

After the selection of the courses that are part of the degree, a description of each of them is warranted:

### A. Sociology of Development and Global Challenges

This course anticipates that the student has had or will be open to an Introduction to Sociology or elements of General Sociology. The content will rescue the perception of change in the classic authors from Comte, Spencer and Marx to Weber. It will venture in more recent theories of middle range that emerged during the sixties with Lerner, Hagen, McLelland and others. It will examine the reflections of the Club of Rome and the Dependency Theories, characteristic of the 70s and 80s. Afterwards it will explain the theories of the global system and finish with the post-modernists and considerations regarding sustainable development which are discussed since the 1990s and nowadays. These lessons will establish linkages with the topics of renewable energies.

Global challenges will be illustrated with continuous references to the development patterns predominant in the least favored countries. Particularly, the emergence of Asian countries in that context will be object of analysis and will be compared with Latin American countries. The role of foreign aid, commerce, foreign direct investment and their impact in social structures and political developments will be focalized. Within this framework the dimensions of demography, gender and environment and recent challenges will be integrated. Afterwards, the main theoretical and conceptual problems with regard to the sustainable development paradigm

will be highlighted and their interrelation with renewable energy will be made evident.

**B. Environment and Sustainable Development**

Introduction to the Environment: The concept of environment, the systems of planet Earth, ecosystems, historic evolution of environmental concerns, global environmental, the relations between human beings and the environment. Introduction to Sustainable Development: The concept of sustainable development, the history of sustainable development from Rio de Janeiro to Cochabamba, Agenda 21, the Kyoto Protocol, environmental indicators, sustainable development in developed countries and developing countries. Sustainable development, natural resources and the environment: Poverty and environmental degradation, international trade, growth and environment, loss of biodiversity, climate change, mitigation and adaptation, the role of natural resources. Sustainable development and renewable energies: The effect of energy consumption and environmental problems, renewable energies and sustainable development, future perspectives of sustainable development.

**C. Planning of the Energy Matrix**

Introduction to Energy Policy. Knowing the bases for the development of policies that reinforce the sustainability of the energy sector. Elements for the design of an Energy Policy. Analysis of Energy and Integration Policies. Energy Planning, Integrated Plans for Resources. Investment Planning. Energy sustainability with emphasis on energy efficiency policies, the obstacles for the efficient use of energy. Energy Planning Tool. Introduction to the tools used for Energy Planning. Comparative analysis of Energy Planning Models, case studies. Selection of Energy Planning tools. Use of Programming Models and detailed operation of LEAP (Long-range Energy Alternatives Planning System) whose main objective consists in bringing integrated and reliable support for the development of integrated energy planning studies.

**D. Environmental Management and Impact Evaluation**

Environmental Management. The distribution of competencies within legislation, planning and management of the Environment at a national and

international scale. Basic knowledge regarding environmental legislation. Characteristics and principles. Management instruments. Environmental management in the company. Environmental responsibility. Administrative, civil and legal solutions. Access to environmental information. Current legal framework for the Environment. ISO norms. Design of an Environmental Management System. The Environmental Audit as an instrument for the company's Environmental management. Ecological marketing as an instrument of Environmental Management. Competence and awareness raising. Communication. Operational control. Preparation and emergency control. Verification. Follow-up and measurement. Evaluation of the legal compliance. No conformity. Corrective and preventive actions. Internal Audit. Revision by the Direction. Ecological Differences of Processes and Products.

With regard to Impact Evaluation. Conceptual, legal and institutional framework. Introduction to Environmental Impact Studies. Technical Document of Project Analysis.. Identification, and evaluation on Environmental Impacts. Preliminary environmental impact study. Partial environmental impact study. Baseline study or socio-environmental diagnostics. Strategic Environmental Evaluation. Preventive and corrective measures. Surveillance plan and Environmental Control. Management procedures of the Environmental Impact studies.

