COURSE DESCRIPTION CARD - SYLLABUS

Course name
Energy management in built environment [S1BZ1E>GEŚZ]

Course

Field of study
Sustainable Building Engineering

Year/Semester
2/4

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

1,00

Coordinators

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Lecturers

Prerequisites

Fundamentals knolwedge of technical thermodynamics and thermal technology, Application of energy balance in the assessment of energy management in built environment engineering; Determination of thermodynamic efficiency of energy systems occurring in built environment engineering

Course objective

Gaining knowledge and skills in the field of energy management necessary to solve problems in systems of built environment engineering

Course-related learning outcomes

Knowledge:
know basic methods, techniques, tools and materials applied to solve simple engineering tasks in the field of environmental engineering.
have knowledge of thermal comfort and air quality in high-energy standard buildings.
know building legislation, Polish standards (PN) and European standards (EN), technical conditions of constructing building facilities and energy-saving buildings.
have structured and theoretically based knowledge of key problems of heat technique, technical

thermodynamics, heat and mass exchange, fluid mechanics (including fluid-flow machines), environmental biology and environmental chemistry.

Skills:
are able to carry out both chemical and biological experiments, including measurements and computer simulation, in the field of: quality assessment of building and installation materials, simple engineering constructions, systems of technical fitting of buildings, external infrastructure, elements and systems applied in the built environment engineering, thermal comfort and air quality; can clearly present and interpret the obtained results and draw conclusions.
are able to critically analyse and evaluate the way of performance of a given technical solution in the field of environmental engineering.

Social competences:
understand the need to transfer to the society the knowledge about sustainable building engineering, transfers the knowledge in a clear and easily comprehensible manner.
are ready to autonomously complete and broaden knowledge in the field of modern processes and technologies of building engineering.
understand the need of team work, are responsible for the safety of their own work and team’s work.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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lectures Passing the lecture test based on the following point criterion: Passing from 51% of the obtained points 51-60% - 3.0 61-70% - 3.5 71-80% - 4.0 81-90% - 4.5 From 91% - 5.0 The possibility of adjusting the thresholds in accordance with the regulations of studies - continuous assessment during each class (rewarding activity).

Programme content

Basic concepts of energy management: definition of energy economy, non-renewable primary fuels, renewable primary fuels, refined fuels, energy chain, gross and net energy efficiency, non-renewable primary energy input rate; carbon dioxide emission factor;
Principle of energy balancing of simple and complex energy systems, determination of energy efficiency of complex energy systems;
Combined heat and electricity production systems (co-generation systems) and heat, cold and electricity production (tri-generation systems); the principle of avoided costs in energy management,
Static and dynamic methods of economic evaluation of energy projects: simple payback time (SPBT), net present value (NPV),
Fundamentals of energy planning based on the multi-criteria evaluation method of energy projects: weighted sum method.

Course topics

Carbon footprint of economy - Kaya equation; Energy balance equation of thermodynamically open system; Building as energy system; Energy balance of buiding's energy systems: cogenerated heat and power plant, compressor heat pump, absorption water chiller; Exergy balance of buiding's energy systems: cogenerated heat and power plant, compressor heat pump, absorption water chiller;
Application of SPBT and NPV methods in evaluation of building's energy systems

Teaching methods

Lecture: lecture based on a multimedia presentation, interactive discussion of case studies, discussion.

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. Mróz, T.M.: Planowanie modernizacji i rozwoju komunalnych systemów zaopatrzenia w ciepło. Wydawnictwo Politechniki Poznańskiej, seria rozprawy Nr 400, 2006.
6. Mróz, T.M.: Energy Management in Built Environment. Tools and Evaluation Procedures. Wydawnictwo Politechniki Poznańskiej, 2013.
Additional
1. Kreith, F., West, R.E.: CRC Handbook of Energy Efficiency. CRC Press Inc. 1997.
2. Biuletyn Międzynarodowej Agencji Energii 2017 www.iea.org
3. Rocznik statystyczny Rzeczpospolitej Polskiej 2017. Warszawa, ZWS 2017.

Breakdown of average student's workload

	Hours	ECTS
Total workload	30	1,00
Classes requiring direct contact with the teacher	15	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	15	0,50