



## Subject card

Subject name and code	Alternative energy sources, PG_00038547						
Field of study	Chemical Technology						
Date of commencement of studies	February 2023	Academic year of realisation of subject				2023/2024	
Education level	second-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	1	Language of instruction				Polish	
Semester of study	2	ECTS credits				3.0	
Learning profile	general academic profile	Assessment form				exam	
Conducting unit	Department of Energy Conversion and Storage -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Anna Dettlaff				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	0.0	30
	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	30		10.0		35.0	75
Subject objectives	Introducing students to the renewable energy sources.						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	K7_K01		student can critically evaluate the received content and use the acquired view to solve cognitive and practical problems			[SK5] Assessment of ability to solve problems that arise in practice	
	K7_K03		understands the non-technical aspects of the operation of a chemical engineer master's degree, including the impact on the environment, is aware of the responsibility for the decisions made			[SK5] Assessment of ability to solve problems that arise in practice	
	K7_W07		the student has knowledge of biotechnological processes such as biogas production			[SW1] Assessment of factual knowledge	
Subject contents	Resources and characteristics of renewable energy sources; hydropower (energy of water flow, energy of water level differences, energy of waves, energy of tides, energy of currents); solar energy (low-temperature and high-temperature solar energy systems, active and passive systems, decentralized systems, centralized systems, solar collectors, photovoltaic cells); wind energy (lifting force, wind farm capacity, onshore and offshore wind farms); geothermal energy (geothermal energy resources, heat pumps); solid, liquid and gaseous biofuels (energy wood, straw, biodiesel, bioethanol, biomethanol, biohydrogen, biogas, wood gas); energy storage (technologies of mechanical, electrochemical, electric, chemical and thermal energy storage, hydrogen energy, galvanic cells, fuel cells, electrochemical capacitors); conventional energy sources (hard coal, lignite, crude oil, natural gas); nuclear energy (principle of operation, construction of the core of a nuclear power plant, types of nuclear reactors, nuclear energy in Poland); environmental contamination						
Prerequisites and co-requisites							
Assessment methods and criteria	Subject passing criteria		Passing threshold			Percentage of the final grade	
	Test		60.0%			100.0%	

Recommended reading	Basic literature	1. Bogdanienko J.: Odnawialne Źródła Energii. Biblioteka Problemów, t. 290. Warszawa, PWN 1989. Brinkworth B.J.: Energia Słoneczna w Służbie Człowieka. Biblioteka Problemów, t. 254. Warszawa, PWN 1979. 2. Cieśliński J., Mikielwicz J.: Niekonwencjonalne źródła energii. Gdańsk, Wydawnictwo Politechniki Gdańskiej 1996. 3. Mikielwicz J., Cieśliński J.T.: Niekonwencjonalne urządzenia i systemy konwersji energii. Seria Maszyny Przepływowe, t. 24. Wrocław, Ossolineum 1999. 4. Lewandowski W.M., Klugmann-Radziemska E., Proekologiczne odnawialne źródła energii - kompendium, PWN Warszawa 2017. 5. Klugmann E., Klugmann-Radziemska E.: Alternatywne źródła energii. Energetyka fotowoltaiczna. Białystok, Wydawnictwo Ekonomia i Środowisko 1999. 6. Klugmann-Radziemska E., Klugmann E.: Systemy słonecznego ogrzewania i zasilania elektrycznego budynków. Wyd. Ekonomia i Środowisko, Białystok 2002. 7. Planning and Installing Solar Thermal Systems, a guide for installers, architects and engineers, The German Solar Energy Society (DGS LV Berlin BRB), Ecofys 2005
	Supplementary literature	No recommendations
	eResources addresses	
Example issues/ example questions/ tasks being completed	<p>What are the differences between a solar collector and a photovoltaic cell?</p> <p>Describe how the heat pump works. How does a nuclear power plant work?</p>	
Work placement	Not applicable	