

Power Systems: Network Regulation and Economics

13 hour technical course



Course Introduction

This online course introduces learners to the most important concepts that affect power system operation, economics and investments.

The course starts by introducing basic components regarding network operation including tools used by system and market operators, planners, as well as market participants. Differences in the design and some aspects of the electricity market operation are also explained.

System operators, as well as owners and investors, also need to understand what the operational costs for running the system are. They need to know where to invest, and how much new investment will cost. The most important concepts that will help understand and answer these questions are presented in sections on OPEX and CAPEX, Reliability, Losses and Efficiency.

Principal issues regarding monitoring and maintenance of the network and individual system components are introduced in order to explain additional techniques and equipment that are often used by system operators and owners.

Finally, understanding policies that are regulating environmental aspects of power system operation will help learners to recognise some additional challenges of operating low-carbon power system networks.

Course topics

1. Overview of Power System Economics of Network Operation

- Components of power systems
- Main issues in operating power systems and tools used by system operators
- Basic aspect of electricity markets
- Electricity markets organisation and designs

2. CAPEX and OPEX

- The context and content of a typical power distribution network operator expenditure plan
- Definition of CAPEX and OPEX and correct identification of expenditure examples as CAPEX or OPEX
- Specific distribution network CAPEX and OPEX options
- Undertake Net Present Value calculations of CAPEX and OPEX programmes in the context of through life costing
- Analyse network operator CAPEX and OPEX strategies and the implications for vendor products and services.

3. Reliability

- The drivers of reliability analysis in electrical distribution networks
- The concept of DNO performance: CI, CMI, SAIFI and SAIDI and how to calculate these from a data set
- The concept of 'system reliability' and perform simple system reliability calculations
- How to work out the reliability of a simple system and the economic impact of reliability

4. Electrical Losses

- Electrical losses through a range of electrical components including lines and cables, transformers, machines, converters and combined system losses
- The concept of energy efficiency
 - The nature of energy losses within electromechanical systems and their effect on efficiency
 - How to calculate end-to-end and round-trip efficiency

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5. Efficiency

- Motivation of energy efficiency component classifications
- Concepts of Performance efficiency, Operation efficiency, Equipment efficiency and Technology efficiency (POET)
- Applications of POET in energy management

6. Carbon

- Drivers behind carbon reduction policies
- Kyoto Protocol and beyond
- Emissions Trading Scheme in European Union
- Additional Policies
- Beyond EU

7. Asset Management

- Maintenance
- Instrumentation
- Condition monitoring and asset management
- Communications

Course Units - Power Systems: Network Regulation and Economics

- Unit 1 Getting Started
- Unit 2 Overview of Power System Economics of Network Operation (1)
- Unit 3 Overview of Power System Economics of Network Operation (2)
- Unit 4 Overview of Power System Economics of Network Operation (3)
- Unit 5 CAPEX and OPEX (1)
- Unit 6 CAPEX and OPEX (2)
- Unit 7 Reliability
- Unit 8 Electrical Losses (1)
- Unit 9 Electrical Losses (2)
- Unit 10 Efficiency
- Unit 11 Carbon
- Unit 12 Asset Management (1)
- Unit 13 Asset Management (2)
- Final Assessment



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Who should take this course?

This course is aimed at graduates through to senior engineers involved in the electricity sector who wish to understand more about the regulatory, reliability and investment considerations involved in operating a modern power network.

Other Engineering Courses

- Power Systems: Renewable Energy Integration
- Power Systems: Protection of Distribution Networks
- Mobile Communications (4G)

Further courses are being developed in BIM Management, Engineering Ethics, Entrepreneurship for Engineers, Professionalism, Railway Safety and Risk Management for Engineers.

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