STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Energy Management**		Code **1010101251010130192**
Field of study **Environmental Engineering First-cycle Studies**	Profile of study (general academic, practical) **(brak)**	Year /Semester **3 / 5**
Elective path/specialty **-**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **30** Classes: **15** Laboratory: **-** Project/seminars: **-**		No. of credits **3**
Status of the course in the study program (Basic, major, other) **(brak)**	(university-wide, from another field) **(brak)**	
Education areas and fields of science and art		ECTS distribution (number and %)

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

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.

Assumptions and objectives of the course:

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.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. The student has a theoretical and practical knowledge on the fossil and renewable primary energy sources - [K1_W03, K1_W04, K1_W07]
2. The student has a theoretical and practical knowledge on the energy balancing of simple and complex energy systems in built environment - [K1_W03, K1_W04, K1_W07]
3. The student has a theoretical and practical knowledge on the calculation of energy efficiency of simple and complex energy systems in built environment - [K1_W03, K1_W04, K1_W07]
4. The student has a theoretical and practical knowledge on the possibilities of energy usage reduction in the energy systems in built environment - [K1_W03, K1_W04, K1_W07]
5. The student knows basic methods of economic evaluation of energy systems - [K1_W06]
6. The student knows the procedures of energy planning - [K1_W03, K1_W04, K1_W06]

Skills:

1. The student can evaluate energy resources and describe them in different units - [K1_U01]
2. The student can construct the calculation model and energy balance equation for elements and energy systems used in built environment - [K1_U09, K1_U10]
3. The student can calculate energy efficiency of simple and complex energy systems used in built environment - [K1_U12, K1_U18]
4. The student can calculate simple payback time (SPBT) and net present value (NPV) for elements and energy systems used in built environment - [K1_U14]
5. The student is able to choose on the basis of multicriteria analysis the recommended scenario of energy management in built environment - [K1_U10, K1_U14]

Social competencies:

1. The student understands the need for teamwork in solving theoretical and practical problems - [K1_K03, K1_K04]
2. The student is aware of the need sustainable development of energy systems in built environment - [K1_K05]
3. The student sees the need for systematic increasing his skills and competences - [K1_K01]

Assessment methods of study outcomes

Lectures

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

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

Classes

Final colloquium (2 calculation examples).

Continuous assessment of the students (rewarding students activity).

Course description

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:

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

Basic bibliography:

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 bibliography:

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

Result of average student's workload

Activity	Time (working hours)

1. Participation in lectures	30
2. Participation in classes	15
3. Participation in consultations related to the project	3
4. Preparation for the final pass of the classes (colloquium)	15
5. Preparation for the final test of lectures	18

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	100	4
Contact hours	48	2
Practical activities	40	1