

Title:	Future Power System in Denmark
This year's theme:	<i>The year's theme takes each year its starting point in its known policy objectives and decisions including international, national or sectoral policy decisions, which in various ways set the framework for future electricity power system in Denmark.</i>
Language:	English. By special agreement Danish students are allowed to present the Danish e.g. in the final individual examinations.
Course type:	Elective: The course is offered as a joint course for the following educational institutions: <ul style="list-style-type: none"> — Aalborg University — Aarhus School of Engineering — University of Southern Denmark — Copenhagen University College of Engineering — Technical University of Denmark
Schedule:	Autumn (September-December)
Course:	Start-up Conference Team work Web-conferences / Question Time Mid term Conference Final conference
Course duration:	1 semester
Course load:	5 ECTS-points
Examination:	Team Report consisting of: <ul style="list-style-type: none"> - Front page - Abstract (max. 1 page) - Contents list, - Report Pages (max. 20 pages) - Reference List - Attachments (max. 10 pages e.g. maps, simulations, etc.) <p>The interim team memorandum (Max. 1500 words excl. figures)</p> <ul style="list-style-type: none"> - Introduction / background - Problem statement - Chosen approach to problem solving <p>Oral team presentation and opponent's defence of own team's midway memorandum, and the opponent for the</p>

second project team's midway memorandum in the mid-term conference.

Oral team presentation of Team Report in connection with the final conference.

Assessment:	Individual, oral examination. External examiner
Type of assessment:	7-step scale. Individual, oral examination.
Aid:	All aid
Prerequisites:	<p>It is assumed that the student prior to or concurrent with attending the course has acquired basic knowledge within the areas:</p> <ul style="list-style-type: none">• Direct current and alternating current theory• Electricity supply in Denmark (basic construction of electrical power system and electrical network, system components)• 3-phase systems• Electrical machines (generators, motors, transformers)• Stationary conditions in power systems (load-flow and short circuit calculations)• Electricity consumption and use of electricity
Overall course objectives:	<p>To cultivate knowledge and understanding of the technique of the grid and system challenges that the electricity power system in Denmark is expected to face in the future in terms of design and system operation. With starting point in Denmark's existing electrical power system, and known political objectives and decisions for Denmark (at regional or national level), students must analyse their way through to a concrete solution for the future electricity supply in Denmark, based on the course's theme and within a more defined, self-elected project focus</p>
Learning objectives:	<p>A student who has fully met the course objectives, is expected to be able to:</p> <ul style="list-style-type: none">• Explain the grid technique and systemic challenges of electricity supply in Denmark in the future facing, both design and / or terms of system operation• Analyse and assess the structure, composition, interaction and mutual influence between the relevant parts of the electricity grid and power system in one or more of the fields distribution, transmission, production and consumption• Use and through that become familiar with earlier learned electrical power system theory• Identify, evaluate, and argue for changes in existing power system facilities taking into consideration high

personal security, high continuity of supply and finance.

Course contents:

With the background of known policy objectives and decisions, the course gives an introduction to the key technological challenges the electricity system is facing in the future. Through conference speeches by specialists from the industry it will be presented how technical challenges traditionally have been solved in the electrical power system in Denmark.

The conference speeches will be followed up by team work. Through team work the teams on this year's theme define and work through a self-elected issue, focusing on the future electrical power system in Denmark. The issue must have focus and take its starting point within one of the following fields: distribution, transmission or production of electrical energy.

The course pays special attention to cultivate confidence with previously learned theoretical substance in the field of electrical power techniques including the involvement of the professional assumptions that underlie the course.

Conference speeches from the industry will include the following topics. The topics will be addressed in an application oriented context:

- Electrical power system components (network components and station facilities, power plants, etc.)
- Criteria and methods for design of 3-phase power systems (consumption forecasts and simultaneity, power transmission / load flow, short circuit calculations, etc.)
- Protection philosophies and principles for system protection (relay protection, etc.)
- Command, control, and monitoring systems (voltage regulators, power control, frequency regulation, etc.)
- Grid connection in electrical power systems (connection rules, system rules, grid codes, technical regulations, etc.)
- Laws and regulations (standards and norms, regulations, grid codes, connection rules, technical regulations, etc.)

Conference dates:

Startup Conference is held:

Thursday 28th August and Friday 29th August 2014

Midterm Conference held:

Wednesday 17th September 2014

Final conference held:

Wednesday 3rd December 2014

Deadlines: Delivery of interim note:
Friday 12th September 2014

Delivery of report:
Wednesday 26st November 2014

Note: Startup Conference: 1½-day conference where the theme for this year's course is presented and enhanced with contributions from decision makers and specialists from the electrical companies.

Mid term conference: 1-day conference in which the teams present an elected issue and preliminary analyses and results. For the mid term conference, each team will elaborate an interim note. Each team will be asked to be the opponent another team's mid term note and presentation. The teams will get additional feedback from both specialists and other teams.

Final conference: 1-day conference where the teams present their final project / report and results to the other teams as well as specialists. Each presentation allows time for questions.

Team work: Teams of 3-6 students from the same educational institution cooperate throughout the course with a self-elected project focus and delimitation of the year's theme.

"Question time" by web-/video conferences: 1-2 times a month specialists from electrical companies have "question time" on predetermined days / times. Via web-/video conference students can ask questions to the appropriate specialist.

Supervisor: Each team will at the start of the course be assigned an external supervisor from a local electrical company located near the place of study. Each team will furthermore be assigned an administrative contact person from his or hers own educational institution. Supervisor meetings with external supervisor will as a rule be held at the electricity company. If geographic distances dictate web-/video conference can be used instead.