**E. Policies and Regulations for Energy and the Environment**

Principles of Energy Policy: Analysis of the different principles and criteria of energy policy, environmental objectives within energy policy, scenario analysis and energy policies. Energy intensity: Analysis of energy intensity by sectors that demand it. Regulation of tariffs and prices within energy markets. Bases of regulation, roles of regulatory organisms, structural analysis of tariffs and prices. Principles of Environmental Policy: Analysis of the different principles and criteria of environmental policy, scenario analysis of environmental policies. Instruments of environmental policy: Moral persuasion, environmental norms, economic instruments (taxes, subsidies, emission trading).

## F. Energy and environmental economics

Introduction to Energy Economics: General aspects of energy, types of energies, energy units. Energy Trade and Environmental Services: Conventional and renewable energy commercialization methods, forms of concentration and fixation of prices in different conventional and renewable energy markets, carbon markets and of environmental services. Analysis of energy supply and demand: Technical structure of conventional and renewable energy sectors, their economic structure, peculiarities and environmental incidence. Sectors with intensive energy demands, energy costs in accordance to products and processes, environmental incidence of energy demand. Introduction to Environmental Economics: Externalities, public goods, the Coase Theorem, optimum level of pollution. Economic Valuation of Environmental Quality: The value of the environment, environmental valuation methods. Economic Development and Environmental Quality: Economic growth models that incorporate energy and environmental restrictions, the energy-environment relationship.

## G. Solar Energy

Fundamentals of solar energy. Role of solar energy within the international energy mix. Energy savings and efficiency. Description of the sources of thermal and photovoltaic solar energy and design of the installations, their maintenance and operation. Advantages and disadvantages. Environmental, social and economic impact of the technologies. Solar thermal energy. Solar collection system. The storage and accumulation sub-system. Performance. Description and design of solar thermal installations. Evaluation of the environmental impact of solar thermal energy. Perspectives and development of the legislation regarding solar thermal energy. Photovoltaic Energy. Applications of Photovoltaic Energy. Fundamentals of photovoltaic energy. Components of photovoltaic installation. Design and calculation of installations. Exploitation and maintenance of an installation. Environmental impact of photovoltaic energy.

## H. Hydro power

Role of hydro power within the international energy mix. Energy savings and efficiency. Description and design of installations, maintenance and operation. Advantages and disadvantages. Environmental, Social and Economic impact. The role of Hydroelectric Energy. Electro-mechanic systems. Environmental impact. Legal and Normative aspects. Criteria for the development of hydro power projects. Tools for preparing projects of hydro power stations. Feasibility study sample.

**I. Biomass Energy**

Role of biomass in the international energy mix. Energy savings and efficiency. Description of the different sources of biomass and the design, maintenance and operation of their installations. Advantages and disadvantages. Environmental, social and economic impact of each of them. Biomass classification. Biomass sources. Physical and chemical characteristics which define a fuel. Processes of conversion of biomass into energy. Energy applications of biomass. Advantages and disadvantages of the use of biomass. Legislation, incentives and fiscal measures.

**J. Wind Energy**

Role of wind energy within renewable energies in the international energy mix. Energy savings and efficiency. Description of the different sources of renewable energies and the design, maintenance and exploitation of their installations. Advantages and disadvantages. Environmental, social and economic impact of each of them. Historical evaluation of the use of wind. Meteorological bases for wind energy. Use of wind. The wind potential. Wind generator: composition and function. The wind park. Off-grid wind power installations. Offshore wind energy. Wind energy and the environment. Phases of the development and management of a wind energy project. Legislation.

