

<b>STUDY MODULE DESCRIPTION FORM</b>		
Name of the module/subject <b>Municipal Energy Systems</b>		Code <b>1010102221010130349</b>
Field of study <b>Environmental Engineering Second-cycle</b>	Profile of study (general academic, practical) <b>(brak)</b>	Year /Semester <b>1 / 2</b>
Elective path/specialty <b>Heating, Air Conditioning and Air Protection</b>	Subject offered in: <b>Polish</b>	Course (compulsory, elective) <b>obligatory</b>
Cycle of study: <b>Second-cycle studies</b>	Form of study (full-time, part-time) <b>full-time</b>	
No. of hours Lecture: <b>30</b> Classes: <b>-</b> Laboratory: <b>-</b> Project/seminars: <b>30</b>		No. of credits <b>4</b>
Status of the course in the study program (Basic, major, other) <b>(brak)</b>		(university-wide, from another field) <b>(brak)</b>
Education areas and fields of science and art <b>technical sciences</b>		ECTS distribution (number and %) <b>4 100%</b>
<b>Responsible for subject / lecturer:</b>  dr hab. inż. Tomasz Mróz, prof. nadzw. email: tomasz.mroz@put.poznan.pl tel. (61) 6652900 Faculty of Civil and Environmental Engineering ul. Piotrowo 5 60-965 Poznań		
<b>Prerequisites in terms of knowledge, skills and social competencies:</b>		
1	<b>Knowledge</b>	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	<b>Skills</b>	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	<b>Social competencies</b>	Awareness of the need to constantly update and supplement knowledge and skills.
<b>Assumptions and objectives of the course:</b> Purchase by the students the knowledge and skills in analysis of energy systems in communities and planning of their modernization and development.		
<b>Study outcomes and reference to the educational results for a field of study</b>		
<b>Knowledge:</b> 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 heating 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]		
<b>Skills:</b>		

<p>1. The student can evaluate the energy capacity of demand and supply side of energy market in communities - [K2_U09, K2_U10]</p> <p>2. The student can identify and calculate the evaluation criteria of demand and supply side of energy markets in communities - [K2_U12, K2_U18]</p> <p>3. The student can identify the basic trends of energy market development in communities - [K2_U01, K2_U08, K2_U18]</p> <p>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]</p>
<p><b>Social competencies:</b></p>
<p>1. The student understands the need for teamwork in solving theoretical and practical problems - [K2_K03]</p> <p>2. The student is aware of the need to sustainable development of energy markets in communities - [K2_K05]</p> <p>3. The student sees the need for systematic increasing his skills and competences - [K2_K01]</p>

<b>Assessment methods of study outcomes</b>	
<p>Lectures:</p> <p>Written examination ? multiple choice test consisting of 30 questions</p> <p>Continuous assessment during lectures (rewarding activity of the students).</p> <p>Project:</p> <p>- preparation and defending the project on energy planning,</p> <p>- continuous assessment during lectures (rewarding activity of the students).</p>	
<b>Course description</b>	
<p>Lectures:</p> <p>Basic knowledge on energy systems in communities: energy market, demand and supply side of energy market, market interdependency;</p> <p>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;</p> <p>Description of demand and supply side of gas system in communities; Principles of evaluation of demand and supply side of gas system in communities;</p> <p>Description of demand and supply side of district heating and district cooling energy system in communities; Principles of evaluation of demand and supply side of district heating and cooling energy;</p> <p>Evaluation criteria of energy systems in communities based on energy, economy and ecological issues;</p> <p>Energy planning procedures based and system approach and multicriteria aided decision making (ELECTRE III/IV, AHP);</p> <p>Project:</p> <p>1. Energy planning for chosen Energy system in community</p>	
<p><b>Basic bibliography:</b></p> <p>1. Szargut J., Ziębik A.: Termodynamika techniczna. Warszawa, WNT 2001.</p> <p>2. Marecki J.: Podstawy przemian energetycznych. Warszawa, WNT 2000.</p> <p>3. Chmielniak T: Technologie energetyczne. Warszawa, WNT 2008.</p> <p>4. Szargut J., Guzik J.: Programowany zbiór zadań z termodynamiki technicznej. Warszawa, WNT 1980.</p> <p>5. Rocznik statystyczny Rzeczypospolitej Polskiej 2010. Warszawa, ZWS 2011.</p> <p>6. Mróz, T.M.: Planowanie modernizacji i rozwoju komunalnych systemów zaopatrzenia w ciepło. Wydawnictwo Politechniki Poznańskiej, seria rozprawy Nr 400, 2006,</p> <p>7. Mróz T.M.: Energy Management in Built Environment. Tools and Evaluation Procedures, Wyd. Politechniki Poznańskiej 2013</p>	
<p><b>Additional bibliography:</b></p> <p>1. Kreith, F., West, R.E.: CRC Handbook of Energy Efficiency. CRC Press Inc. 1997.</p>	
<b>Result of average student's workload</b>	
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	
<b>Student's workload</b>		
<b>Source of workload</b>	<b>hours</b>	<b>ECTS</b>
Total workload	120	4
Contact hours	66	3
Practical activities	70	1