COURSE DESCRIPTION CARD - SYLLABUS

Course name
Renewable energy sources

Course

Field of study
Electromobility

Year/Semester
2/4

Area of study (specialization)

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes

Other (e.g. online)

Tutorials

Projects/seminars
15

Number of credit points

2

Lecturers

Responsible for the course/lecturer:
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Responsible for the course/lecturer:
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Prerequisites

Students starting this field of study should have a basic knowledge of mathematics, physics and electrical engineering, as well as the ability to work in a team.

Course objective

To acquaint students with the structure, principle of operation and the possibilities of using renewable energy sources (mainly photovoltaic and wind systems). Acquiring practical skills in designing simple generation systems from RES, including the hybrid type.

Course-related learning outcomes

Knowledge

1. has knowledge about the phenomena and processes that allow for the conversion of energy from renewable sources in electricity

2. has knowledge of the structure, parameters and modeling methods of basic generation elements of RES systems

3. has knowledge of the methods of designing simple generation systems with renewable energy sources

Skills

1. knows how to apply an appropriate mathematical description to the analysis of RES systems

2. knows how to design a system generation from RES in line with agreed objectives, taking into account its geographical location

3. can use software for the analysis of wind and solar energy resources as well as for modeling and designing RES systems

Social competences

1. is aware of the importance of non-technical aspects and effects of engineering activities, including its impact on the environment and the associated responsibility for decisions

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: knowledge acquired in the lecture is verified in the course of the written test during the last lecture and partial test platform eKursy. Examination consists of open questions bulleted depending on the level of difficulty. Points from the partial test, after the fourth lecture (20% of the total number of points), are added to the points obtained on the written test. Passing threshold: 50% of the total number of points. Final essay topics are placed on the platform eKursy.

Project: passing the project classes is based on the ongoing monitoring of progress, activity in the classroom and the implementation of the final project carried out in subgroups of several people. The final grade will take into account the activity during the project classes.

Programme content

Lecture:

Definition and general characteristics of renewable sources, the situation of renewable energy sources in Poland against the background of the European Union, legal aspects (the RES Act in Poland), including the importance of micro and small generation systems from RES, basic rules of billing energy producers (prosumer, energy auctions), energy wind and sun, measurements of wind speed and irradiance (equipment, methodology), ground roughness classes, vertical wind speed profile, wind rose, use of data from the Institute of Meteorology and Water Management, time series and their properties,

photovoltaics (characteristics of components, operating parameters and conditions, review design solutions, replacement models, on-grid and off-grid system configurations, inverters, electrical installation, energy storage in the PV system), wind energy (construction and operation of selected types of wind turbines, operating parameters, methods and methods of power regulation, review the most important solutions of generators, a simple model of a wind turbine - interpolation of the power curve, estimation energy yields from RES for wind sources (statistical description of wind energy - Weibull distribution), solar and hybrid sources, cooperation of simple generation systems using RES with electricity grid, hybrid systems with RES (definition and types, advantages and disadvantages, examples, simplified models of hybrid systems), characteristics of prosumer installations with renewable sources and energy storage, basic methods of economic analysis of generation installations with renewable energy sources.

Project:

Classes project concern the development of hybrid generation system type using on-grid PV modules and wind turbines. The tasks performed in detail concern:

- analysis of design assumptions and determination of the overall structure of the system

- analysis of energy resources at the location of the generation system and determining its power

- equipment selection (PV modules, turbines, inverters, optimizer systems, security, cables, lightning and surge protection, monitoring)

- economic analysis and determination of the investment payback period

- development of project documentation, including the places of installation of PV modules and wind turbines

- use of software intended for the analysis and design of generation systems from RES

Teaching methods

Lecture: multimedia presentation (including: figures, photos, animations, films) supplemented with examples given on the board, especially computational examples. Taking into account various aspects of the issues presented, including: economic, ecological, legal and social. Introducing a new topic, preceded by a reminder of related content, known to students in other subjects.

Project: working in teams, using catalog data and tools that enable students to perform tasks at home (e.g. open source software), developing project documentation.

Bibliography

Basic

1. Jastrzębska G., Ogniwa słoneczne. Budowa, technologia i zastosowanie, Wydawnictwa Komunikacji i Łączności, Warszawa, 2013.

2. Wolańczyk F., Elektrownie wiatrowe, Wydawnictwo KaBe, Krosno, 2009.

3. Corkish R., Sproul A., and others, Applied Photovoltaics, 3rd Edition , Taylor&Francis eBooks, 2013.

4. Haberlin H, Photovoltaics system design and practice, Wiley, 2013.

5. Jenkins D., Renewable Energy Systems, Earthscan Expert, 2013.

Additional

1. Kasprzyk L., Tomczewski A., Bednarek K., Bugała A., Minimisation of the LCOE for the hybrid power supply system with the lead-acid battery, E3S Web of Conferences 19, 01030 (2017).

2. Głuchy D., Kurz D., Trzmiel G., The impact of shading on the exploitation of photovoltaic installations, Renewable Energy, vol. 153, p. 480-498, June 2020, DOI: https://doi.org/10.1016/j.renene.2020.02.010.

3. Trzmiel G., Analiza metod regulacji mocy w elektrowniach wiatrowych, Computer applications in electrical engineering vol. 89/2017, Poznan University of Technology Academic Journals Electrical Engineering, Poznań, 2017, str. 395-404.

4. Trzmiel G., Układy śledzące punkt maksymalnej mocy w inwerterach stosowanych w instalacjach fotowoltaicznych, Computer applications in electrical engineering vol. 87/2016, Poznan University of Technology Academic Journals - Electrical Engineering, Poznań, 2016, str. 23 - 36.

5. Internet: specialist subject literature, datasheets, standards.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	30	1,5
Student's own work (literature studies, preparation for project classes and project preparation, preparation for the final test) [1]	20	0,5

[1] delete or add other activities as appropriate