COURSE DESCRIPTION CARD - SYLLABUS

Course name
Elective course A: Electricity demand side management

Course

Field of study
Power Engineering
Year/Semester
4/8
Area of study (specialization)
Electrical Power Engineering
Profile of study
general academic
Level of study
First-cycle studies
Course offered in
Polish
Form of study
part-time
Requirements
elective

Number of hours

Lecture
20
Laboratory classes
10
Other (e.g. online)
0
Tutorials
0
Projects/seminars
0

Number of credit points

3

Lecturers

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

Basic knowledge in mathematics, physics, electrical circuits, electrical power engineering and electricity transmission and distribution. Ability to self-study effectively topics related to the chosen field of study and combine knowledge acquired in previous courses. Ability to assess costs and benefits of implementation of the analyzed processes by its participants. Awareness of the need to extend competences, readiness to cooperate within a team, aiming for efficiency improvements in processes' performance.

Course objective

Gaining knowledge in the field of demand side reponse and energy management, as elements of the sustainable development of energy systems and shaping proper market relations. Understanding the tools for effective shaping of the demand curve and the impact of price elasticity of demand on shaping

the load curve in power grids and electricity prices. Getting to know methods of forecasting electricity demand for various customers, basics of designing effective demand control programs, and modern techniques for managing energy flows in power networks.

Course-related learning outcomes

Knowledge

1. Student is able to characterize new development directions in the area of effective and safe energy management in distribution networks and shaping market relations in this area.

2. Student has knowledge of the basic methods of demand side response and energy management, as well as the principles of designing activities and the use of tools aimed at using the elasticity of electricity demand to optimize its supply to customers.

Skills

1. Student is able to collect data on solutions in the field of energy distribution and supply in terms of the requirements compatible with the EU energy policy and assess and seek modifications of the solutions used.

2. Student is able to propose actions aimed at changing the way energy is used to achieve technical and economic benefits, and compare and evaluate proposed solutions in terms of their economic and environmental efficiency.

Social competences

1. Student is aware of the need to search for new solutions in the field of energy management and electricity supply to the customers, taking into account economic and ecological aspects.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:
- knowledge and skills assessment through a problem-based written exam,
- continuous assessment of student's skills and competences during each class (rewarding attendance and active participation in the classes).

Laboratory classes:
- assessment of the knowledge necessary to solve problems in a given task area through written tests,
- continuous assessment during each class - rewarding the increase in the ability to use presented principles and methods,
- assessment of the knowledge and skills concerning the laboratory tasks, evaluation of the tasks' elements prepared individually by the student taking into account the aesthetic values of the reports and tasks solved as part of self-study.

Programme content

Lecture:
Supply and demand in the electricity market. Potential of demand side response in the national power system, significance for the operation of the electricity market in Poland and in Europe. Demand side management as an element for managing energy flows in the network and improving the efficiency of energy and network assets use. Types of demand side management programs and related benefits. Construction of demand side response programs. Market analysis for the design of demand management programs. Tariffs as a tool for demand side management. Possibilities of implementing demand response as a result of smart meters' implementation. Demand response as smart grid's element, inducing the improvement of energy security and reliability and quality of electricity supply. Technological solutions enabling effective control of receiving devices. Demand control using distributed and centralized energy storage. Basic design parameters of effective demand response programs. Energy efficiency as a strategic demand management tool. Demand response as an element of the capacity market in the reformed electricity market. Demand management for the purposes of network operators. Methods for forecasting energy consumption for urban, residential or industrial consumers.

Laboratory classes:
Demand side management as an element of managing energy flows in the network and improving the efficiency of energy and network assets use. Types of demand management programs and related benefits. Construction of demand side response programs. Market analysis for the design of demand management programs. Tariffs as a tool for demand side management. Basic design parameters of effective demand response programs. Methods for forecasting energy consumption for urban, residential or industrial consumers.

Teaching methods

Lecture: multimedia presentation - informational and problem lectures

Labolatory classes: computer-based calculation tasks using spreadsheets, problem methods, solving tasks individually and in groups

Bibliography

Basic

1. Billewicz K., Smart metering: inteligentny system pomiarowy, Wydawnictwo Naukowe PWN, Warszawa 2012
2. Górzyński J., Efektywność energetyczna w działalności gospodarczej, Wydawnictwo Naukowe PWN, Warszawa 2017
3. Majka K., Systemy rozliczeń i taryfy w elektroenergetyce, Politechnika Lubelska Wydawnictwo Uczelniane 2005
4. Marzecki J., Rozdzielcze sieci elektroenergetyczne, Wydawnictwo Naukowe PWN, Warszawa 2001
5. Paska J., Ekonomika w elektroenergetyce, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2007
6. Rasolomampionona D.D., Robak S., Chmurski P., Tomasik G., Przegląd istniejących mechanizmów DSR

stosowanych na rynkach energii elektrycznej, Rynek Energii nr 4/20108. Żmuda K., Elektroenergetyczne układy przesyłowe i rozdzielcze. Wybrane zagadnienia z przykładami, Wydawnictwo Politechniki Śląskiej, Gliwice 2016

Additional

1. Andruszkiewicz J., Lorenc J., Warunki wdrożenia w Polsce cenowych programów sterowania popytem dla ograniczenia szczytowego zapotrzebowania na energię elektryczną, Przegląd Elektrotechniczny, r. 90 nr 8/2014, 97-10
2. Andruszkiewicz J., Lorenc J., Weychan A., Sterowanie popytem przy wykorzystaniu systemów taryfowych w Polsce, Przegląd Elektrotechniczny, r. 95 nr 10/2019, 48-51
3. Kirschen D.S., Strbac G., Fundamentals of Power System Economics, John Wiley & Sons Ltd 2004
4. National Action Plan on Demand Response. The Federal Energy Regulatory Commission Staff USA 2010, Docket No. AD09-10, www.ferc.gov

Breakdown of average student's workload

	Hours	ECTS
Total workload	85	3,0
Classes requiring direct contact with the teacher	35	1,0
Student's own work (literature studies, preparation for classes and tests, preparing homework, preparing for the exam) [1]	50	2,0

[1] delete or add other activities as appropriate