COURSE DESCRIPTION CARD - SYLLABUS

Course name
Unconventional energy sources [S2Elmob1-PAiME>NZE]

Course

Field of study
Electromobility

Year/Semester
2/3

Area of study (specialization)
Alternative Fuels and Energy Storage

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
15

Number of credit points

2,00

Coordinators

dr inż. Dariusz Kurz
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Lecturers

Prerequisites

Basic knowledge of physics, electrical engineering and renewable energy sources. The ability to effectively self-study in a field related to the chosen field of study. Ability to study literature, inference. The awareness of the need to expand their competences, readiness to cooperate within a team.

Course objective

Extending knowledge related to the structure, principles of operation, parameters and application possibilities of solar cells and wind turbines. Understanding the technical and technological issues of geothermal energy and heat pumps. To acquaint students with the methods and possibilities of cooperation of various renewable energy sources (electricity and heat). Justification of the need to replace conventional sources with renewable ones, due to the depletion of the former resources and increasing environmental pollution. Presentation of new possibilities in the field of obtaining electricity and heat and possibilities of reducing its consumption. Presentation of modern technologies used in the renewable energy sector and their cooperation with energy management systems (building automation).

Course-related learning outcomes

Knowledge:

1. has general knowledge of environmental protection and ways to protect it, including methods of recycling materials used in RES and electromobility.
2. knows the methods and principles of designing and simulating renewable energy systems in available commercial programs and using mathematical equations.
3. knows the construction and principles of operation of devices used to generate electricity and heat from renewable energy sources.
4. knows the current state of RES development and prospective trends in Poland and in the world, as well as unconventional energy resources.
5. has knowledge of diagnostic methods, sensor technology, signal processing and analysis of measurement data; knows the methods of diagnostics and assessment of the quality of electricity.
6. knows the impact of changes in the ways of powering vehicles on the natural environment and the use of RES in them.

Skills:
1. can obtain information from the literature and data sheets, analyze them and make interpretations in order to select the components of the designed system or installation, also in the field of electromobility.
2. can work independently and in a team, use properly selected methods and devices in terms of electrical parameters and characteristics, in order to implement design tasks integrating various technical fields.
3. interpret the obtained results, draw conclusions regarding various design solutions for energy production systems (electric and/or thermal) from renewable sources due to the set utility, technical and economic criteria.

Social competences:
1. can work individually and cooperate in a group as well as think and act in an entrepreneurial way.
2. is aware of the need for continuous education and expanding own knowledge due to the changes taking place in technical industries
3. is aware of the importance and understanding of non-technical aspects and effects of engineering activities, including its impact on the environment and the related responsibility for decisions made and the importance of knowledge in solving practical problems or using the opinions of experts in various fields.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge acquired during the lecture is verified by passing the exam lasting about 40-60 minutes, consisting of test and open questions, variously scored. Passing threshold: 50% of points. The issues on the basis of which questions are prepared will be successively indicated in classes.
Skills acquired as part of the project classes are verified on the basis of the assessment for the implementation of the project task regarding the selection of appropriate elements of the selected renewable energy sources installation in accordance with the assumed criteria.
In addition, students can get extra points for activity during classes, especially for: offering to discuss additional aspects of an issue, the effectiveness of applying the acquired knowledge when solving a given problem, the ability to cooperate within a team that practically performs a specific project task, and aesthetic care of developed tasks.

Programme content

Characteristics of renewable energy sources, such as: geothermal energy, solar farm, wind energy. Characteristics of devices enabling conversion and storage of energy from RES. Legal conditions. Control and management of production, distribution and consumption of energy from RES through energy management systems. Estimating energy yield. Application
possibilities in various areas. Presenting innovative solutions in the field of the subject, used in the latest practical solutions, eg. BIPV, half-cell,
bifacial PV cell, HJT PV cell, MPPT algorithm.

Course topics

Lecture:

Justification of the need to use renewable energy sources (RES). Legal conditions. Characteristics of renewable energy sources, such as: geothermal energy, solar farm, wind energy. Characteristics of devices enabling conversion and storage of energy from RES. Control and management of production, distribution and consumption of energy from RES through energy management systems. Costs of generating electricity and heat obtained from various types of RES. Estimating energy yield. Application possibilities in various areas. Advantages, disadvantages, limitations of this type of solutions. Presenting innovative solutions in the field of the subject, used in the latest practical solutions, eg. BIPV, half-cell, bifacial PV cell, HJT PV cell, MPPT algorithm.
Projects:
Getting to know the principles of design, simulation and analysis of energy yields from various renewable energy sources (photovoltaics, BIPV, wind turbins) using mathematical models and computer programs. Analysis of technical documentation of the components of installations in the field of renewable energy for the production, storage and distribution of electricity and heat.

Teaching methods

Lecture: multimedia presentations including drawings, diagrams, photos, supplemented with practical examples on the board, slides and computer programs, which makes it easier to link theory and practice. The lecture supplemented with additional materials provided to students for independent study. Utilizing students' knowledge of other subjects, initiating discussions, asking questions to increase students' activity and independence.
Projects: Team work using datasheets of devices and elements of renewable energy systems (PV panels, PV inverters, wind turbines) cooperating with receiving devices (electrical installation, heat pumps, energy management systems) in order to develop the installation project in accordance with the assumed criteria.

Bibliography

Basic:
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3. Klugmann-Radziemska E.: Odnawialne źródła energii. Przykłady obliczeniowe, Gdańsk 2016
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Additional:
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photovoltaics (BIPV) on reducing the demand for electricity and heat in buildings located in Poland, Energies, 13(10), 2020, pp. 2549-1-2549-19 (IF=2,707), https://doi.org/10.3390/en13102549
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15. Internet: specialist literature, catalog cards, standards.

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	25	1,00