DESCRIPTION OF THE COURSES

- Course code: **ELR2202**
- Course title: **DISPERSED ENERGY SOURCES**
- Language of the lecturer: **polish**

Course form	***Lecture***	***Classes***	***Laboratory***	***Project***	***Seminar***
*Number of hours/week**	**2**				
*Number of hours/semester**	**30**				
Form of the course completion	**pass**				
ECTS credits	**3**				
Total Student's Workload	**90**				

- Level of the course (basic/advanced): **basic**

Prerequisites: Theory **of Electrical Circuits, Electrical Power System, Electric Machines, Disturbances in Industrial Devices and Distribution Networks, Energy Production**

- Name, first name and degree of the lecturer/supervisor: **Wilhelm Rojewski, Ph.D., Henryk Wojciechowski, Ph.D., Paweł Żyłka, Ph.D.**
- Names, first names and degrees of the team's members:
- Year:...**IV/I stage**..... Semester:.....**7**.....
- Type of the course (obligatory/optional): **obligatory**
- Aims of the course (effects of the course): **to make students familiar with problems related to dispersed and non-conventional energy sources and systems**.
- Form of the teaching (traditional/e-learning): **traditional**
- Course description:

Energy carriers, transformations of energy technological schemes of electricity and heat generation, technical and economical effectiveness.

The principle diagrams and requirements for coupling of dispersed generators to the grid. Impact of dispersed generators on power load flow, short-circuit currents, voltage changes, power quality and protection of distribution network. Autonomous operation of dispersed generators.

Problems of unconventional energy sources for dispersed systems will be discussed: solar energy, nuclear energy micro-systems, superconducting and supercapacitor energy storage systems, and electrical micro-generators. The practical presentation will also get students acquainted with problems related to fuel cells and their application. Finally issues related to various doubtful ideas of „perpetuum mobile" energy generators will also be discussed and commented on the basis of classical physics.

- Lecture:

Particular lectures contents	*Number of hours*
1. Primary energy carriers in local application, energy transformation and its influence on environment, dispersed energy sources.	**2h**
2. Technologies of dispersed generation, heat cycles, technical and	**2 h**

economical efficiency, prefeasibility study of investment processes.	
3. Technical and economical effectiveness of poligeneration, costs of electricity and heat generation.	**2 h**
4. Geothermal sources for heat and electricity generation.	**2 h**
5. Wind sources of electricity, small hydroelectric sources. Legal regulations in local conditions, basic energetical and economical calculations.	**2 h**
6. Principle diagrams of connection of dispersed generators into power distribution system.	**1 h**
7. Technical impacts of dispersed generators on power system. Connection requirements.	**1 h**
8. Connection of induction generator into distribution network.	**2 h**
9. Connection of synchronous generator into distribution network.	**2 h**
10. The effect of dispersed generators on power quality and reliability of distribution network.	**1 h**
11. Automatic control and relay protection of dispersed generators.	**2 h**
12. Autonomous generation.	**1 h**
13. Fuel cells – technology and practice (presentation of "live" fuel cell system).	**2 h**
14. Electrical micro-generators.	**2 h**
15. Small-scale solar energy conversion (photovoltaic systems, solar collectors).	**2 h**
16. Nuclear energy micro-systems.	**1 h**
17. Superconducting and supercapacitor energy storage systems.	**2 h**
18. Doubtful ideas of „perpetum mobile" energy sources in relation to the classical physics.	**1 h**

- Classes – the contents:
- Seminars – the contents:
- Laboratory – the contents:
- Project – the contents:
- Basic literature:

1. **Laudyn D., Pawlik M., Strzelczyk F., Elektrownie. WNT, Warszawa 1997.**
2. **Chmielniak J., Rusin A., Czwiertnia K., Turbiny gazowe. Ossolineum, Wrocław, 2001.**
3. **Skorek J., Kalina J., Gazowe układy kogeneracyjne . WNT, Warszawa, 2005**
4. **Paska Jozef, Wytwarzanie energii elektrycznej , Oficyna Wydawnicza Politechniki Warszawskiej , Warszawa 2005**
5. **Kacejko P.: Generacja rozproszona w systemie elektroenergetycznym. Wydawnictwo Uczelniane. Politechnika Lubelska 2004.**
6. **Jenkins N., Allan R., Crossley P., Kirschen D., Strbac G.: Embeded Generation. Power & Energy 2000.**
7. **Lubośny Z.: Elektrownie wiatrowe w systemie elektroenergetycznym. WNT warszawa 2006.**
8. **Synal B., Rojewski W., Dzierżanowski W.: Elektroenergetyczna automatyka zabezpieczeniowa. Podstawy. Oficyna Wydawnicza PWr., Wrocław 2003.**
9. **Praca zbiorowa: Energia ze źródeł przyjaznych środowisku : zagadnienia wybrane, Gdańsk : Wydawnictwo Instytutu Maszyn Przepływowych, 2001.**

10. **Praca zbiorowa: Niekonwencjonalne źródła energii , Wrocław : Wydawnictwo Akademii Rolniczej, 1999**

- Additional literature:

1. **www.ptpiree.pl; www.cire.pl; www.pse.pl, www.kape.gov.pl, www.elektrownie-wiatrowe.org.pl, www.mew.pl**
2. **Lewandowski Witold M., Proekologiczne odnawialne źródła energii, Warszawa: Wydawnictwa Naukowo-Techniczne, 2006.**
3. **Da Rosa, Aldo Vieira, Fundamentals of renewable energy processes, Amsterdam: Elsevier Academic Press, cop. 2005.**

- Conditions of the course acceptance/credition: **Pass of examination**

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