**K. Energy Efficiency**

Basic definitions: Energy sources: Primary/secondary. Renewable/non-renewable, Energy systems: Primary energy, Production and converting of sources in energy carriers, Transport and distribution of energy carriers, net energy. Final use of the energy. Useful energy, supplied service, received benefit. Flow of energy: Unit operation, Global Energy

Performance. Energy efficiency: General bases and measurements of EE: Good operational practices; Closed circuit of recycling; Substitution of energies; Modification and optimization of processes; Product reformulation; Technological Improvement/substitution; The Energy Diagnostic: Unitary operations; Process flows; Focus on diagnostic; Balance of energy; Thermal energy; Electric energy; Identification of losses/inefficiencies; Consumptions, emissions and specific costs; Critical unitary operations; Energy efficiency measures; Technical – economic evaluation; Efficiency of the productive processes. Application examples: Considerations of EE within the energy mix; EE in a system of electricity distribution; Measures of EE in productive systems.

**L. Renewable Energy Project Management**

The students will be prepared as managers of renewable energy projects and firms, developing capabilities of conceptualizing and managing this type of projects within the current economic scenario. Economical and legal aspects which allow for the development of own business initiatives within the sector. Organization, planning and coordination of projects of diverse complexity through an ample study of experiences, techniques, tools and methodologies related to Project Management. Viability and design. Business opportunities, profitability and opportunities for financing. Legal procedures, permits and operations. Analysis of suppliers and products. Management tools: Integrated management of Projects. Project planning management. Project cost management. Product quality management and energy efficiency. Project resource management. Project human resource management. Project communications management. Project risk management. Project acquisitions management. Analysis for the reduction of emissions.

## MODULES BY COURSES

The above described courses pertain to three areas susceptible of becoming modules. Table 1 shows this relationship that helped to give the title to the Postgraduate.

**Table 1. Postgraduate Modules**

| SUSTAINABILITY | ENVIRONMENT | RENEWABLE ENERGIES |
|---|---|---|
| 1 Sociology of Development and Global Challenges | 4 Environmental Management and Impact Evaluation. | 7 Solar Energy |
| 2 Environment and Sustainable Development | 5 Policies and Regulations for Energy and the Environment. | 8 Hydro power |
| 3 Planning of the Energy Mix. | 6 Energy and Environmental Economics. | 9 Biomass |
| | | 10 Wind Energy |
| | | 11 Energy Efficiency and Renewable Energy |
| | | 12 Renewable Energy Project Management |
| 13 Research Methodology | | |

Table 2 shows the distribution of courses by trimesters.

**Table 2. Distribution of Courses by Module and Trimesters**

| Modules and courses | Trimesters | | | | |
|---|---|---|---|---|---|
| | 1st. | 2nd. | 3rd. | 4th. | Total Courses |
| SUSTAINABILITY | Sociology of Development and Global Challenges | | | Planning of the Energy Mix | 2 |
| | Environment and Sustainable Development | | | | 1 |
| ENVIRONMENT | | Environmental Management and Impact Evaluation | Policies and Regulations for Energy and the Environment | | 3 |
| | | Energy and Environmental Economics | | | |
| RENEWABLE ENERGY | Biomass | Solar Energy | Hydro Power | Wind Energy | 4 |
| | | | Energy Efficiency and Renewable Energy | Renewable Energy Project Management | 2 |
| COMMON AREA | | Research Methodology | *Preparation of the final thesis* | *Preparation of the final thesis* | 1 |
| Total | 3 | 4 | 3 | 3 | 13 |

## INSTITUTIONAL FRAMEWORK

The Postgraduate degree is a joint effort and as such the work is shared. The following courses will be prepared by the partner universities in accordance to Chart 3 in the corresponding countries (the numeration corresponds to the course description stated above).

**Table 3. Responsibilities of the courses per Participating Partner**

| | | |
|---|---|---|
| Bolivia | 2) + 5) + 6) | 3) + 11) will be shared between Guatemala and Bolivia. See note) |
| Guatemala | 1) + 4) + 12) | |
| Brazil | 7) + 8) + 10) + 13) | |
| Latvia | 9) | |

**Note:** Courses 3 and 11 will have a shared responsibility with the main responsibility of 3 falling on Guatemala with the support of Bolivia and of 11 in Bolivia with the support of Guatemala.

