STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Unconventional energy sources**		Code **1010322431010325680**
Field of study **Power Engineering**	Profile of study (general academic, practical) **(brak)**	Year /Semester **2 / 3**
Elective path/specialty **Ecological Source of Electrical Energy**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **30** Classes: **-** Laboratory: **30** Project/seminars: **15**		No. of credits **6**
Status of the course in the study program (Basic, major, other) **(brak)**	(university-wide, from another field) **(brak)**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **6 100%** **6 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge of renewables and unconventional energy sources.
2	**Skills**	Ability to effective self education related to the chosen field of study.
3	**Social competencies**	Is aware of the need to expand own competences. Willingness to work in a team.

Assumptions and objectives of the course:

1. Extend knowledge related to the design, technology and principles of operation and possibilities of application of unconventional energy sources.
2. Demonstrate new opportunities to acquire and storage energy. Promote clean energy technologies with environmental, ecological and efficiency considerations.
3. Familiarize students with selected applications of unconventional energy sources (mainly construction and transportation), on a global scale.
4. Practical introduction of students with selected applications of unconventional energy sources available in the city of Poznan and surroundings during outside activities.
5. Raising the importance of energy self-sufficiency on a micro and macro scale.
6. Developing of theoretical and practical skills in solving problems in the field of unconventional energy sources, including design.
7. Briefing on normalization, legal issues, economic issues and recycling.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Have a advanced knowledge of renewables (wind, solar, water, biomass and geothermal sources) and unconventional energy sources, both in the description and analysis of elements and systems, phenomena, mathematical and chemical description - [K_W04+]
2. Is familiar with current state of unconventional energy sources and trends in Poland and in the world - [K_W18++]

Skills:

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1. Is able to use use known mathematical methods and models, modify them, if necessary to analyze or design of circuits - [K_U07+]

2. Can select the calculation method, use or realize the appropriate software to solve a specific problem, taking into account new technological achievements - [K_U08+]

Social competencies:

1. Can think and act in a creative and entrepreneurial way, understands the need for information and public consultation about unconventional energy sources - [K_K01 +]

Assessment methods of study outcomes

The basis for assessing the knowledge and skills is a written exam.

Additional points (during lecture project and laboratory) are given for:

- continuous assessment (rewarding activity and quality of perception during classes),
- control of the increase of skills in the use of learned principles and methods),
- the effectiveness of the use of acquired knowledge when solving a given problem;
- assessment of the degree of project task completion and evaluation of the report of the laboratory exercise,
- proposing to discuss additional aspects of the issue;
- discussion of results, proposals for different solutions. choice of the most favorable,
- ability to cooperate within the team practically fulfilling the task (project and laboratory exercise);
- comments related to the improvement of didactic materials;
- the aesthetic diligence of the reports and design tasks elaborated (graphic illustration),
- independence in the selection of complementary bibliography.

Course description

Update 2017. Learning methods include lecture, project and laboratory.

Lecture with multimedia presentation (drawings, photographs, animations and illustrations of own research). Reference to content known to students from other subjects.

1. Develop and complete of RES messages from sem. 6 and 7, concerning also the description and analysis of elements and systems, phenomena occurring in them in mathematical and chemical terms.

2. Familiarize with the practical aspects of the discussed issues on the example of unconventional energy sources; in the construction and transportation sectors. Architecture (energy saving, low energy, passive, zero energy, plus energy). Possibilities to use RES in new and modernized buildings. Optimization possibilities. Electric and hybrid vehicles. Unconventional methods of power supply and storage, Recuperation, Monitoring, Vehicle charging stations. Environmental effect.

3. Raising the importance of energy self-sufficiency as an important aspect of energy security. Analysis of the issue on the national scale - characterization of selected self-sufficient energetic objects, powered exclusively by RES. Characteristics of the selected places worldwide (islands, cities) powered by unconventional energy sources.

4.Multi-dimensional design issues on the example of hybrid power supply in architecture and transport.

Project

Multimedia demonstration. Project of powering a sample object.

- analysis and discussion of various aspects (economic, environmental, legal and social) and methods of problem solving,
- detailed review of the project documentation by the project leader,
- discussion on the effects of work,
- teamwork.

Laboratory

- Detailed review of the report by the teacher, including the evaluation of the student's results and conclusions
- discussion on the effects of work,
- teamwork.

Due to the incorporation of practical aspects - introduction of outside activities: participation in the Renewable Energy Sources Fairs, meetings with Toyota consultants, sightseeing of a self-sufficient energetic facility in Krzyżowa, Utilization of Waste and Generation of Electricity and Heat Department.

Basic bibliography:

1. Jastrzębska G.: Energia ze źródeł odnawialnych i jej wykorzystanie, WKŁ, Warszawa, 2017.

2. Jastrzębska G. Odnawialne źródła energii i pojazdy proekologiczne, WNT, 2009.

3. Zimny J.: Odnawialne źródła energii w budownictwie niskoenergetycznym, Polska Geotermalna Asocjacja WNT/AGH Warszawa Kraków 2010.

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Additional bibliography:

1. Chwieduk D. : Energetyka w budynku, Wydawnictwo Arkady, 2011.

2. Wnuk R. Instalacje w domu pasywnym i energooszczędnym, Wydawnictwo Przewodnik Budowlany 2007, względnie Wnuk, R. : Budowa domu pasywnego w praktyce. Warszawa: Wydawnictwo Przewodnik Budowlany.2012

3. Praca zbiorowa Odnawialne i niekonwencjonalne źródła energii, Poradnik, Tarbonus 2008.

4. Jastrzębska G.: Akumulator jako źródło energii w Poradniku Montera Elektryka, PWN, Warszawa 2016.

5. Frydrychowicz-Jastrzębska G., Perez E.: Computer simulation of Power balance of a solar vehicle depending on its parameters and outsider factors, The International Conference on Renewable Energy and Power Quality, ICREPQ? 11, Las Palmas de Gran Canaria, 2011, April 13-15.

6. Frydrychowicz-Jastrzębska G., Perez E.: Symulacja osiągów pojazdu zasilanego energią Słońca w Barcelonie i w Warszawie,, II Konferencja Fotowoltaiki, Krynica Zdrój, 2011, 12- 15 maja.

Result of average student's workload

Activity	Time (working hours)
1. lecture participate	30
2. laboratory participate	30
3. project participate	15
4. lecture consultation participate	6
5. project consulation participate	8
6. laboratory consultation participate	6
7. exam preparation	20
8. exam	2
9. laboratory preparation and report preparation	12
10. project preparation	25

Student’s workload

Source of workload	hours	ECTS
Total workload	154	6
Contact hours	97	4
Practical activities	96	4

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