

MODULE INFORMATION SHEET

Name of Module Unit	Energy systems and environment
Name in polish language	Systemy energetyczne i środowisko
Module type	compulsory / <i>elective</i>
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. Maciej Chaczykowski, prof. PW

Semester	Lectures(E)	Tutorials	Laboratory	Computer Exercises	Projects	ECTS
5	30 (Exam)				15	4

Objectives (summary)

The subject gives students an introduction in energy systems with particular emphasis on fossil fuel based energy sources and their environmental impact. The methodology of energy and exergy analysis is introduced and energy conversion and storage processes are discussed. Next, the current status of internal combustion engines, steam and gas turbines is reviewed. Selected new and emerging energy technologies like waste energy recovery and carbon capture and storage are also presented.

After completing the course, the student should:

- understand the theoretical framework of energy conversion processes,
- be familiar with the methodology of energy and exergy efficiency assessments of power generation sources,
- know the issues concerning the evaluation of energy systems, particularly related to thermal efficiency, economical and environmental aspects.

Prerequisites

Thermodynamics, Fluid mechanics

Rules of integrated grade setting

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

Recommended readings

1. Y.A. Cengel, M.A. Boles: Thermodynamics: An Engineering Approach, McGraw-Hill, New York 2008
2. M. Kutz., A. Elkamel (Eds.): Environmentally Conscious Fossil Energy Production, Wiley & Sons, Hoboken NJ 2010
3. E-resources at Main Library of Warsaw University of Technology: e.g. Knovel, CRCnetBASE.

Contents of lectures (syllabus)

	Topics	Time (hrs.)	Scope (S / Ex)
1	Energy demand trends. Depletion of traditional fuels. (Energy consumption in various sectors, projected energy consumption, exponential increase in energy consumption, energy resources, coal, oil, natural gas, nuclear power.)	2	S
2	Thermal analysis. (Conservation of energy, Energy conversion, Energy efficiency. Second law of thermodynamics, Exergy, Energy flow diagram.)	6	S
3	Current Energy Sources in Thermal & Electrical Utilities (Boilers, Steam turbines, Gas turbines, Cogeneration and Waste heat recovery, Industrial heating systems, HVAC and Refrigeration Systems)	12	S
4	Selected Alternative Energy Systems (Hydrogen Technology and Fuel Cell Technology)	4	S
5	Economic appraisal of renewable/conventional technology	6	S
Total		30	hours

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

Ex – extended topics

Lecturers

dr hab. inż. Maciej Chaczykowski, prof. PW
--

Assessment method

Exam

Contents of guided projects

	Topics	Time (hrs.)	Scope (S / Ex)
1	Energy efficiency related calculations, Understanding Energy Costs, Maximising System Efficiency	5	S
2	Economic analysis of energy investment project taking into consideration project lifetime and discount rates	10	Ex
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. Maciej Chaczykowski, prof. PW
--

Assessment method for guided projects

Projects description and/or presentation.