## PERIODS AND ACADEMIC CREDITS

**Duration:** 1 year divided in 4 trimesters of ten weeks each.

**Frequency:**

**Hours per week:**

**Distribution of Academic Credits:**

The Academic Credit is a measurement of the students' working hours to achieve learning goals and allows comparing and approving the studies conducted in several institutions. It is also an efficient instrument for the achievement of curricular flexibility and the planning of the. The credits as well as the assigned hours are detailed in Chart 4.

**Table 4. Calendar per Trimester and Academic Credits**

| Trimesters | Course | Academic Hours | Credits |
|---|---|---|---|
| I - Trimester Jul – Aug-Sept | Sociology of Development and Global Challenges | 30 | 2 |
| | Environment and Sustainable Development | 30 | 2 |
| | Biomass | 30 | 2 |
| II - Trimester Oct – Nov - Dec | Environmental Management and Impact Evaluation | 30 | 2 |
| | Energy and | 30 | 2 |

| | | | |
|---|---|---|---|
| | Environmental Economics | | |
| | Solar Energy | 30 | 2 |
| | Research Methods | 30 | 2 |
| III - Trimester Jan-Feb-Mar | Policies and Regulations for Energy and the Environment | 30 | 2 |
| | Hydro power | 30 | 2 |
| | Energy Efficiency and Renewable Energy | 30 | 2 |
| IV - Trimester Ap-May-Jn | Planning of the Energy Mix | 30 | 2 |
| | Wind Energy | 30 | 2 |
| | Renewable Energy Project Management | 30 | 2 |
| | Thesis at the end of the prior courses | 0 | 0 |
| TOTAL | | 390 | 26 |

**Note:** For lectures, reports and other curricular activities an average of four additional hours is estimated in each course which will demand in a uniform manner for all of the countries an effort of 442 hours of teaching and personal study.

## ACADEMIC METHODOLOGY

### A) Research

This component will be present in the application of the online methodology, expecting that once the curriculum is finished, the student culminates his/her effort with a paper in the area of his/her interest. Likewise, all of the professors will put emphasis on the applications of research methodologies, which constitute by themselves important contents of the curriculum.

### B) Participation: essential characteristic of the Program

The expert or specialist who works as a professor of the course is mainly a facilitator of the self-study and research activity of the students; the main feature of this profile is not the face-to-face presentation. Nevertheless, the online modality must also allow for the interaction between students and professors as well as among students.

### C) The balance between theory and practice

The direction of the degree will foresee that the formation and activity keep a balance between theory and practice. Managerial aspects, practical

knowledge, and systematic actions in real life situations will be part of the courses.

**D) Evaluation**

In consonance with the dynamic, participative and balanced character that the program wishes to establish, the evaluation exercise will emphasize academic excellence, comprehension, efficiency, feasibility and viability.

## E-LEARNING METHODOLOGY

The aforementioned principles must be seen in light of the e-learning modality that will be applied.

**A) Learning Modality**

The Postgraduate Degree will be offered completely in the e-learning modality due to two primary motivations:

1. Being able to have a group of excellent experts with multidisciplinary approaches focused on a very specialized topic, as is renewable energy, will encourage the construction of different scenarios.

2. Allowing a wider application, taking into account that, with the e-Learning modality, several countries of the world can be reached, allowing for the interaction among different people and cultures.

The courses within the e-learning modality are educational concepts that integrate technological, didactic and administrative support to extend and transfer the contents of any subject of knowledge. These types of courses are based in the application of new Information and Communication Technologies (TICs) which allow for learning without limitations regarding place, time, occupation or age of the students.

**B) Principles of the modality.**

- Self-study: The courses materials as well as great part of the practical activities are designed in a way so as the student can advance at its own pace and assess his/her progress at any time.

- Team work: The student will not learn in an isolated manner, part of the knowledge will be constructed by the group, thanks to its interaction with the rest of the course members.

