



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze Agrarie, Alimentari e Forestali		
ACADEMIC YEAR	2021/2022		
BACHELOR'S DEGREE (BSC)	AGRICULTURAL SCIENCES AND TECHNOLOGIES		
INTEGRATED COURSE	RENEWABLE ENERGIES - INTEGRATED COURSE		
CODE	21244		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	AGR/02, ING-IND/11		
HEAD PROFESSOR(S)	DI MICELI GIUSEPPE	Professore Associato	Univ. di PALERMO
OTHER PROFESSOR(S)	CURTO DOMENICO	Ricercatore a tempo determinato	Univ. di PALERMO
	DI MICELI GIUSEPPE	Professore Associato	Univ. di PALERMO
CREDITS	6		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	3		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	<p>CURTO DOMENICO</p> <p>Monday 11:00 12:00 Aula docente: Ed. 9, aula 2010 (S09P2011)</p> <p>Wednesday 10:00 12:00 Aula docente: Ed. 9, aula 2010 (S09P2011)</p> <p>Friday 10:00 12:00 Aula docente: Ed. 9, aula 2010 (S09P2011)</p> <p>DI MICELI GIUSEPPE</p> <p>Monday 09:00 11:00 Studio del docente - Dip. SAAF Ed.4 Ingresso L, 2° Piano - studio 210</p> <p>Friday 10:00 12:00 Studio del docente - Dip. SAAF Ed.4 Ingresso L, 2° Piano - studio 210</p>		

DOCENTE: Prof. GIUSEPPE DI MICELI

PREREQUISITES	The attendance of the course "Renewable Energies" requires the knowledge of Mathematics, Physics and Agronomy.
LEARNING OUTCOMES	Knowledge and understanding: at the end of the course the student will acquire basic knowledge of technical language of the discipline, of principles of energy exchanges and of the sources of renewable energy from the sun, wind and biomass, as well as specific knowledge concerning the energy needs of the farm and the possibility to produce energy within the same farm. Applying knowledge and understanding: the knowledge and skills acquired will allow the student to apply in practice the techniques for improving the energy efficiency of the farm and transfer, in different company context, the application of the main conversion processes and technologies available for the production of renewable energy . Making judgments: the student, in relation to the specific characteristics of the farm, will be able to assess and to choose the best renewable energy solution for the reduction of the primary energy needs and to suggest the adoption of more suitable technologies to improve the energy efficiency of the farm. Communication skills: the student, using a simple and proper language, will be able to work in team with other professionals and stakeholder and to address the energy choices of agricultural and agro-energy companies Learning skills: the gained knowledge will allow the student to interact with specialists in the field of renewable energy and to use effectively and independently the technical and scientific sources of upgrading
ASSESSMENT METHODS	Learning is assessed through an interview. The questions (usually three or four), open or semi-structured, tend to test knowledge, acquisition of interpretative skills, capacity of connecting and processing the topics, as well as a relevant presentation capacity. The final grade will be expressed in thirtieth using the following criteria: Excellent 30-30 cum laude: excellent knowledge of the topics, excellent mastery of language, good analytic capability; the student is able to apply his knowledge to solve the proposed problems. Very good 26-29: good knowledge of the subjects, full mastery of language, the student is able to apply knowledge to solve the proposed problems. Good 24-25: basic knowledge of the main topics, basic command of language, limited ability to independently apply the knowledge to the solution of the proposed problems Satisfactory 21-23: student does not have full capabilities but has the knowledge, satisfactory command of language, poor ability to independently apply the knowledge Sufficient 18-20: student has minimal knowledge of topics and minimal technical language, very little or no ability to independently apply the knowledge Insufficient: student does not have an acceptable knowledge of the topics.
TEACHING METHODS	Lectures. Tutorials. Guided visits.

