

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Demand side management of electrical energy		Code 1010314381010316901
Field of study Electrical Engineering	Profile of study (general academic, practical) (brak)	Year /Semester 4 / 8
Elective path/specialty Power Networks and Electric Power System	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: First-cycle studies	Form of study (full-time, part-time) part-time	
No. of hours Lecture: 18 Classes: - Laboratory: 9 Project/seminars: -		No. of credits 2
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 %) 2 100% 2 100%
Responsible for subject / lecturer: Dr inż. Jerzy Andruszkiewicz email: jerzy.andruszkiewicz@put.poznan.pl tel. 61 665 2392 Electric Engineering ul. Piotrowo 3A, 60-965 Poznań		
Prerequisites in terms of knowledge, skills and social competencies:		
1	Knowledge	Basic knowledge of electricity, power systems, telecommunications and information technology, transmission and distribution of electricity, the information technology in power systems and security of power supply.
2	Skills	The ability to assess the costs and benefits from the implementation of the analysed processes by their participants. Ability of effective self-education in the chosen field of study.
3	Social competencies	Is aware of the need to broaden his competences, presents willingness to work together within a team, aspires to improve the efficiency of process performance.
Assumptions and objectives of the course: Presentation of the impact of price elasticity of demand on the formation of the load curve shape of power grids and on electricity prices. Presentation of the role of demand-side as one of elements needed for the sustainable development of energy systems and of the benefits gained by demand side management. Learning of tools for the effective development of the demand curve shape. Demand side control assessment as an effective element for the development of effective market relations. Learning of modern technologies of energy flows management in power networks.		
Study outcomes and reference to the educational results for a field of study		
Knowledge: 1. Student is able to describe the new directions in the development of effective and safe management of the power flows in distribution networks and development of market relations in this area. - [K_W24+++] 2. Student is able to apply the principles and tools of demand side management making profit of the price elasticity of demand for optimal electricity delivery to customers. - [K_W10 ++, K_W05 +]		
Skills: 1. Student can propose actions to change the energy usage pattern in order to achieve the technical and economic benefits. - [K_U20++] 2. Student can evaluate and investigate modification of approach in the power distribution and energy consumption patterns to improve efficiency basing on market conditions designed in accordance with European Union energy strategy. - [K_U23++]		
Social competencies: 1. Student is able to think and act in an entrepreneurial manner, taking into account the tasks performed by all participants in the process of power delivery to consumers. - [K_K02 +++]		

Assessment methods of study outcomes		
<p>Lectures: evaluation of the knowledge and skills demonstrated in written tests concerning issues discussed, Laboratory: - test of knowledge necessary for the accomplishment of laboratory tasks, - the assessment of the report prepared in result of laboratory exercise completion</p>		
Course description		
<p>Supply and demand in the electricity market. The potential of the demand side management in the national power system. The importance of the demand side management for the operation of the electricity market in Poland and Europe. Demand side management and demand response as part of the management of the power flow in the network and to improve energy efficiency and network assets utilisation. Types of demand-side programs and benefits they can achieve. Building demand side management programs. Tariffs as a tool for demand side management. The improvement of efficiency of demand-side programs implementation as a result of the installation of smart meters. Demand side management as part of the smart grid, improving the security of power supply of electricity as well as the reliability and quality of power supply. Technological solutions for effective control of demand side devices. Demand management using distributed and centralized energy storage. Plans of demand side management application in Poland. ICT technologies used in demand side management and demand response programs. Update 2017 - energy efficiency as a strategic tool of demand response</p>		
Basic bibliography:		
<p>1. Smart metering. Inteligentny system pomiarowy. Krzysztof Billewicz. Wydawnictwo Naukowe PWN, Warszawa 2012 2. Opracowanie modelu stosowania mechanizmów DSR na rynku energii w Polsce. Polskie Sieci Elektroenergetyczne Operator S.A. CATA, 2010, www.piio.pl 3. Sterowanie popytem na energię elektryczną w sytuacjach niedoboru mocy ? przegląd metod. Dariusz Bober, Politechnika Lubelska, Prace Instytutu Elektrotechniki, zeszyt 238, 2008.</p>		
Additional bibliography:		
<p>1. Jednolity rynek energii elektrycznej w Unii Europejskiej w kontekście bezpieczeństwa energetycznego Polski. Agnieszka Pach-Gurgul, Difin 2012, ISBN: 978-83-7641-717-2 2. Zbudowanie i uzgodnienie modelu rynku opomiarowania i stosowania mechanizmów zarządzania popytem wraz z opracowaniem modeli biznesowych. Opracowanie Hewlett-Packard Polska Sp. z o.o. 2009, www.piio.pl 3. National Action Plan on Demand Response. The Federal Energy Regulatory Commission Staff USA 2010, Docket No. AD09-10, www.ferc.gov 4. Jerzy ANDRUSZKIEWICZ, Józef LORENC: Warunki wdrożenia w Polsce cenowych programów sterowania popytem dla ograniczenia szczytowego zapotrzebowania na energię elektryczną. PRZEGLĄD ELEKTROTECHNICZNY, ISSN 0033-2097, R. 90 NR 8/2014 ss. 97-100</p>		
Result of average student's workload		
Activity	Time (working hours)	
1. participation in lectures	18	
2. preparation for the exam	21	
3. participating in consultations on the lecture	3	
4. participation in specialized laboratories	9	
5. preparation for laboratory exercises	9	
6. Participation in consultations on laboratory exercises	2	
7. Development of the laboratory reports	15	
Student's workload		
Source of workload	hours	ECTS
Total workload	105	2
Contact hours	23	1
Practical activities	41	1