COURSE DESCRIPTION CARD - SYLLABUS

Course name

Energy Management

Course

Field of study

Environmental Engineering

Year/Semester

3/5

Area of study (specialization)

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

English

Form of study

full-time

Requirements

elective

Number of hours

Lecture

10

Laboratory classes

Other (e.g. online)

Tutorials

5

Projects/seminars

Number of credit points

6

Lecturers

Responsible for the course/lecturer:

prof. Tomasz Mróz, Ph.D., Dr.SC. Eng.

email: tomasz.mroz@put.poznan.pl

tel. (61) 6652900

Faculty of Civil and Environmental Engineering

ul. Piotrowo 5 60-965 Poznań

Responsible for the course/lecturer:

Prerequisites

1. Knowledge:

Basic knowledge on thermodynamics and heat engineering.

2. Skills:

Application of Energy balance equation in evaluation of energy systems in built environment. Calculation of thermodynamic efficiency of Energy systems in unbuilt and built environment

3. Social competencies:

Awareness of the need to constantly update and supplement knowledge and skills.

Course objective

Purchase by the students basic knowledge and skills in energy management necessary to solve common tasks of energy flows occurring in the built and natural environment.

Course-related learning outcomes

Knowledge

1. The student has a theoretical and practical knowledge on the fossil and renewable primary energy sources .

2. The student has a theoretical and practical knowledge on the energy balancing of simple and complex energy systems in built environment.

3. The student has a theoretical and practical knowledge on the calculation of energy efficiency of simple and complex energy systems in built environment.

4. The student has a theoretical and practical knowledge on the possibilities of energy usage reduction in the energy systems in built environment.

5. The student knows basic methods of economic evaluation of energy systems.

6. The student knows the procedures of energy planning.

Skills

1. The student can evaluate energy resources and describe them in different units.

2. The student can construct the calculation model and energy balance equation for elements and energy systems used in built environment.

3. The student can calculate energy efficiency of simple and complex energy systems used in built environment.

4. The student can calculate simple payback time (SPBT) and net present value (NPV) for elements and energy systems used in built environment.

5. The student is able to choose on the basis of multicriteria analysis the recommended scenario of energy management in built environment .

Social competences

1. The student understands the need for teamwork in solving theoretical and practical problems .

2. The student is aware of the need sustainable development of energy systems in built environment .

3. The student sees the need for systematic increasing his skills and competences.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:

Test of competences (6 questions based on case study calculations)

Continuous assessment during lectures (rewarding activity of the students).

Tutorials:

Final colloquium (2 calculation examples).

Continuous assessment of the students (rewarding students activity).

Programme content

Lectures:

Basic knowledge on energy management: definition of energy management, non-renewable primary energy sources, renewable primary energy sources, upgraded fuels, energy chain, gross and net energy efficiency, coefficient of non-renewable primary energy consumption, coefficient of carbon dioxide emission.

Principles of energy balancing of simple and complex energy systems in built environment, calculation of energy efficiency of complex energy systems in built environment;

Co-generated heat and power energy production systems (CHP). Co-generated heat, power and cooling energy production systems (CHCP). Avoided cost principle in energy management.

Static and dynamic methods of economical evaluation of energy systems in built environment: simple payback time (SPBT), net present value (NPV), internal rate of return (IRR), total operation cost (TOC);

Basic knowledge on energy planning procedures based on multicriteria approach weighted sum method.

Tutorials:

1. Calculation of Energy performance coefficient for chosen residential building with sensitivity analysis

Teaching methods

Lectures - transparent and multimedia projector.

Tutorials – blackboard case study calculations.

Bibliography

Basic

1. Szargut J., Ziębik A.: Termodynamika techniczna. Warszawa, WNT 2001.

2. Marecki J.: Podstawy przemian energetycznych. Warszawa, WNT 2000

3. Chmielniak T: Technologie energetyczne. Warszawa, WNT 2008.

4. Szargut J., Guzik J.: Programowany zbiór zadań z termodynamiki technicznej. Warszawa, WNT 1980.

5. Rocznik statystyczny Rzeczpospolitej Polskiej 2010. Warszawa, ZWS 2011.

6. Mróz, T.M.: Planowanie modernizacji i rozwoju komunalnych systemów zaopatrzenia w ciepło. Wydawnictwo Politechniki Poznańskiej, seria rozprawy Nr 400, 2006.

7. Mróz, T.M.: Energy Management in Built Environment. Tools and Evaluation Procedures. Wydawnictwo Politechniki Poznańskiej, 2013.

Additional

1. Kreith, F., West, R.E.: CRC Handbook of Energy Efficiency. CRC Press Inc. 1997.

Breakdown of average student's workload

	Hours	ECTS
Total workload	150	6,0
Classes requiring direct contact with the teacher	25	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	125	5,0

[1] delete or add other activities as appropriate