COURSE DESCRIPTION CARD - SYLLABUS

Course name
Elective course B: Energy management and demand side response

Course

Field of study
Electrical Engineering

Year/Semester
3/6

Area of study (specialization)
Systems and electric power protection automatics

Profile of study
practical

Level of study
First-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
15

Projects/seminars
15

Number of credit points

3

Lecturers

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.Knowledge on enterpreneurship and basic principles of economics. 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. Understanding the methods of assessing the economic viability of energy enterprises.

Course-related learning outcomes

Knowledge

1. Student has knowledge of the basic methods of demand side response and energy management, methods and assessment of the economic viability of energy enterprises as well as methods and principles for the design of activities and the use of tools aimed at using the elasticity of electricity demand to optimize its supply to customers.

2. Student has knowledge on the structure and mechanisms at the energy market and infrastructure that allows energy management.

3. 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.

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.

3. Student is able to assess the economic and environmental effectiveness of solutions in the field of demand side response and energy management.

Social competences

1. Student is aware of the need to search for new solutions in the field of energy management.

2. Student is able to think and act in a cost-effective manner, taking into account the tasks carried out by all participants of the process of providing electricity to consumers.

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).

Tutorial:

- 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,

Project:
- assessment knowledge and skills concerning the project tasks, evaluation of the reports on completed tasks,
- additional points for active paritcipation during classes, in particular for the ability to cooperate within a team that handles that project task.

Programme content

Lecture:
Supply and demandin 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 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. Possibilities of implementing demand response as a result of smart meters' implementation. Demand response as smart grid's element, including 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, methods for assessing the economic viability of energy enterprises.

Tutorial:
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. Methods for assessing the economic viability of energy enterprises.

Project:
Activities in the area of industrial plant. Designing effective demand response programs. Methods for forecasting energy consumption for urban, residential or industrial consumers.

Teaching methods

Lecture: multimedia presentation - informational and probel lectures

Tutorial: multimedia presentation with calculation examples presented on the board, problem methods, expert table method

Project: sollving project tasks in groups, case study and discussion; problem-solving in groups implemented with the help of a teacher / tutor at the workplace.

Bibliography

Basic

1. Billewicz K., Smart metering: inteligentny system pomiarowy, Wydawnictwo Naukowe PWN, Warszawa 2012
2. Góra S., Gospodarka elektroenergetyczna w przemyśle, Państwowe Wydawnictwo Naukowe, Warszawa 1982
3. Górzyński J., Efektywność energetyczna w działalności gospodarczej, Wydawnictwo Naukowe PWN, Warszawa 2017
4. Majka K., Systemy rozliczeń i taryfy w elektroenergetyce, Politechnika Lubelska Wydawnictwo Uczelniane 2005
5. Marzecki J., Rozdzielcze sieci elektroenergetyczne, Wydawnictwo Naukowe PWN, Warszawa 2001
6. Paska J., Ekonomika w elektroenergetyce, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2007
7. Rasolomampionona D.D., Robak S., Chmurski P., Tomasik G., Przegląd istniejących mechanizmów DSR stosowanych na rynkach energii elektrycznej, Rynek Energii nr 4/2010

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. Bielecki S., Zaleski P., Fortuński B., Wybrane problemy zarządzania energetyką, Texter, Warszawa 2016
4. Kirschen D.S., Strbac G., Fundamentals of Power System Economics, John Wiley & Sons Ltd 2004
5. 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	88	3,0
Classes requiring direct contact with the teacher	67	2,0
Student's own work (literature studies, preparation forclasses andtests, solving project tasks)[1]	21	1,0

[1] delete or add other activities as appropriate