

MODULE INFORMATION SHEET

Name of Module Unit	Renewable Energy Systems
Name in polish language	Systemy energetyki odnawialnej
Module type	compulsory / elective
Form of studying	full-time day courses
Level of study	undergraduate course (B.Sc. level)
Type of study (for extra-mural courses)	-
Programme	Environmental Engineering
Speciality	Environmental Engineering
Responsible department	Department of District Heating and Gas Systems
Responsible person	dr hab. inż F.E. Uilhoorn

Semester	Lectures(E)	Tutorials	Laboratory	Computer Exercises	Projects	ECTS
7	30				15	4

Objectives (summary)

In order to meet the world's growing energy demand, renewable energy becomes more important. On the other hand renewable energies are required to reduce the greenhouse emissions and pollutions from fossil fuels. This course provides a comprehensive overview of the most important renewable energies systems. After completion the student will be able to formulate the underlying thermodynamics and main characteristics of renewable energy sources. The student will be able to describe renewable energy technologies, sources, conduct techno-economical assessments and define the optimal combination of technological solutions to minimize greenhouse gases and pollutions.

Prerequisites

Transport phenomena

Rules of integrated grade setting

Exam grade (60%), Project grade (40%)

Recommended readings

Boyle, G. (2004). Renewable Energy: Power for a Sustainable Future.

Contents of lectures (syllabus)

	Topics	Time (hrs.)	Scope (S / Ex)
1	General Introduction. Energy demand, sources, energy systems, scenarios.	2	S
2	Wind energy. Characteristics and aerodynamics (wind speed distribution, blade element theory, momentum theory, power coefficient, power curve, airfoil, blade design). Conversion systems, power calculations and economics. Failure analysis of the rotor blades. Applications of wind turbines.	4	S
3	Hydro electric power generation. History and new developments, fluid mechanics, turbines types, calculation of hydropower and hydro potential.	4	S
4	Energy from biomass. Definition of biomass and its relation to global. Biomass characterization and biomass conversion systems (fixed bed, fluidized bed, entrained flow reactors). Combustion, gasification and fundamentals of pyrolysis. Emissions.	6	S
5	Photovoltaic energy. Introduction, solar radiation, cell materials, solar cell physics, alternative concepts, thin-film solar cell technologies, autonomous and grid connected PV systems, MPPT algorithms. Economic aspects.	4	S
6	Solar collectors. Principle of solar collectors, collector and storage interaction, estimation of energy yield and conversion efficiencies, available systems, collectors, daily yield estimation.	2	S
7	Renewable energy in the building environment. Energy flows, passive solar energy, heat storage and heat pumps.	4	S
8	Hydrogen technology and fuel cells. Transition strategies and comparison with other fuels. Hydrogen production, distribution and storage. Hydrogen fuel cells and concepts.	4	S
Total		30	hours

S – topics listed in the legal study programme standards from 12.07.2007

Ex – extended topics

Lecturers

Dr hab. inż. F.E.Uilhoorn

Assessment method

Final test

Contents of guided projects

	Topics	Time (hrs.)	Scope (S / Ex)
1	The students will present a compulsory paper on a chosen energy topic which has to be approved before entering the final examination. The conclusion of the paper will be presented in the class	15	S
Total		15	hours

S – topics listed in the legal study programme standards from 12.07.2007

Ex – extended topics

Persons responsible for guided projects

dr hab. inż. F.E. Uilhoorn

Assessment method for guided projects

Paper and their successful defend.