MODULE TYPES AND ROLE OF ENERGY SOURCES

Prof. DOMENICO CURTO

SUGGESTED BIBLIOGRAPHY

- Raccolta delle slides proiettate a lezione, materiale tecnico commerciale.
- Renewable Energy, 4th Edition, Physics, Engineering, Environmental Impacts, Economics & Planning
- Renewable Energy Systems, 2nd Edition, A Smart Energy Systems Approach to the Choice and Modeling of 100% Renewable Solutions

AMBIT	10689-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	45
COURSE ACTIVITY (Hrs)	30

EDUCATIONAL OBJECTIVES OF THE MODULE

The course aims to provide principles and practices relating to the knowledge and assessment of energy systems using renewable sources .

In a first step we will describe the renewable energy sources to produce electricity and heat . It will also describe the main conversion processes and available technologies such as solar thermal , photovoltaics , biomass energy and micro wind .

SYLLABUS

Hrs	Frontal teaching
1	Introduction, sustainability and climate change. General classification of Renewable Energy resources
2	Thermo-dynamics and heat transmission : introduction to the first and second thermodynamics laws; description of the main heat transmission processes by conduction, convection and radiation
3	Sun energy, solar geometry and technical reference standard
4	Fundamentals of Solar Energy. Solar radiation. Basics of thermal conversion, solar cooling and solar thermodynamics. Heat balance and efficiency of a solar thermal collector (Bliss law), main features and technologies of solar thermal collectors.
3	Photovoltaic systems: the energy balance of a PV panel, the photoelectric effect, conversion efficiency and leading technology available
4	Biomass. Classification, availability and use of different biomasses. Technologies for energy conversion. Production biofuels (biogas, pellet, biodiesel, ethanol, etc) and related technologies (anaerobic digestion, pyrolysis, gasification, chemical treatments, etc..). Power production and direct combustion
4	Wind energy. Wind phenomena at macro, meso and microscale. Wind analysis, frequency (legge di Weibull) and vertical gradients. Maximum theoretical power of a wind turbine (Betz). Blade design: lift and drag. Power factor of a turbine. Construction and operation of a wind turbine. Applications for remote sites, wind fields and off shore. Assessment of annual electricity production
3	The LCA methodology and renewable sources
Hrs	Practice
6	Exercises on case studies of energy systems using renewable sources

MODULE
AGRICULTURAL FARM AND RENEWABLE ENERGIES

Prof. GIUSEPPE DI MICELI

SUGGESTED BIBLIOGRAPHY

Giuseppe Zicari. Energie rinnovabili da biomasse: rischi e opportunità. EPC editore. I edizione. ISBN: 978-88-6310-720-3.
Giuseppe Dell'Olio. Agroenergie e biomassa. Dario Flaccovio editore. I edizione. ISBN: 978-88-579-0202-9.

AMBIT	10689-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	45
COURSE ACTIVITY (Hrs)	30

EDUCATIONAL OBJECTIVES OF THE MODULE

The educational objectives of this course are to provide the student with the basic and applicative elements for the assessment of the energy needs of farms and efficiency in relation to different cultivation and business management systems and the elements relating to the different agro-energy chains. These acquisitions will constitute a professional tool for the design and development of biological systems with high energy sustainability also through the diversification of the productions and activities of farms.

SYLLABUS

Hrs	Frontal teaching
2	Presentation of the course. General overview of the problems relating to the use and production of energy from the agricultural sector.
4	Energy sources used on the farm and their impact on the environment. Methods of estimating the energy needs on the farm. Comparison between cultivation techniques and systems for improving energy efficiency and reducing environmental impact.
4	Energy production on farm. Description of the main agro-energy chains based on agricultural biomass. Other possible sources of renewable energy production on farm.
7	Technical aspects, transformation processes and regulatory aspects of the agro-energy supply chains. Biodiesel, bioethanol, biogas, biomethane. Dedicated crops and biomass. Residual biomass and waste from agro-food production.
5	Recycling of residual biomass, waste from agricultural crops and residues from agro-food chains: agronomic, environmental and energy saving effects. Composting materials and techniques. Classification and use of composted soil improvers in agriculture.
Hrs	Others
8	Technical-educational events to visit energy farm.