- Tutorial Support: The tutor will guide the group in the learning process, conducting an individual follow-up of their participation, efforts and results during the course.

**C) Characteristics of the model.**

- The students' participation is not passive- they turn to be the protagonists of the teaching-learning process.
- It is important how the students learn and not how the teachers teach.
- The tutor plays a guiding role.
- It is not fit for all educational levels because it requires much discipline, great maturity and engagement in depth.
- The learning must guide the student towards reality.
- More responsibility from the student in the learning process.
- Flexibility in time management. Nevertheless, this does not imply an absence of deadlines for learning activities.

**D) Structure, Characteristics and Resources.**

All courses have been developed by professionals in the subject. Each of the syllabus is adapted to practice in a way in which they end up being interesting, enjoyable, and practical. The common structure is the following: introduction, contents, activities (case studies), annexes, bibliography and glossary.

Furthermore, each topic comes with questions that allow the student to fine tune its knowledge and measure his/her rhythm of study, in the section of Activities. There also are exercises that allow for evaluating the student's skills. The team of tutors, specialists on the different areas of study, will pay attention to the students through email, forums or chats and, if necessary, with a synchronous meeting (video conference).

**Learning activities**

- Forums, homework, exercises, field work, research, case study

**Use of resources**

- Videos, presentations, audio, animations

**Student rate per e-moderators**

- 1 for 20 or 30 students

**Platform**

There are services provided like:

- Communication services: discussion groups, forums or news, chat or interactive talks, email, working groups, etc.
- Evaluation services: tests, questionnaires, auto evaluations, report cards, monitoring tools, wiki.
- Information services: glossaries, dictionaries, etc.

**Online academic periods**

There is an estimate of an average of 390 tutorial hours plus other 52 hours dedicated to reading, studying, discussions, reports and essay elaboration, field works, elaboration and drafting of a final research project. The total will be of 442 hours.

**E) A suggestion for the marketing design**

An important aspect to consider is the promotion of the Postgraduate degree and more relevant is contemplating the prospective student. Therefore it is recommended to create an induction document, with the objective of showing the most relevant characteristics of the model. Here are some of the considerations that must be taken into account:

**Table of Contents**

a) Welcome

b) About us

c) How to study?

d) What do you need?

e) Learning about the e-learning modality:

1. Why?

2. Where?
3. When?
4. How?

f) Advantages

## F) Beginning of the Postgraduate Course

Regarding implementation it is anticipated that the degree of development of the different virtual platforms in the participating universities provides the opportunity for a technology transfer from one university to another which is conducted on the base of a collaboration agreement. The agreement will include training, graphic design and instructional methodologies, etc.

Another critical point is the development of contents based on a uniform model as well as their virtualization which will be conducted by experts in the area. It is also necessary to fine tune the costs and make them uniform for each responsible entity in the universities. A gross estimate of the program's cost makes it a strategic period for return on investment in the design of contents, instructional advice, and the assembly of contents taken into virtualization and graphic design (multimedia). The investment during the first year will be the greatest; it will become lower in accordance to its use in time. This calls for the need of contemplating a feasibility study of administrative and financial management of this modality[3].

In the meeting of Florianopolis, between the 4th and 8th of July, 2010, a schedule of activities was elaborated for the execution in a joint and individual manner. The date for the launching of the Postgraduate Degree in Sustainability, Environment and Renewable Energy was set for July 1st, 2011.

[3] To put an example regarding the costs of the program, a similar program that is being conducted in the Galileo University of Guatemala, a Masters in Telecommunications, has an approximate total cost for the student of US$728.0 dollars per quarter, that includes US$130.0 dollars per enrollment, 3 payments per month of US$196.0 for all the courses that correspond to the quarter and US$10.0 dollars for electronic services and ID. Per year it would be approximately US$2912 dollars.

