

**SPECIALISATION SYLLABUS : Sustainable Energy Management**  
European Master in Sustainable Energy Systems Management

Contents:	TOTAL HOURS
1. Socio-economic aspects of the energy	50
2. Renewable energy markets	50
3. Electricity and efficiency energy markets	50
4. Systems and tools for energy management	100
5. Start up and management of energy services companies and projects	50
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<b>TOTAL HOURS</b>	<b>300</b>

### 1. Socio-economic aspects of the energy

After providing students with an overview of the important role of energy in sustainable development due to its impacts on the environment, society and economy, the first objective of this module is to contextualize the program given the stage for the various European standards and objectives established for the use of renewable, saving energy and emission reduction. The second objective is to highlight the key role of the companies and their management systems as main actors for a green energy market. However, as a consequence of the existence of a 'Market Failure' in the case of the energy where the interest of the society not always meet those of the companies there is a need for the application of a cost-benefit analysis to energy results in order to accomplish a reliable sustainable management.

Syllabus	Lectures	Tutorials	Laboratory
<b>Socioeconomic impact of the energy</b>	12		4
<ul style="list-style-type: none"> <li>• Energy, environment and development</li> <li>• Energy security</li> <li>• Green economy</li> </ul>			
<b>Drivers for sustainable energy</b>	12		6
<ul style="list-style-type: none"> <li>• Macroeconomy</li> <li>• Government and society</li> <li>• Market actors: supply and demand</li> </ul>			
<b>Cost - benefit analysis applied to energy</b>	12	4	
<ul style="list-style-type: none"> <li>• Foundations and methodology</li> <li>• Direct and indirect financial costs and benefits</li> <li>• Externalities</li> </ul>			
<b>Learning outcomes</b> The student will get knowledge and understanding of the impacts of the energy on the environment, society and economy in order to internalise them in any system for sustainable energy management.			
<b>MODULE TOTAL</b>	<b>36</b>	<b>4</b>	<b>10</b>

## 2. Renewable Energy Markets

After a first introduction where foundations about the establishment and behaviour of markets are showed, renewable energy markets are analysed in detail highlighting the differences with conventional energy markets. In a first approach renewable technologies are classified regarding the final use of the energy. Although the structure for their study is the same some insight on the main characteristics will be made.

Syllabus	Lectures	Tutorials	Laboratory
<b>Energy Market Foundations</b> <ul style="list-style-type: none"> <li>• Market Pools</li> <li>• National, zonal and nodal pricing</li> <li>• Over-The-Counter negotiation</li> <li>• Regulation and control issues</li> <li>• Overview of significant market structures worldwide</li> <li>• The role of renewable energy and energy efficiency</li> </ul>	8	4	
<b>Renewable energy markets for thermal energy (solar thermal and biomass)</b> <ul style="list-style-type: none"> <li>• Nature and background</li> <li>• Specific characteristic for each industry</li> <li>• International markets</li> <li>• European market</li> </ul>	12	4	3
<b>Renewable energy markets for electricity (concentrated solar thermal, photovoltaics and wind power)</b> <ul style="list-style-type: none"> <li>• Nature and background</li> <li>• Specific characteristic for each industry</li> <li>• International markets</li> <li>• European market</li> </ul>	12	4	3
<b>Learning outcomes</b> The student will have knowledge and understanding of the strategic, managerial, institutional, economic and social aspects of the renewable energy markets. The student will be able to point out the relevance of renewables in the future European energy market.			
<b>MODULE TOTAL</b>	<b>32</b>	<b>12</b>	<b>6</b>

### 3. Electricity and efficiency energy markets

In the first half of this module a specific vision of the electrical system, the options for trading of existing contracts in a deregulated market, the production of electric energy in special regime and its relationship to other markets such as the GHG emission market are provided. New schemes for electricity supply based on the application of TICs or on the use of storage systems are shown.

The energy efficiency, often referred to as a “hidden fuel” because it extends energy supplies, increases energy security, lowers carbon emissions and usually supports sustainable economic growth, has also developed a strong market at a similar scale to those in renewable energy or fossil-fuel power generation according the IEA. However, the energy efficiency market is diffuse, varied and involves all energy-consuming sectors of the economy. Because of the above the analysis of efficiency energy market is undertaken in the second half of this module on the basis of several successfully case studies.

Syllabus	Lectures	Tutorials	Laboratory
<b>Electricity market</b> <ul style="list-style-type: none"> <li>• Operational, management and market</li> <li>• Special regime production energy and economic analysis</li> <li>• Evolution and prospects for the sector</li> <li>• Community rules</li> <li>• Electricity retail market</li> </ul>	8	4	6
<b>GHG Emission market</b> <ul style="list-style-type: none"> <li>• Carbon emissions market</li> <li>• Voluntary schemes</li> </ul>	4	4	4
<b>New technologies and schemes for electricity</b> <ul style="list-style-type: none"> <li>• Smart grids and communities</li> <li>• Electric vehicle</li> <li>• Electricity storage</li> <li>• Self-consumption and net-metering</li> </ul>	8		
<b>Efficiency energy market</b> <ul style="list-style-type: none"> <li>• Nature and background</li> <li>• Market actors</li> <li>• Specific schemes: industrial symbiosis, valorisation, ESCOS</li> </ul>	12		6
<b>Learning outcomes</b> The student will be able to describe how electricity prices, power system operation and investments depend on geographical, technical and economic factors, among others. The student will acquire an overview of the strategic, managerial, institutional, economic and social aspects of the efficiency energy market.			
<b>MODULE TOTAL</b>	<b>32</b>	<b>8</b>	<b>10</b>

#### 4. Systems and tools for energy management

This module introduces the main systems to manage efficiency and energy demand from the point of view of strategic planning, decision making and investment analysis are provided. It also presents an overview of energy audits aimed at identifying opportunities for energy cost and greenhouse gas reduction in existing installations. Students will gain an understanding on how to procure an energy audit, how to carry out an energy audit, how to evaluate energy audits completed and how to plan for the implementation of the findings. Students will also be able to specify, procure, and review energy audits.

