STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Municipal Energy Systems**		Code **1010102221010130349**
Field of study **Environmental Engineering Second-cycle**	Profile of study (general academic, practical) **(brak)**	Year /Semester **1 / 2**
Elective path/specialty **Heating, Air Conditioning and Air Protection**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **30** Classes: **-** Laboratory: **-** Project/seminars: **30**		No. of credits **4**
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:

prof. dr hab. inż. Tomasz Mróz
email: tomasz.mroz@put.poznan.pl
tel. (61) 6652900
Faculty of Civil and Environmental Engineering
ul. Piotrowo 5 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Classification of renewable and non-renewable primary energy sources, evaluation of energy capacity of demand and supply side of energy market; , Principles of energy balancing, economic and ecological evaluation of energy systems in built environment.
2	**Skills**	Application of energy balance equation in evaluation of energy systems in built environment; Calculation of coefficients of energy, economic and ecologic efficiency of energy systems in 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 the knowledge and skills in analysis of energy systems in communities and planning of their modernization and development.

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

Knowledge:

1. The student has a theoretical and practical knowledge on energy systems in communities - [K2_W03, K2_W04, K2_W07]
2. The student has a theoretical and practical knowledge on the structure and principles of exploitation of electro-energy systems in communities - [K2_W03, K2_W04, K2_W07]
3. The student has a theoretical and practical knowledge on the structure and principles of exploitation of gas systems in communities - [K2_W03, K2_W04, K2_W07]
4. The student has a theoretical and practical knowledge on the structure and principles of exploitation of district eating and district cooling systems in communities - [K2_W03, K2_W04, K2_W07]
5. The student knows the principles of demand and supply side analysis of energy markets in communities and market interdependences between energy sides - [K2_W06]
6. The student knows the methods of multicriteria aided planning of modernization and development of energy market in communities - [K2_W03, K2_W04, K2_W06]

Skills:

1. The student can evaluate the energy capacity of demand and supply side of energy market in communities - [K2_U09, K2_U10]
2. The student can identify and calculate the evaluation criteria of demand and supply side of energy markets in communities - [K2_U12, K2_U18]
3. The student can identify the basic trends of energy market development in communities - [K2_U01, K2_U08, K2_U18]
4. The student is able to use one of multicriteria analysis in planning of modernization and development of energy markets in communities - [K2_U10, K2_U14]

Social competencies:

1. The student understands the need for teamwork in solving theoretical and practical problems - [K2_K03]
2. The student is aware of the need to sustainable development of energy markets in communities - [K2_K05]
3. The student sees the need for systematic increasing his skills and competences - [K2_K01]

Assessment methods of study outcomes

Lectures:

Written examination ? multiple choice test consisting of 30 questions

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

Project:

- preparation and defending the project on energy planning,
- continuous assessment during lectures (rewarding activity of the students).

Course description

Lectures:

Basic knowledge on energy systems in communities: energy market, demand and supply side of energy market, market interdependency;

Description of demand and supply side of electro-energy system in communities; Principles of evaluation of demand and supply side of electro-energy system in communities;

Description of demand and supply side of gas system in communities; Principles of evaluation of demand and supply side of gas system in communities;

Description of demand and supply side of distrct heating and district cooling energy system in communities; Principles of evaluation of demand and supply side of district heating and cooling energy;

Evaluation criteria of energy systems in communities based on energy, economy and ecological issues;

Energy planning procedures based and system approach and multicriteria aided decision making (ELECTRE III/IV, AHP);

Project:

1. Energy planning for chosen Energy system in community

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, Wyd. 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 projects	30
3. Participation in consultations related to the project	6
4. Preparation of the project	20
5. Preparation for the final examination	20
6. Preparation for the defending of the project	14

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	120	4
Contact hours	66	3
Practical activities	70	1