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**APPENDIX 1**: **Postgraduate examples in countries of Latin-America and the world**

**Mexico:**

**1. Masters in Environment and Renewable Energies**
http://www.lumni.com.mx/articulos/index.php?consecutivo=526&se=54&ca=

**2. Renewable Energies**
http://maestria.emagister.com.mx/maestria_energias_renovables-cursos-797173.htm

**Paraguay:**

**1. Masters in Energy for Sustainable Development, Renewable Energies and Energy Efficiency**
http://estudios.universia.net/paraguay/estudio/uc-maestria-energia-desarrollo-sostenible-energia-renovables-eficiencia-energetica

**Argentina:**

**1. Masters in Renewable Energies**
http://www.universia.com.ar/contenidos/buscador_carreras/form_alf.php

**The UNIVERSIA network has online programs in the following countries of Latin America:**
Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, México, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Dominican Republic , Uruguay and Venezuela.

**Examples of postgraduate degrees in European countries:**
In **Spain** the following online degrees are an example of the obtained amplitude due to the simplicity of implementing degrees in an e-learning modality.

**1. Postgraduate Degree in Renewable Energies**
http://www.emagister.com/master/master-energias-renovables-kwes-1697.htm

**2. Postgraduate Degree in Renewable Energies**

http://www.cursosypostgrados.com/programas/postgrado-en-energias-renovables-1856.htm

**3. Postgraduate Degree in Renewable Energy Management and Development**

http://www.tumaster.com/Postgrado-en-Gestion-y-Desarrollo-de-Energias-Renovables-mmasinfo18529.htm

**4. Postgraduate Degree in Renewable Energies**

http://www.mastersadistancia.com/master/postgrado-en-energias-renovables-1856.html

**5. Solar Energy Study Center Professional Distance Learning Courses**

http://www.construmatica.com/formacion/tag/energias_renovables/6

**6. Masters in Renewable Energies**

http://postgrado.ceu.es/energias-renovables/

**7. Masters in Environment and Renewable Energies**

http://www.escuelademedioambiente.com/pdf/master-medio-ambiente-y-energias-renovables.pdf

| APPENDIX2: COMPETENCIES SELECTED BY COURSES (those competencies which are relevant to the contents that will be offered are marked with a cross) | | | | | |
|---|---|---|---|---|---|
| **COMPETENCIES** | | **COURSES** | | | |
| | | **SOCIOLOGY OF DEVELOPMENT AND GLOBAL CHALLENGES** | **ENVIRONMENT AND SUSTAINABLE DEVELOPMENT** | **PLANNING OF THE ENERGY MIX** | **ENVIRONMENTAL MANAGEMENT AND IMPACT EVALUATION** |
| 1. | Capacity for abstraction, analysis and synthesis | X | X | X | |
| 2. | Social responsibility and commitment to citizenship | X | X | | X |
| 3. | Ability to use of information and communication technologies | | | X | X |
| 4. | Commitment to look after the environment | | X | | X |
| 5. | Commitment to socio-cultural environment | X | | | X |
| 6. | Improve and innovate administrative processes using information and communication technologies for the process which allow for its formulation and optimization | | | X | |
| 7. | Conscience about the responsibilities regarding the environment and the values of urban and architectural heritage as well as the capability of knowing and applying research methods to resolve creatively the demands of the human habitat, in different scales and complexities | X | X | | X |

| | | | | | |
|---|---|---|---|---|---|
| 8. | Ethical commitment regarding the discipline, manifesting social conscience of solidarity and justice, and respect for the environment | X | X | X | X |
| 9. | Provide advice regarding the use of natural resources in the formulation of development policies, norms, plans and programs, interacting in interdisciplinary and transdisciplinary areas | X | X | X | X |
| 10. | Development of the professional activity within a framework of responsibility, legality, security and sustainability, planning, executing, managing and supervising projects and services focused in knowledge, exploitation and use of renewable natural resources | | X | X | X |
| 11. | Propose solutions which contribute to sustainable development, planning, designing and executing research in the topic | X | | X | X |

