GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Energy recovery from waste biomass, PG_00055976		
Field of study	Power Engineering, Power Engineering, Power Engineering		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish -
Semester of study	6	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Environmental Engineering Technology -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Aneta Łuczkiewicz	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	15.0	15.0	0.0	60
E-learning hours included: 0.0						

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	60	5.0	60.0	125

Subject objectives

Familiarizing students with technologies for the energy use of biomass and waste, their fuel properties, the energy balance of processes, environmental impacts, and the legal and economic conditions governing such installations.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W07] knows the basics of economic calculus in the energy sector; knows the legal, organizational and economic principles of the functioning of energy markets, knows the basic principles of management and running a business	The student knows and understands the fundamentals of using biomass and waste for energy purposes, as well as the basic legal, organizational, and economic conditions governing the operation of such installations in the energy sector and waste management.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K6_W17] has an elementary knowledge on land mechanics, ground science, land reclamation and geotechnics; has basic knowledge about the composition of air, water and soil, environmental pollution and processes responsible for their formation and ways to reduce them, student knows the principles and organization of sustainable resource management within a circular economy	The student knows and understands the possibilities of using biomass and waste, as well as the basic environmental and siting conditions for such installations, including issues related to pollutant emissions and methods of their reduction. The student is familiar with the fundamental principles of resource management in line with the assumptions of the circular economy	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
[K6_W06] knows classic and developmental energy technologies, rules for the selection and operation of heat and energy devices and installations, basic principles of energy systems operation, basic issues regarding the reliability of energy devices and diagnostics, environmental effects of energy technologies used, methods of using renewable energy sources	The student knows and understands technologies for the energy use of biomass and waste, in particular combustion, co-combustion, gasification, pyrolysis, and anaerobic digestion, as well as the principles of selecting and the basic operation of equipment and installations used for energy conversion. The student understands the role of these technologies in energy systems and their environmental impacts.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects

Subject contents

Course content – lecture
undamentals of energy recovery from waste and biomass in the context of the energy transition, the circular economy, and climateenergy policy. Characteristics of biomass and waste as fuels, their physicochemical properties, classification, and preparation for energy conversion processes. Overview of thermochemical and biochemical technologies: combustion, cocombustion, gasification, pyrolysis, and anaerobic digestion. Mass and energy balances of processes, installation efficiency, pollutant emissions, and methods of their reduction. Technologies for energy recovery from municipal, industrial, and agricultural waste. Production of heat, electricity, and gaseous and liquid fuels from biomass and waste. Environmental, economic, legal, and operational aspects of energy recovery facilities. Assessment of the energy potential of biomass and waste, as well as development directions of modern WastetoEnergy and Bioenergy technologies.

Course content – laboratory
Investigation of the basic fuel properties of biomass and waste. Determination of moisture content, ash content, and calorific value. Calculations of combustion air demand and flue gas quantities. Mass and energy balancing of energy processes and analysis of installation efficiency

Course content – project
Development of a concept for an energyrecovery installation using biomass or waste, selection of appropriate technologies, preparation of a simplified material and energy balance, and assessment of environmental and legal aspects.

Prerequisites and co-requisites

Fundamentals of chemistry, thermodynamics, environmental protection and waste management

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Lecture	60.0%	40.0%
Laboratory	60.0%	30.0%
Project	60.0%	30.0%

Recommended reading

Basic literature	Official EU legal acts (EURLex), Polish legal acts (ELI), and strategic documents from gov.pl: the Waste Framework Directive 2008/98/EC, the Renewable Energy Directive 2018/2001, the Industrial Emissions Directive 2010/75/EU, the Waste Act, the Renewable Energy Sources Act, the Energy Law, the Environmental Protection Law, emission standards, the Polish Energy Policy until 2040 (PEP2040), the National Waste Management Plan 2028 (KPGO 2028), the National Energy and Climate Plan for 20212030, and the Draft Update of the National Energy and Climate Plan for 2030.
Supplementary literature	-
eResources addresses	

Example issues/ example questions/ tasks being completed

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Practical activites within the subject

Not applicable

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