

66374 - Smartgrids and electric mobility

Syllabus Information

Academic year: 2024/25

Subject: 66374 - Smartgrids and electric mobility

Faculty / School: 110 - Escuela de Ingeniería y Arquitectura

Degree: 636 - Master's in Renewable Energies and Energy Efficiency

ECTS: 6.0

Year: 1

Semester: Second semester

Subject type: Optional

Module:

1. General information

The objectives of the subject are to identify the problems of the current electricity system and propose solutions to them, specifically through the distributed generation that needs the development of Smartgrid and microgrids. It studies the technologies that are used and need to be developed in order to change the model. It also analyses the need for change in the road transport sector towards electric mobility and how it becomes a fundamental asset of the Smartgrid.

2. Learning results

- To know the problems associated with the current power grid model.
- To know the distributed generation concept
- To know the concept of grid-connected and isolated microgrid
- To know the concept of Smartgrid
- To know the grid quality and security of supply conditions that distributed generation systems and microgrids must meet for their connection to the grid and for stand-alone operation.
- To learn about the flexibility needs of transmission and distribution networks in order to adapt to the new model.
- To know the possibilities of flexible services provided by electrical energy storage
- To know the possibilities of the flexible services that Prosumer can provide
- To know the distributed R.E. generation systems and electrical energy storage systems, in general DER, that can be used in smart grids and microgrids.
- To know power electronics configurations suitable for connection to microgrids and smart grids of DERs
- To know power electronics configurations suitable for connection to microgrids isolated from DERs
- To learn about D-FACTS and FAPS, as well as their functionalities applied to smart grids and microgrids.
- To learn about the basic concepts of electric mobility and its possible integration in distributed generation.
- To learn about electric vehicle charging methods and their impact on the electric power grid.
- To learn about the methods needed to mitigate the impact of EV charging on the grid.
- To be able to model a distribution network and perform static and quasi-dynamic load studies.

3. Syllabus

Theory:

- The global energy system and associated problems
- The electric power system and its current problems
- Distributed generation
- Smartgrid
- Supergrid
- Microgrids
- Key technologies and services for the Smartgrid: flexibility, REE integration, storage, power electronics, ICTs.
- Need for electric mobility
- Electric mobility as a key part of the Smartgrid

Practice:

1. Effect of distributed generation connection on the low voltage grid. Balanced systems
2. Effect of unbalance in the low voltage network. Connection of single-phase mini-generators.
3. Analysis of home systems with photovoltaic generation, storage and electric vehicles

4. Effect of the connection of domestic systems of point 3 on the medium voltage network.

4. Academic activities

- Master class (15 hours): presentation of contents by the teaching staff or external experts to all students of the subject
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- Problem solving and case studies (30 hours): practical exercises with all the students of the subject
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- Laboratory practice (15 hours): practical exercises in small groups of students
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- Practical application or research work (27 hours)
- Self-study by the student (60 hours).
- Assessment tests (3 hours)

The hours indicated above are indicative and will depend on the academic calendar.

5. Assessment system

In the ordinary call, the assessment will consist of:

- Continuous assessment works (including those derived from practice sessions): 60 %.
- Practical work and its presentation: 40 %.

The works of the subject will be presented in public.

For the practical work of the subject, different topics will be proposed for team work. They will be presented and discussed among the subject's participants.

In order to be eligible for this type of assessment, it is necessary to continuously follow the subject.

Students who do not opt for the assessment method described above in the ordinary call for exams will be entitled to a global assessment test. In this case, the grade for the subject is the one obtained in a final, written, individual test, with several application exercises or short questions so that the student can demonstrate their competence in the learning results.

In the extraordinary call for exams, the assessment will consist of a global test during the dates scheduled for this purpose. Final del formulario

6. Sustainable Development Goals

9 - Industry, Innovation and Infrastructure
11 - Sustainable Cities and Communities
13 - Climate Action