



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Low emission energy technologies [S2TOZ1-TSO>NTE]

Course

Field of study

Circular System Technologies

Year/Semester

2/3

Area of study (specialization)

Renewable raw material technologies

Profile of study

general academic

Level of study

second-cycle

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

15

Laboratory classes

0

Other

0

Tutorials

0

Projects/seminars

0

Number of credit points

1,00

Coordinators

dr hab. inż. Katarzyna Materna prof. PP
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Lecturers

Prerequisites

The student possesses organized, theoretically grounded knowledge of key issues related to technologies used in the circular economy. They can effectively gather information from literature, databases, and other sources, including in English, as well as analyze, interpret, draw conclusions, and formulate justified opinions. The student is capable of collaborating in a team and prioritizing tasks necessary for the achievement of set objectives.

Course objective

Acquiring knowledge about modern energy technologies that reduce greenhouse gas emissions and other pollutants, while also increasing energy efficiency, contributing to the reduction of the negative impact of the energy sector on the environment.

Course-related learning outcomes

Knowledge:

1. The student possesses advanced and detailed knowledge of the principles of sustainable production and key trends and practices in low-emission energy technologies, which are essential for implementing circular economy strategies. [K_W03]

2. The student has advanced and systematic knowledge that enables the identification and assessment of environmental harmful factors, as well as the implementation of solutions related to low-emission energy technologies aimed at minimizing negative impacts on ecosystems. [K_W04]
3. The student possesses in-depth knowledge of advanced energy technologies that reduce pollution emissions and methods for optimizing energy production processes, supporting sustainable development and minimizing impact on the natural environment. [K_W05]

Skills:

1. The student can effectively communicate verbally with specialists in low-emission energy technologies, sustainable development, and circular economy, as well as with experts from related fields. [K_U01]
2. The student has the ability to selectively apply knowledge from chemistry and related fields in planning and executing research tasks related to low-emission energy technologies, and can also analyze their impact on the environment in the context of the circular economy. [K_U08]
3. The student is capable of working independently, planning and implementing lifelong learning, and collaborating in a team. [K_U05, K_U09]

Social competences:

1. The student understands the need to popularize knowledge about low-emission energy technologies and sustainable technological solutions that support the circular economy. [K_K01]
2. The student critically assesses their knowledge in the field of low-emission energy technologies, understands the necessity of continuous education, and recognizes the importance of enhancing their professional, personal, and social competencies in the area of modern sustainable technologies. [K_K03]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture - written credit; evaluation criteria:

- Satisfactory: 50.1% - 60.0%
- Satisfactory Plus: 60.1% - 70.0%
- Good: 70.1% - 80.0%
- Good Plus: 80.1% - 90.0%
- Very Good: 90.1% and above.

Programme content

The program content covers topics related to technologies that reduce greenhouse gas emissions, systems that enhance energy efficiency, and methods that minimize the negative environmental impacts of the energy industry.

Course topics

1. Introduction to Low-Emission Energy Technologies: Definition and significance of low-emission technologies, the role of the energy sector in the global CO₂ emissions balance, and international regulations (e.g., the European Green Deal, the Paris Agreement).
2. Conventional Energy Sources and Emission Reduction: Challenges related to the use of fossil fuels, emission reduction technologies, and sustainable energy production technologies from natural gas (e.g., cogeneration, trigeneration systems).
3. Carbon Capture and Storage (CCS) Technologies.
4. Alternative Fuels and Their Role in Emission Reduction.
5. Future Technologies in Energy.
6. Case Studies and Industrial Implementations: Analysis of industrial cases, such as power plants with CCS technologies, hydrogen projects, and their impact on the economy.

Teaching methods

Lecture - multimedia presentation.

Bibliography

Basic:

1. Klugmann-Radziemska E., Energetyka i ochrona środowiska : generowanie i magazynowanie energii : odpady energetyczne : analiza cyklu życia, Wydawnictwo Naukowe PWN, Warszawa 2023.
2. Rybak A.: Rola i przyszłość węgla w zapewnieniu bezpieczeństwa energetycznego Polski, Wyd. Politechniki Śląskiej, Gliwice 2020.
3. Mazurkiewicz J., Pająk K.: Gospodarka niskoemisyjna: uwarunkowania i wyzwania, Wydawnictwo Adam Marszałek, Toruń 2014.
4. Kwiatkiewicz P., Szczerbowski R., Energetyka - aspekty badań interdyscyplinarnych : prawo i polityka, zrównoważony rozwój i OZE, ekonomia, technika, bezpieczeństwo, Fundacja na rzecz Czystej Energii, Poznań 2018.

Additional:

1. Jabłoński J.: Technologie "zero emisji", Wydawnictwo Politechniki Poznańskiej, Poznań 2011.
2. Chmielniak T., Łukowicz H.: Modelowanie i optymalizacja węglowych bloków energetycznych z wychwytem CO₂, Wydawnictwo Politechniki Śląskiej, Gliwice 2015.

Breakdown of average student's workload

	Hours	ECTS
Total workload	25	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)	10	0,50