



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Energy Management

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### Course

Field of study

Environmental Engineering

Area of study (specialization)

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

3 / 6

Profile of study

general academic

Course offered in

Polish

Requirements

compulsory

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### Number of hours

Lecture

30

Tutorials

Laboratory classes

Projects/seminars

15

Other (e.g. online)

### Number of credit points

4

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### Lecturers

Responsible for the course/lecturer:

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Faculty of Environmental Engineering and  
Energy

ul. Berdychowo 4 61-131 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).

Project

To pass the project classes, the energy performance of the building should be calculated in two variants. Also, a test will be carried out as part of the credit.

A minimum of 50% of the points must be obtained. We reserve the right to amend this threshold.

### 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.



**Project:**

As part of the project, calculations of the design energy performance of the selected building will be made. An analysis of energy balance for heating, ventilation, domestic hot water, and cooling will be carried out. Review of compliance with legal regulations regarding energy consumption in the building will be carried out, as well as proposals for improvements in the building to improve the energy balance. As part of the energy performance calculation, usable, final and primary energy indicators, as well as carbon dioxide emissions and fuel consumption, will be determined. Two energy performance certificates should also be completed.

**Teaching methods**

Lecture: lecture based on a multimedia presentation, interactive discussion of case studies, discussion

Project: interactive calculations, results discussion Calculation of Energy performance coefficient for chosen residential building with sensitivity analysis

**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 Rzeczypospolitej 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	100	4,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work (literature studies, preparation for tests/exam, project preparation) <sup>1</sup>	55	2,0

<sup>1</sup> delete or add other activities as appropriate