Universidad Zaragoza

Academic Year/course: 2022/23

66378 - Optimization of hybrid generation systems with renewable sources

Syllabus Information

Academic Year: 2022/23
Subject: 66378 - Optimization of hybrid generation systems with renewable sources
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 636 - Master's in Renewable Energies and Energy Efficiency
ECTS: 3.0
Year: 1
Semester: Second semester
Subject Type: Optional
Module:

1. General information

1.1. Aims of the course

The fundamental objective of the subject is to ensure that students are able to define the electrical demand of a system, evaluate the possibilities of self-consumption and carry out the optimal dimensioning of the renewable hybrid system, connected or isolated from the electrical grid, taking into account the technical and economic aspects.

1.2. Context and importance of this course in the degree

The electrical supply of microgrids and other electrical off-grid systems (pumping systems, houses, farms, mountain refuges, etc.), has historically been carried out through fossil generation (diesel generator, gasoline...) but for some decades now, it is carried out mainly through renewable energies (photovoltaic, wind, hydroelectric, usually with storage). In some cases, hybrid systems, made up of more than one generation system, even hybridized with a fossil generator, are the best technical and economic solution (that is, the optimal solution) to cover a given electrical consumption in an off-grid system. In systems connected to the electricity grid, self-consumption with renewables (mainly photovoltaic), which covers part of the electricity consumption, is an increasingly widespread option, with various modalities depending on the different countries' regulations (net balance or net billing). This subject will deal with these issues, emphasizing the optimization of the different systems.

1.3. Recommendations to take this course

Previous knowledge is required for correct learning of the subject. Above all, the student needs a good base of solar photovoltaic energy and wind energy.

Following the lectures, problems, laboratory, and external practices are essential, as well as personal study and the preparation of the assignments for the subject.

Continuous work is fundamental to good use of the knowledge transmitted in the classes and passing it successfully. To facilitate this ongoing work, the student has the teacher's advice, both during lessons and tutoring hours, specially designed for this purpose.

2. Learning goals

2.1. Competences

Basic and general skills:

- CB6.- Possess and understand the knowledge that provides a base or opportunity to be original in the development and/or application of ideas, often in a research context.
- CB7.- That students know how to apply the knowledge acquired and their ability to solve problems in new or little-known environments within broader (or multidisciplinary) contexts related to their area of ??study.
- CB8.- That students can integrate knowledge and face the complexity of formulating judgments based on information that, being incomplete or limited, includes reflections on the social and ethical responsibilities linked to applying their knowledge and judgments.
- CB9.- That students know how to communicate their conclusions and the knowledge and ultimate reasons that support them to specialized and non-specialized audiences clearly and unambiguously.

- CB10.- That students have the learning skills that allow them to continue studying in a way that will be largely self-directed or autonomous.
- CG1.- Carry out research, development and innovation in products, processes and methods concerning energy efficiency.
- CG2.- Carry out research, development and innovation in products, processes and methods concerning renewable energies.
- CG4.- Follow the technological evolution of renewable energies and have prospective knowledge of this evolution.
- CG5.- Apply knowledge of advanced sciences and technologies to the professional or investigative practice of efficiency.
- CG6.- Identify current legislation and regulations applicable to the renewable energy and energy efficiency sector.
- CG7.-Assess the application of emerging technologies in energy and the environment.
- CG9.- Solve complex problems in the field of energy efficiency and sustainability.

Specific skills:

- CE1.- Use and develop methodologies, methods, techniques, programs for a specific use, norms and computing standards.
- CE3.- Assess the importance and implications of energy use in the development of society.
- CE15.- Calculate energy storage systems.
- CE17.- Calculate electric power generation, transport and distribution systems, and the integration of renewable energies in each.

2.2. Learning goals

- Characterize the demand for electrical energy in a system
- Evaluate technically and economically the different forms of self-consumption with net balance or net billing schemes.
- Use specific software for simulation and optimization of isolated hybrid systems and microgrids and interpret the results obtained
- Model the different elements of an isolated system or a microgrid for optimal dimensioning.

2.3. Importance of learning goals

This subject analyzes the systems isolated from the electrical grid (off-grid systems), as well as the systems connected to the grid with self-consumption. The various possibilities of hybridization of renewable sources and their optimization are shown. In professional development, the economic optimization of these systems is extremely important since clients always demand to minimize costs.

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The students must demonstrate that they have achieved the expected learning outcomes through the following assessment activities.

The evaluation of the subject will be carried out as follows:

In the first call, the evaluation will consist of: academic works (including those derived from practices) 50% and open-response written test 50%. The student who does not opt ??for the evaluation procedure described above in the first call will have the right to take a global evaluation test (the subject will be completely evaluated in a single test).

The second call for evaluation will be carried out through a global test carried out in the period established for this purpose in the months of June or July of the academic calendar.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives.

It is based on participation and the active role of the student favours the development of communication and decision-making skills. A wide range of teaching and learning tasks are implemented, such as lectures, assignments, computer lab sessions,

autonomous work, and tutorials.

Students are expected to participate actively in the class throughout the semester.
Classroom materials will be available via Moodle. These include a repository of the lecture notes used in class, the course syllabus, as well as other course-specific learning materials, including a discussion forum.

Further information regarding the course will be provided on the first day of class.

4.2. Learning tasks

This is a 3 ECTS course organized as follows:

- Lectures (6 hours). The teacher explains the course contents and solves representative applied problems. Regular attendance is highly recommended.
- Practice sessions (15 hours). Exercises and cases will be resolved by the whole group of students.
- Computer lab sessions (7.5 hours). Students will work together in groups.
- Assignments (12 hours). Students will complete assignments, problems and exercises related to concepts seen in laboratory sessions and lectures.
- Autonomous work (63 hours). Students must spend about 63 hours studying theory, solving problems, preparing sessions, and taking exams.

4.3. Syllabus

- Introduction to distributed power generation
- Generation of electrical energy connected to microgrids or in off-grid systems
- Self-consumption with net metering or net billing
- Hybrid power generation systems with integration of renewable sources
- Modelling of electrical energy generation systems, storage and demand for the optimal dimensioning of hybrid systems
- Optimization of hybrid systems

There will be 3 computer lab sessions.

4.4. Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the EINA website (http://eina.unizar.es).

4.5. Bibliography and recommended resources

http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=66378