

<b>STUDY MODULE DESCRIPTION FORM</b>		
Name of the module/subject <b>Municipal Energy Systems</b>		Code <b>1010135221010130349</b>
Field of study <b>Enviromental Engineering Extramural Second-</b>	Profile of study (general academic, practical) <b>(brak)</b>	Year /Semester <b>1 / 2</b>
Elective path/specialty <b>Heating, Air Conditioning and And</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>part-time</b>	
No. of hours Lecture: <b>20</b> Classes: <b>-</b> Laboratory: <b>-</b> Project/seminars: <b>10</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. Marek Juszczyk email: marek.juszczyk@put.poznan.pl tel. (61) 6652524 Faculty of Civil and Environmental Engineering ul. Piotrowo 5 60-965 Poznań		<b>Responsible for subject / lecturer:</b> dr inż. Łukasz Amanowicz email: lukasz.amanowicz@put.poznan.pl tel. (61)6652524 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, assess the potential of energy supply and demand side of the energy market, Fundamentals of balancing energy and the evaluation of the economic and ecological energy systems used in engineering, the built environment and undeveloped
2	<b>Skills</b>	The use of the energy balance in the evaluation of energy management in engineering, the built environment and undeveloped; Determination of indicators to assess energy efficiency, economic and ecological energy management systems in engineering, the built environment and undeveloped
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> Aim of course: Acquiring knowledge and skills of system analysis of municipal energy systems and planning their modernization and development.		
<b>Study outcomes and reference to the educational results for a field of study</b>		
<b>Knowledge:</b>		
1. Student has ordered and theoretically founded knowledge in the field of municipal energy systems - [[K2_W03, K2_W04, K2_W07]]		
2. Student has ordered and theoretically founded knowledge of the structure and functioning of the municipal power system - [[K2_W03, K2_W04, K2_W07]]		
3. Student has ordered and theoretically founded knowledge of the structure and functioning of the municipal gas system - [[K2_W03, K2_W04, K2_W07]]		
4. Student has ordered and theoretically founded knowledge of the structure and functioning of the municipal system thermal-cooling - [[K2_W03, K2_W04, K2_W07]]		
5. The student knows the principles of the analysis of the supply side and the demand of municipal energy markets and market mechanisms linking these pages - [[K2_W06]]		
6. The student knows the chosen methods of multi-criteria support the planning of modernization and development of municipal energy systems - [[K2_W03, K2_W04, K2_W06]]		
<b>Skills:</b>		

<p>1. The student is able to assess the energy potential of the supply side and the demand of municipal energy systems - [[K2_U09, K2_U10]]</p> <p>2. The student knows how to calculate identify and enumerate the criteria for assessing the supply side and the demand of municipal energy markets - [[K2_U12, K2_U18]]</p> <p>3. The student is able to identify basic trends of development of municipal energy markets - [[K2_U01, K2_U08, K2_U18]]</p> <p>4. The student can apply the chosen method for the assessment of multi-planning modernization and development of municipal energy markets - [[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 develop sustainable urban energy systems - [[K2_K05]]</p> <p>3. The student sees the need for systematic deepening and broadening of its powers - [[K2_K01]]</p>

<b>Assessment methods of study outcomes</b>	
<p>-Lecture:</p> <ul style="list-style-type: none"> <li>- 2-part exam part. 1 checking skills (2 jobs), part. 2 knowledge test (4 questions)</li> <li>- Continuous assessment for each class (rewarding activity).</li> </ul> <p>Quarter. design</p> <ul style="list-style-type: none"> <li>- Preparation and defense of the project in the field of energy planning,</li> <li>- Continuous assessment for each class (rewarding activity).</li> </ul>	
<b>Course description</b>	
<p>-Basic concepts of municipal energy systems: energy market, the demand side of the energy market; supply side of the energy market, the market mechanism;</p> <p>Rules for the assessment of supply and demand side of the municipal power system, the principles of the assessment of supply-side and demand municipal gas system, rules for the assessment of supply and demand side of the municipal system thermal-cooling;</p> <p>Criteria for evaluation of municipal energy systems related to their energy performance, environmental and economic;</p> <p>Methods for energy planning based on the analysis of system and multi-criteria decision support;</p> <p>Decomposition method of diagnosis in identifying global trends of modernization of municipal development systems energetycznych;</p> <p>Methods of multi-criteria decision support: the weighted sum method, methods based on the relationship of the topping (ELECTRE III / IV), methods of hierarchical analysis (AHP)</p> <p>Subject design exercises:</p> <ol style="list-style-type: none"> <li>1. Planning the modernization and development of the municipal power system</li> </ol>	
<p><b>Basic bibliography:</b></p> <ol style="list-style-type: none"> <li>1. Szargut J., Ziębik A.: Termodynamika techniczna. Warszawa, WNT 2001.</li> <li>2. Marecki J.: Podstawy przemian energetycznych. Warszawa, WNT 2000.</li> <li>3. Chmielniak T: Technologie energetyczne. Warszawa, WNT 2008.</li> <li>4. Szargut J., Guzik J.: Programowany zbiór zadań z termodynamiki technicznej. Warszawa, WNT 1980.</li> <li>5. Rocznik statystyczny Rzeczpospolitej Polskiej 2010. Warszawa, ZWS 2011.</li> <li>6. Mróz, T.M.: Planowanie modernizacji i rozwoju komunalnych systemów zaopatrzenia w ciepło. Wydawnictwo Politechniki Poznańskiej, seria rozprawy Nr 400, 2006.</li> </ol>	
<p><b>Additional bibliography:</b></p> <ol style="list-style-type: none"> <li>1. Kreith, F., West, R.E.: CRC Handbook of Energy Efficiency. CRC Press Inc. 1997.</li> </ol>	
<b>Result of average student's workload</b>	
Activity	Time (working hours)

1. Participation in lectures:	20
2. Participation in the project activities:	10
3. Participation in the consultations related to the implementation of the project (assuming that the student uses 3 consultations)	5
4. Implementation of the project activities (own work at home, including eg. Install and mastering software):	20
5. Preparing to pass the final project:	5
6. Preparation for the final exam of the lectures:	10
<b>Student's workload</b>	
<b>Source of workload</b>	<b>hours</b>
<b>ECTS</b>	
Total workload	70
Contact hours	55
Practical activities	15