Warsaw University of Technology | Doctoral School No. 4

Course offered in the Doctoral School No. 4 – Spring semester of the 2021/2022 academic year

TITLE
Mathematical modeling and computer simulation of distributed energy systems
CONDUCTING UNIT
Doctoral School No. 4
SCIENTIFIC DISCIPLINE
Environmental engineering, mining and energy
IMPLEMENTING UNIT
113000 - Faculty of Power and Aeronautical Engineering
SUMMARY DESCRIPTION
In the part related to the lecture, various distributed energy sources and their application are discussed, as well as legal aspects related to distributed generation. Sources that can operate as distributed are: reciprocating engines; gas turbines; Stirling engines; combined systems based on gas turbines and reciprocating engines; small hydropower plants; wind farms; photovoltaic systems (direct method); geothermal power plants; fuel cells; heliothermic systems (indirect method); systems using: biomass and waste, tides, currents, sea waves and heat; heat pumps etc. Technical parameters and characteristics of selected distributed sources are discussed during the lecture. During the laboratories, the method of modeling selected distributed energy sources with the use of commercial software is presented. The software used during the classes is Aspen HYSYS and DWSIM. To pass, doctoral students must submit a project. As part of the project, doctoral students must build a mathematical model of the selected distributed energy source.
FULL DESCRIPTION
In the part related to the lecture, various distributed energy sources and their application are discussed, as well as legal aspects related to distributed generation. Sources that can operate as distributed are: reciprocating engines; gas turbines; Stirling engines; combined systems based on gas turbines and reciprocating engines; small hydropower plants; wind farms; photovoltaic systems (direct method); geothermal power plants; fuel cells; heliothermic systems (indirect method); systems using: biomass and waste, tides, currents, sea waves and heat; heat pumps etc. Technical parameters and characteristics of selected distributed sources are discussed during the lecture.

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LITERATURE

1. Gevorg Gharehpetian, Mohammad Mousavi. Distributed Generation Systems: Design, Operation and Grid Integration, BUTTERWORTH HEINEMANN, 2017.
2. Handbook of Distributed Generation: Electric Power Technologies, Economics and Environmental Impacts, Springer, Cham, 2017.
3. Jan Popczyk. Energetyka rozproszona. Od dominacji energetyki w gospodarce do zrównoważonego rozwoju, od paliw kopalnych do energii odnawialnej i efektywności energetycznej. Polski Klub Ekologiczny Okręg Mazowiecki, Warszawa 2011
4. Ł. Szabłowski. Strategia sterowania źródłami pracującymi w systemie energetyki rozproszonej. Rozprawa doktorska. Politechnika Warszawska, Wydział Mechaniczny Energetyki i Lotnictwa, Warszawa 2013
5. Ł. Szabłowski, J. Milewski, K. Badyda. Cooperation of energy sources in distributed generation. Rynek Energii. 6(115)/2014. pp 120-131.

ASSESSMENT METHODS AND CITERIA; COURSE COMPLETION FORM

The course is counted as a project. As part of the project, doctoral students are tasked with modeling any chosen distributed energy source. The project is presented in the last class in front of the whole group and then assessed. The grading scale is from 2 to 5.

LANGUAGE OF THE COURSE	ECTS CREDITS
English	5

TYPE OF CLASSES	NUMBER OF HOURS	COURSE INSTRUCTOR
Laboratory	26	Łukasz Szabłowski, dr inż.
Lecture	4	Łukasz Szabłowski, dr inż.; Krzysztof Badyda, prof. dr hab. inż.