Syllabus	Lectures	Tutorials	Laboratory
<b>The scope of the energy management</b> <ul style="list-style-type: none"> <li>• Standards: ISO 50001</li> <li>• Corporate strategy foundations</li> <li>• Eco-innovation management</li> </ul>	16	4	6
<b>Efficiency and energy demand management</b> <ul style="list-style-type: none"> <li>• Electricity and gas purchase management</li> <li>• Energy accounting</li> <li>• Energy efficiency in the final use of energy</li> </ul>	16	8	6
<b>Energy management tools</b> <ul style="list-style-type: none"> <li>• Energy audit foundations</li> <li>• The audit report</li> </ul>	20	16	8
<b>Learning outcomes</b> The student will be able to evaluate the energy flows by means of auditing and develop energy management systems under the framework of the international standard 50001			
<b>MODULE TOTAL</b>	<b>52</b>	<b>28</b>	<b>20</b>

<b>5. Start up and management of energy services companies and projects</b>			
This module presents an overview of the full scope of the development of an energy management project. The module provides a practical opportunity to bring together all the components of an energy management project learned in the Sustainable Energy Manager program by preparing an energy management project plan for a real business or building. Various project delivery methods, financing models and perspectives on gaining executive approval are explored.			
<b>Syllabus</b>	Lectures	Tutorials	Laboratory
<b>Business plan</b> <ul style="list-style-type: none"> <li>• Market analysis</li> <li>• Marketing and production plan</li> <li>• Projected profit and loss accounts</li> <li>• Financing plan</li> <li>• Business risk assessment</li> </ul>	8	12	
<b>Energy Service Companies</b>	8	12	6
<b>Start-up</b>	4		
<b>Learning outcomes</b> The student will acquire knowledge and understanding of the different techniques for investment analysis from economically and financially and be able to apply solutions to specific problems. The student will be able to establish cost reduction and alignment of risk management with overall business strategy. The student will get knowledge and understanding of the different business models for energy services and be able to value their propositions. The student will have an overview of legal procedures, financial and public support to help existing entrepreneurs to build new businesses and to be able to create a business idea and shape to outline possible future energy service company.			
<b>MODULE TOTAL</b>	<b>20</b>	<b>24</b>	<b>6</b>

**PROGRAMME TOTAL HOURS = 300 hours**

finance. Strategic planning, decision taking and investment analysis.

*Module 4: Economic feasibility of projects and installations*

*Module 7: Energy management systems: Auditing*

*Module 8: Start up and management of energy services companies and projects*

## **Laboratory**

### **Introduction to Energy markets (4 hours)**

Numerical case studies will be proposed to the students – mainly in the form of interactive market games - to familiarize them with the competitive dynamics of energy pricing.

### **Solar thermal Sector (4 hours)**

This activity consists of a seminar where components and systems for this technology will be shown and operated, so the students have a practical experience on the technology performance.

### **Concentrated Solar Power sector (2 hours)**

This activity consists of a seminar where one or more specialized companies working in different stages of this sector supply chain will explain how they are interrelated in this specific market.

### **Solar Photovoltaic Sector (4 hours)**

This activity consists of a seminar where a real installation with this technology will be shown and operated, so the students have a practical experience on the technology performance.

### **Wind Power Sector (4 hours)**

This activity consists in a seminar where companies working in different stages of this sector supply chain will explain how they are interrelated in this specific market.

### **Biomass (4 hours)**

As the supply logistics for the biomass is the major bottleneck for the spread of this sector, some successful case studies will be shown to the students.

### **Electricity Market (3 hours)**

Students will visit the Electricity Market Operator (OMIE) and the Electricity System Operator (REE) in order to be familiar with the operation of the main Spanish operators.

OMEL is the responsible of the management of the Iberian spot electricity market and REE is the system operator that guarantees the continuity and security of the electricity supply maintaining the constant balance between generation and consumption in Spain as well as the manager of the transmission grid.

### **Electricity retail market (3 hours)**

Several case studies will be proposed to the students to optimise electricity costs by means of the introduced tools.

### **Carbon trading (3 hours)**

The students will realize the trade-offs that exist within carbon trading through an online role playing game.

### **New technologies and schemes (3 hours)**

Different activities and case studies will be conducted within the theme of energy smart communities and electric vehicle massive deployment.

### **Energy audit interpretation (6 hours)**

The student will learn how to analyse an audit report in order to identify and prioritize the feasibility of energy conservation measures identified by the auditor.

### **Efficiency and energy demand management (6 hours)**

The student will learn practical ways on how to manage energy efficiency and electricity demand, in order to improve and optimize the energy performance, thus maximizing savings.

### **Energy management tools (6 hours)**

The student will learn how to identify and manage the most relevant and efficient tools for energy management, as well as the systems, certifications and existing schemes related to this topic.

### **Specialization final project (20 hours)**

The student will work on a short project devoted to one or more of the themes included in the specialization, which may serve as an opportunity to bring ideas and concepts to real terms, and as a means to evaluate the student final level of understanding and progress.

## References

Efficiency Energy markets <http://www.iea.org/w/bookshop/add.aspx?id=460>