

DIE-IND-522 Operation of Electric Power Systems

SEMESTER: Fall
CREDITS: 6 ECTS (4 hrs. per week)
LANGUAGE: Spanish / English
DEGREES: MII

Course overview

Main principles related to the economic operation of Power Systems are provided, and expansion and operation planning of Power Generation is explained. The mathematical programming techniques required to model and solve this kind of problems are reviewed and applied.

In addition, different approaches for organizing the electric sector regarding the expansion and operation decision making process are described and analyzed, focusing on the functioning of Power Markets that have appeared following the liberalization processes launched all over the world. The Spanish electricity sector is especially studied.

Prerequisites

- Knowledge related to linear power flow analysis and to basic mathematical linear programming will help following the course, although the course is almost self contained.

Course contents

1. Introduction. Organization of PS high level operation issues. Centralized and decentralized operation contexts. Generation unit's fix and variable costs. Generation mix. Investment decisions.
2. Single-node economic dispatch of thermal units. Input-output curves, Average and marginal costs. Marginal price.
3. Network constrained economic dispatch. Losses factors. Power Transfer Distribution Factors. Nodal prices.
4. Unit commitment. No-load and start-up costs.
5. Hydrothermal coordination. Marginal value of water.
6. Electricity energy markets. Economic theory applied to PS.
7. An example: Spanish electricity market organization. Day-ahead market. Intraday markets. Congestion management. Ancillary services markets. Tariffs

Textbooks

- A. J. Wood, B. F. Wollenberg, Power Generation, Operation and Control. John Wiley and Sons, 1984 (First edition). 2014 (last edition).
- A. Gómez-Expósito, A. Conejo, C. Cañizares, Electric Energy Systems - Analysis and Operation. CRC Press. 2009.
- A. Gómez Expósito, Análisis y Operación de Sistemas de Energía Eléctrica. McGraw-Hill. 2003

Grading

The overall grade is obtained as follows:

- Final exam accounts for 65% of the final grade
- Mid-term exam(s) accounts for 35% of the final grade