820774 - ESEP - Efficiency in Power Systems

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering
Teaching unit: 709 - EE - Department of Electrical Engineering
Academic year: 2017
Degree: MASTER'S DEGREE IN ENERGY ENGINEERING (Syllabus 2013). (Teaching unit Optional)
MASTER'S DEGREE IN ENERGY ENGINEERING (Syllabus 2013). (Teaching unit Optional)
ECTS credits: 5  Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: Sumper, Andreas
Others: Roberto Villafáfila Robles
F. Javier Heredia Cervera
Andreas Sumper

Opening hours
Make an appointment via e-mail.

Prior skills
Knowledge of power systems and linear programming.

Requirements
Have taken the speciality courses of the subject Energy economy and markets, and the compulsory course Energy markets.

Degree competences to which the subject contributes
Specific:
CEMT-8. Understand, describe and analyse, in a clear and comprehensive manner, the functioning of energy markets and carry out the optimum procurement of energy supplies.
CEMT-3. Assess the economic, social and environmental impact of the production, use and management of energy, with a holistic view of the life cycle of the different systems, and recognise and value the most remarkable developments in the fields of energy efficiency and the rational use of energy.
CEMT-2. Identify and describe the components of electrical systems (production, transportation, distribution, markets, procurement and consumption) and evaluate the technological solutions used in the production of electricity.
CEMT-9. Undertake projects related to energy management in production and service sectors, recognise and value advances and developments in the field and contribute innovative ideas.
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Teaching methodology

- In-person class:
  Lectures (CM): 20 h
  Active lectures: 10 h
  Theoretica-practical work (TD): 13 h
  Evaluation activities (EV): 2 h
- No attendance:
  Limited scope project/activity (PR): 15 h
  Broad scope project/activity (PA): 25 h
  Self-study (EA): 40 h

Learning objectives of the subject

Know, understand and be able to apply the techniques and technologies in order to improve efficiency in power systems.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Hours large group:</th>
<th>0h</th>
<th>0.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Hours small group:</td>
<td>30h</td>
<td>24.00%</td>
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<tr>
<td></td>
<td>Guided activities:</td>
<td>10h</td>
<td>8.00%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>85h</td>
<td>68.00%</td>
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</tbody>
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## Content

<table>
<thead>
<tr>
<th>Section</th>
<th>Learning time</th>
<th>Description</th>
<th>Specific objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction</strong></td>
<td>4h</td>
<td>Review of power system components and power system equations. Introduction to energy efficiency in power systems.</td>
<td>Understand the different aspects that affect power system efficiency.</td>
</tr>
<tr>
<td><strong>Technologies</strong></td>
<td>60h 30m</td>
<td>Technologies for improving energy efficiency.</td>
<td>Know the technologies.</td>
</tr>
<tr>
<td><strong>Techniques</strong></td>
<td>60h 30m</td>
<td>Modeling and optimization techniques. Linear and non-linear programming. Heuristics methods.</td>
<td>Know optimization techniques.</td>
</tr>
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</table>

### Introduction

- **Description:**
  - Review of power system components and power system equations. Introduction to energy efficiency in power systems.

- **Specific objectives:**
  - Understand the different aspects that affect power system efficiency.

### Technologies

- **Description:** Technologies for improving energy efficiency.

- **Related activities:** Technologies

- **Specific objectives:** Know the technologies.

### Techniques

- **Description:** Modeling and optimization techniques. Linear and non-linear programming. Heuristics methods.

- **Related activities:** Techniques.

- **Specific objectives:** Know optimization techniques.
Planning of activities

**Technologies**

| Description: | Student will work in pairs in order to apply their knowledge on power system efficiency. |
| **Descriptions of the assignments due and their relation to the assessment:** | Writing report and presentation. |
| **Specific objectives:** | Analyze the improvement of efficiency in power systems and explain orally the analysis. |
| **Hours:** | 7h 30m |
| Guided activities: | 7h 30m |

**Techniques**

| Description: | Individual activity in order to implement the optimization techniques described at lecture sessions. |
| **Descriptions of the assignments due and their relation to the assessment:** | Report. |
| **Hours:** | 7h 30m |
| Guided activities: | 7h 30m |

Qualification system

Writing exam (PE): 60%
Individual/group assignment (TR): 40%

Regulations for carrying out activities

The writing exam (PE) will deal with the issues described during the course. Any kind of supporting material is not allowed.

There will be one practical assignment (TR) that will be developed in groups. The assignment will be delivered in writing format and presented orally.

Bibliography

**Basic:**
