COURSE DESCRIPTION CARD - SYLLABUS

Course name
Energy Management [N1IŚrod2>GE]

Course

Field of study
Environmental Engineering

Year/Semester
4/8

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
20

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge on thermodynamics and heat engineering 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 Awareness of the need to constantly update and supplement knowledge and skills.

Course objective

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.

Course-related learning outcomes

Knowledge:
1. The student has a theoretical and practical knowledge on the fossil and renewable primary energy sources.
2. Has a theoretical and practical knowledge on the energy balancing of simple and complex energy systems in built environment.
3. Has a theoretical and practical knowledge on the calculation of energy efficiency of simple and

complex energy systems in built environment.
4. Has a theoretical and practical knowledge on the possibilities of energy usage reduction in the energy systems in built environment.
5. Knows basic methods of economic evaluation of energy systems.
6. Knows the procedures of energy planning.

Skills:
1. The student can evaluate energy resources and describe them in different units
2. Can construct the calculation model and energy balance equation for elements and energy systems used in built environment
3. Can calculate energy efficiency of simple and complex energy systems used in built environment
4. Can calculate simple payback time (SPBT), net present value (NPV) and total operation cost (TOC) for elements and energy systems used in built environment
5. Is able to choose on the basis of multicriteria analysis the recommended scenario of energy management in built environment

Social competences:
1. The student understands the need for teamwork in solving theoretical and practical problems
2. Is aware of the need sustainable development of energy systems in built environment
3. Sees the need for systematic increasing his skills and competences

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:
Test. Rating scale: 0-50%: 2,0; 51-60%: 3,0; 61-70%: 3,5; 71-80%: 4,0; 81-90%: 4,5; 91-100%: 5,0. .
The possibility of adjusting the thresholds in accordance with the study regulations.

Programme content

Lectures:
1. Basic concepts of energy management.
2. The building as an energy system.
3. principle of energy balancing and determination of energy efficiency of simple and complex energy systems.
4. introduction to heat, electricity and cooling production systems.
5. The principle of avoided costs in energy management.
6. Static and dynamic methods of economic evaluation of energy projects: simple payback time (SPBT), net present value (NPV), total operating cost (TOC).
7. Fundamentals of energy planning, method of multi-criteria evaluation of energy projects.

Course topics

Carbon footprint of economy - Kaya equation; model of thermodynamically open system; energy balace equation in integral and differencial form; energy efficiency; energy balance for simple systems: steam turbine, heat exchanger, compressor, circulation pump; energy balance fo complex systems: gas fired boiler, cogenerated heat and power plant, air handling unit, compressor heat pump, absorption water chiller; application of SPBT method for evaluation of heat recovery system; application of NPV method for evaluation of district heatin system; application of IRR method in evaluation of chilled water production an distribution system

Teaching methods

Lectures:
Informative lecture with elements of a conversational lecture; Multimedia presentation; Discussion; Discussing case studies

Bibliography

Basic:
[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, 2022.

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

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	20	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00