

## UNIVERSITA' DEGLI STUDI MEDITERRANEA DI REGGIO CALABRIA

<b>Subject Code</b>	56T025
<b>Subject Name</b>	Chemistry for Environment and Energy
<b>Professor</b>	FRANCESCO MAURIELLO
<b>Department:</b>	DICEAM
<b>Degree course:</b>	Civil - Environmental Engineering (Curriculum Environment)
<b>Class:</b>	L7
<b>Type of educational activity:</b>	Lectures with the use of electronic media for the display of text, images and video.
<b>Disciplinary Area:</b>	Basic Discipline
<b>Scientific-Disciplinary Sector:</b>	CHIM/07
<b>Compulsory preliminary exams:</b>	Chemistry
<b>Course Year:</b>	3
<b>Semester:</b>	I
<b>ECTS:</b>	6
<b>Hours:</b>	48

### **Synthetic description:**

The aim of the course is to provide students the tools to understand the energy issue in its global interdisciplinary from the management of primary resources to the international geo-political fallout in order to develop critical skills in the comprehension of the events related to energy themes. The analysis of energy chains will be focused on the technologies used for energy production from both primary (coal, oil and gas) and renewable (biomass and biofuels) resources. The basic chemical processes involved in the air, water and soil will also be addressed with an analysis of emerging environmental issues in the framework of the relevant legislation at Italian and European level.

### **Acquisition of knowledge on:**

At the end of the course the student will acquire the basic understanding of energy based on chemical reactions/transformations and the ability to fully tackle issues related to energy generation, conversion, storage, and utilization taking into consideration the problems related to resources and environment. The analysis of the energy production will also be focused on the different technologies used in the industrial processing of primary (coal, oil and gas) and renewable (biomass and biofuels) energy resources. The processes used in these industries will be discussed in light of the chemical and physical properties of the feedstocks and their transformation in desired market products. The student will also acquire a background of environmental chemistry, with specific knowledge about emerging environmental issues and hints of European and National environmental legislation.

### **Evaluation method:**

- Term-essay and oral exam

### **Student's independent work**

- The preparation of a term-essay with the aim to investigate in detail a specific topic chosen by the student and to present a cross-cutting approach to environmental and energy issues.
- Self-study

### **Detailed course program**

- Definition of Energy: First and Second Law of Thermodynamics, Energy and Exergy Analysis.
- Energy resources: renewable and non-renewable resources.
- Coal: the role of chemistry in the coal industry.
- Composition and classification of oil; oil processing into energy and chemical products.
- Diesel fuels: characteristics and environmental issues.
- Natural Gas: Physical and chemical properties of natural gas and processing principles; Production/consumption in the natural gas market. Shale Gas.
- Energy from Biomass and Biofuels.
- Nuclear Energy.
- The international energy system: history of reserves and consumption of primary energy resources, European and national
- Energy resources and geopolitical worldwide analysis: the chains of oil, coal and natural gas, international equilibrium and their changes as a function of expected consumptions.
- Direct conversion of solar energy: photosynthesis as a biological model for the development of clean and renewable energy.
- General Aspects of Environmental Chemistry: chemistry of air, water and soil.
- Climate change and greenhouse gases: impact in the use of chemical resources for energy production.
- Elements of Ecology.
- General aspects related to environmental controls. Kyoto Protocol and the EU program 20-20-20. Basics of the European and national legislation.

### **Resources and main references**

- Energia per l'astronave Terra, di Nicola Armaroli e Vincenzo Balzani - Editore: Zanichelli (2011)
- Energetica Generale (5 edizione), di Gianni Comini, Giuliano Croce e Stefano Savino – Editore: SGEEditoriali (2011)
- Chimica dell'ambiente, Manahan S. E. – Editore: Piccin