



Subject card

Subject name and code	Life cycle assesment of nuclear power plants, PG_00065902						
Field of study	Nuclear Engineering						
Date of commencement of studies	February 2025		Academic year of realisation of subject		2025/2026		
Education level	second-cycle studies		Subject group		Specialty 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	Zakład Systemów i Urządzeń Energetyki Ciepłej -> Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Michał Pysz				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	15.0	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		8.0		37.0	75
Subject objectives	To introduce students with the basic tools and methods for determining the environmental footprints generated by energy technologies and, in particular, by the nuclear power sector.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_U14] integrates information obtained from literature and other properly selected sources, including those in a foreign language, creatively interpreting and critically evaluating them, and drawing conclusions		is able to use scientific publications on life cycle analysis and extract the necessary information for the project. In addition, it is able to use the ISO 14040 and ISO 14044 standards to conduct a life cycle analysis of a nuclear power plant.		[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information		
	[K7_W03] demonstrates structured and theory supported knowledge encompassing key issues in the field of Nuclear Power Technologies, enabling design of energy processes and systems		knows the key processes involved in the construction, operation and decommissioning of a nuclear power plant and can assign the corresponding environmental impacts		[SW1] Assessment of factual knowledge		
	[K7_U11] communicates and justifies opinions on specialized topics in a manner understandable to diverse audiences, including the use of modern techniques, including information technology		can analyse and present the results of the life-cycle analysis to the group		[SU5] Assessment of ability to present the results of task [SU3] Assessment of ability to use knowledge gained from the subject		
	[K7_U04] creatively designs or modifies, either entirely or at least in part, nuclear power systems, considering both technical and non-technical aspects, estimating costs and utilizing design techniques appropriate for tasks within the scope of Nuclear Power Technologies		performed a life cycle analysis for a designated facility, process or equipment using available tools and standards		[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment		

Subject contents	Lecture: 1. Introduction to life cycle analysis (LCA) - historical background, limitations and drawbacks, assumptions used in models2. definition of the objective and scope of the analysis - introduction to ISO standards, reference to good engineering practice, presentation of examples, definition of model boundaries3. inventory - basic principles for creating databases, creating inventory questionnaires, global databases4 Impact assessment - representation of environmental impacts according to commercially available models, normalisation and weighting of impacts5 Interpretation of results - uncertainty analysis, sensitivity analysis, introduction to Monte Carlo method6. nuclear power plant life cycle analysis - nuclear power plant construction (site preparation, material transport, impact and composition of construction materials and equipment)7 Nuclear power plant life cycle analysis - nuclear fuel extraction and reprocessing8. nuclear power plant life cycle analysis - power plant operation (water consumption, equipment, overhaul)9. nuclear power plant life cycle analysis - decommissioning (spent fuel storage, post plant land use, material disposal)Project:Implementation of an environmental life cycle analysis based on the knowledge gained from the lectures.		
Prerequisites and co-requisites	Chemistry: stoichiometric equations, materials engineering, Mechanical engineering: technological processes		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	project	60.0%	40.0%
	exam	60.0%	60.0%
Recommended reading	Basic literature	G. Sonnemann, M. Tsang, M. Schuhmacher, Integrated Life-Cycle and Risk Assessment for Industrial Processes and Products, Taylor & Francis, Floryda 2019 M. Góralczyk, Z. Kowalski, Ekologiczna ocena cyklu życia procesów wytwórczych (LCA), Wydawnictwo Naukowe PWN, 2007 Standards ISO 14040 i ISO 14044	
	Supplementary literature	Scientific literature from databases such as Scopus, WoS	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	<ul style="list-style-type: none">Life cycle analysis phases: Goal and Scope Definition; Life Cycle Inventory (LCI) input-output data set analysis; Life Cycle Impact Assessment (LCIA); Interpretation of results.Principles of system boundaries in LCA (System Boundaries).Product Functionality Analysis: Functional Unit.The role of databases in life cycle analysis (e.g. Ecoinvent).Allocation methods in LCA (Allocation Methods): allocation of impacts in multi-product processes.Environmental impact categories in LCIA:What are the key phases of the life cycle of a nuclear power plant that should be included in the LCA analysis?How is the functional unit defined in a nuclear LCA analysis?What system boundaries should be adopted in an LCA for a nuclear power plant (e.g. from uranium mining to waste management)?		
Work placement	Not applicable		

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