# STUDY MODULE DESCRIPTION FORM

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| Name of the module/subject<br>**Municipal Energy Systems** | | Code<br>**1010102221010130349** |
| Field of study<br>**Environmental Engineering Second-cycle** | Profile of study (general academic, practical)<br>**(brak)** | Year /Semester<br>**1 / 2** |
| Elective path/specialty<br>**Heating, Air Conditioning and Air Protection** | Subject offered in:<br>**Polish** | Course (compulsory, elective)<br>**obligatory** |
| Cycle of study:<br>**Second-cycle studies** | Form of study (full-time,part-time)<br>**full-time** | |
| No. of hours<br>Lecture: **30** Classes: **15** Laboratory: **-** Project/seminars: **15** | | No. of credits<br>**4** |
| Status of the course in the study program (Basic, major, other)<br>**(brak)** | (university-wide, from another field)<br>**(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:

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| 1 | **Knowledge** | Classification of renewable and non-renewable primary energy sources, evaluation of energy capacity of demand and supply side of energy market; ,<br>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;<br>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).

Classes:

- Final colloquium - 3 calculation examples

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) |
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|---|---|
| 1. Participation in lectures | 30 |
| 2. Participation in projects | 15 |
| 3. Participation in classes | 15 |
| 4. Participation in consultations related to the project | 6 |
| 5. Preparation of the project | 10 |
| 6. Preparation for the final examination | 20 |
| 7. Preparation for the defending of the project | 14 |
| 8. Preparation for final colloquium | 10 |

**Student's workload**

| Source of workload | hours | ECTS |
|---|---|---|
| Total workload | 100 | 4 |
| Contact hours | 66 | 3 |
| Practical activities | 50 | 2 |