| APPENDIX 2: COMPETENCIES SELECTED BY COURSES (those competencies which are relevant to the contents that will be offered are marked with a cross) | | | | | |
|---|---|---|---|---|---|
| **COMPETENCIES** | | **COURSES** | | | |
| | | **ENERGY AND ENVIRONMENTAL POLICIES AND REGULATIONS** | **ENERGY AND ENVIRONMENTAL ECONOMICS** | **SOLAR ENERGY** | **HYDRO POWER** |
| 1. | Capacity for abstraction, analysis and synthesis | X | | | |
| 2. | Social responsibility and commitment to citizenship | | X | | |
| 3. | Ability to use of information and communication technologies | | X | X | X |
| 4. | Commitment to look after the environment | X | | | |
| 5. | Commitment to socio-cultural environment | X | | | |
| 6. | Improve and innovate administrative processes using information and communication technologies for the process which allow for its formulation and optimization | X | X | X | X |
| 7. | Consciousness about the responsibilities regarding the environment and the values of urban and architectural heritage as well as the capability of knowing and applying research methods to resolve creatively the demands of the human habitat, in different scales and complexities | X | | | |

| | | | | | |
|---|---|---|---|---|---|
| 8. | Ethical commitment regarding the discipline, manifesting social conscience of solidarity and justice, and respect for the environment | X | X | | |
| 9. | Provide advice regarding the use of natural resources in the formulation of development policies, norms, plans and programs, interacting in interdisciplinary and transdisciplinary areas | X | X | X | X |
| 10. | Development of the professional activity within a framework of responsibility, legality, security and sustainability, planning, executing, managing and supervising projects and services focused in knowledge, exploitation and use of renewable natural resources | X | X | X | X |
| 11. | Propose solutions which contribute to sustainable development, planning, designing and executing research in the topic | X | X | X | X |

| APPENDIX2: COMPETENCIES SELECTED BY COURSES (those competencies which are relevant to the contents that will be offered are marked with a cross) | | | | | | |
|---|---|---|---|---|---|---|
| **COMPETENCIES** | | **COURSES** | | | | |
| | | **BIO-MASS** | **WIND ENERGY** | **ENERGY EFFICIENCY AND RENEWABLE ENERGY** | **RE ENERGY& PROJECT MANAGEMENT** | **RESEARCH METHODOLOGIES FOCUSED ON SUSTAINABILITY, ENVIRONMENT AND RE** |
| 1. | Capacity for abstraction, analysis and synthesis | | | | X | X |
| 2. | Social responsibility and commitment to citizenship | | | | | |
| 3. | Ability to use of information and communication technologies | X | X | X | | |
| 4. | Commitment to look after the environment | | | X | | |
| 5. | Commitment to socio-cultural environment | | | | | |
| 6. | Improve and innovate administrative processes using information and communication technologies for the process which allow for its formulation and optimization | X | X | | X | X |
| 7. | Consciousness about the responsibilities regarding the environment and the values of urban and architectural heritage as well as the capability of knowing and applying research methods to resolve creatively the demands of the human habitat, in different scales and complexities | | | X | | X |

| | | | | | | |
|---|---|---|---|---|---|---|
| 8. | Ethical commitment regarding the discipline, manifesting social conscience of solidarity and justice, and respect for the environment | | | | | |
| 9. | Provide advice regarding the use of natural resources in the formulation of development policies, norms, plans and programs, interacting in interdisciplinary and transdisciplinary areas | X | X | X | X | X |
| 10. | Development of the professional activity within a framework of responsibility, legality, security and sustainability, planning, executing, managing and supervising projects and services focused in knowledge, exploitation and use of renewable natural resources | X | X | X | X | X |
| 11. | Propose solutions which contribute to sustainable development, planning, designing and executing research in the topic | X | X | X | X | X |

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