UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2020/2021
SECOND CYCLE (7TH LEVEL) COURSE	ENGINEERING AND INNOVATIVE TECHNOLOGIES FOR THE ENVIRONMENT
SUBJECT	MANAGEMENT OF TERRITORIAL ENERGY RESOURCES
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	20937-Attività formative affini o integrative
CODE	03726
SCIENTIFIC SECTOR(S)	ING-IND/11
HEAD PROFESSOR(S)	RIZZO GIANFRANCO Professore Ordinario Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**RIZZO GIANFRANCO** Tuesday 09:00 11:00 Deaim - Stanza T218

DOCENTE: Prof. GIANFRANCO RIZZO

PREREQUISITES	The student must hold basic knowledge of calculus, physics and applied physics that allow him to face, without problems, issues related to the energy management at land scale, in order of suitably assessing urban and district energy balances.
LEARNING OUTCOMES	- Knowledge and understanding skills At the end of the course, the student will have acquired the knowledge and the methodologies to deal with the issues connected with the use of energy resources both at local and territorial level, within the context of environmental sustainability preservation. The conceptual scheme of action consists of the principles of thermodynamics and the European Union documents regarding the energy safety of the Member States. - Ability to apply knowledge and understanding The student will be able to identify the analysis methodologies most appropriate to the nature and extent of the energy management problems in the territory. It will also be able to assess the effect of different intervention scenarios on the energy policies and on the pressures exerted on the environment. - Critical judgment autonomy The knowledge of the integrated analysis methods will allow the student to intervene autonomously to face different energy problems and to formulate territorial development hypotheses based on the correct use of the energy sources. - Communication skills The methods of conducting the course and those of the final verification are strongly aimed at enhancing the student's communication capacity towards external users, both institutional and private. Learning skills The student will also be able to learn new methods of approach to the energy and environmental problems and to face new issues concerning environmental sustainability.
ASSESSMENT METHODS	Oral examination and discussion on the project work. The interview is aimed at determining the student's ability to process the knowledge gained by using them to solve problems and the ability to express the teaching content using a technically correct language. Special attention will be paid to the ability of the students to sketch out an energy balance at regional and/or urban scale, taking into account the different forms of energy involved. The vote is expressed in thirtieths with possible praise, according to the scheme reported in the “CdS” website.
EDUCATIONAL OBJECTIVES	The aim of the class is preparing the students at interpreting and managing the energy and environmental problems caused by anthropogenic activities, both at urban and territorial levels. The students will be also capable of assessing the environmental consequences of the use of renewable and non-renewable sources of energy by means of qualitative and quantitative models of analysis. These methods refer to the in force national and European standards. Moreover, students will be able to evaluate phenomena responsible of the impact of anthropogenic activities on the natural environment with a specific focus on the use of fossil and fissile fuels. Finally, a further objective of the course is getting students conscious of the recent technologies that, particularly in the civil sector, use renewable energy sources. The critical approach characterizing the course will enable students to effectively updating their knowledge in a field subjected to a continuous changing.
TEACHING METHODS	The class is composed by frontal lessons, exercises and a project work. Moreover, some visit to energy sites in the university campus is foreseen. Exercises are proposed by the teacher and developed by students, while the project is autonomously made by the students with the tutoring of teachers.
SUGGESTED BIBLIOGRAPHY	• Dispense didattiche inserite in rete ed a disposizione degli studenti. • Chiesa G. e Dall’O’ G., “Gestione delle Risorse Energetiche nel Territorio”. C.E.A. - Casa Editrice Ambrosiana. • Filippi M., Rizzo G., “La certificazione energetica e la verifica ambientale degli edifici”, Dario Flaccovio Editore, Palermo, 2007. • Filippi M., Rizzo G., Scaccianoce G., “La certificazione energetica per l’edilizia sostenibile”, Dario Flaccovio Editore, Palermo, 2014. • Scheer H., “Autonomia Energetica. Una nuova politica per le energie rinnovabili”. Edizioni Ambiente. • Normativa di settore.

SYLLABUS

Hrs	Frontal teaching
2	Course introduction. General remarks on energy problems in the territory. The different forms of energy. The energy conservation law. Energy quality and its degradation. Energy and net useful work. Irreversibility types in transformations. The exergy concept. Comparison among energy sources.
3	The energy demand of the humankind. Historical data on energy consumption. Energy balances of human societies in various historical époques. Energy balances at territorial scale. Different forms of primary energy. Classification of the primary energy sources. The non-renewable energy sources: coal, natural gas, petrol. The non-breeder nuclear fission. The almost inexhaustible energy sources. The endogenous heat. The nuclear power. Origin of nuclear fuels. Introduction to the renewable energy sources (RES). Environmental and economic benefits deriving from the use of RES. Limits to the use of RES. RES availability.
6	The Sun. Physical characteristics. The spectrum of the extra-terrestrial solar radiation. Solar paths. Brief description on the extra-terrestrial and terrestrial solar radiation. Shadows. Climatic data at territorial scale.
6	Energy distribution within the territory. Energy vectors and users. Plants for the energy transformation. Low temperature solar thermal system. The flat-plate solar collector. General characteristics of the flat-plate solar collectors. Technological characteristics of a solar thermal plant. Designing of a solar thermal plant. Economically optimal sizing of a solar panels' system. Environmental analysis of flat solar systems. Notes on Photovoltaic solar systems. Notes on the wind power. The biomass. Hydrogen fuel cells for the electric power generation. The geothermal energy.
6	Building Energetics. Energy demand of buildings. The indoor requirements. Green roofs.
5	Tools for the environmental sustainability assessment. Environmental consequences of the energy production from primary and secondary sources. Primary and secondary pollutants. Natural and anthropogenic pollution sources. Effects on humans and the environment. Transport-related atmospheric pollution. The environmental impact at global and local level. The Environmental Impact Assessment (EIA). The Strategic Environmental Assessment (SEA). The Ecological Footprint.

Hrs	Practice
24	Support and tutoring in class for the project.