Renewable Energy Grid Integration and Distributed Generation
Presentation Index

- Why studying this?
- Why studying here?
- Learning programme
- Student materials
- Laboratories
- Technical visits
- Enterprise conferences
Why studying this?

The main challenges of RE grid integration

- The electric grid needs an accurate balance
- Mass electric storage is not possible
- RE are not always producing when there is a higher demand
- RE random behaviour

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Why studying this?

Electric exchange helps to maintain the balance

Spain can be considered nearly an island!
Why studying here?

Spain is a RE integration leader

Evolution of RE in Spain (GWh)

http://www.ree.es/sistema_electrico/informeSEE.asp
Why studying here?

High-Quality training

The University of Zaragoza is considered one of best universities in Spain to study Electrical Engineering, as well as Mechanical Engineering, due to the involvement of their professors in present and future challenges in the field.

*Annual ranking of Spanish Universities elaborated by the national newspaper “El Mundo”*

Among the masters offered in Spain the one given by CIRCE and promoted by EUREC, which consists of the CE section and the specialization in “RE Grid Integration and Distributed Generation”, has been ranked second in the “Energy” category.

*It is the forth year in a row that this study is among the 5 best masters in this category. Annual ranking of Spanish Masters elaborated by the national newspaper “El Mundo”*
Why studying here?

Innovation Experience

Wind and Solar power projects
- AVER - Optimization and demonstration of a new vertical axis wind turbine for microgeneration
- SWIP - New innovative solutions, components and tools for the integration of wind energy in urban and peri-urban areas

Sustainable mobility
- UNPLUGGED - Wireless charging for electrics vehicles
- FABRIC - FeAsiBility analysis and development of on-Road chargIng solutions for future electric vehiCles

Electrical grids and substations
- Monitoring of Critical Parameters on High Voltage Lines
- Technology Innovation at electrical substation

Smart-Grids and storage
- E+ - New systems, technologies and operations models based on ICTs for the managements of energy positives and proactive neighbourhoods
- DISCERN - Distributed Intelligence for Cost-Effective and Reliable Distribution Network Operation

Learning Programme

1- Distributed Generation

2- Generation and Storage Technologies

3- Control Techniques and Renewable Energy Integration Systems

4- Power Grid Analyses and Studies

5- Smart Grids

6- Standards and Electric Markets

End of section Project
Student materials

Moodle

https://moodle.unizar.es

Books

Software
Facilities

Lessons will take place at Betancourt and Torres Quevedo Buildings

Circe's Building
Laboratories

Protection Lab

Renewable Energy Grid Integration and Distributed Generation
Laboratories

Smart Grid Lab

Wind Generator: Asynchronous motor and its frequency controller

Controlled Loads

PLC board
Technical visits

Hydraulic central
Technical visits

CECOEL and CECRE, Spanish grid operator’s control centre
Technical visits

Unión Fenosa Distribución, LINTER facilities
Technical visits

Walqa Centre for the Promotion of Hydrogen Technologies

Renewable Energy Grid Integration and Distributed Generation
Technical visits

MEGHA & QuEST Lab
ACCIONA is an international company with activities in renewable energy, infrastructure, water and services. The energy division of the ACCIONA Group is a world leader in the field of renewable energy sources. It takes on the mission of demonstrating the technical and economic viability of a new energy model based on criteria of sustainability.

**ACCIONA Energy** has 20 years' experience in the sector. It is present in seven technologies, has operations in 14 countries, and deploys its activity throughout the value chain.

**ACCIONA Wind power** is a global leader in the development, construction, operation and maintenance of wind power facilities, with over 15 years' experience.

**Arteche** has 65 years of experience in the electricity sector. As an international benchmark with equipment in service in over 150 countries, they desire to play a leading role in the shaping of our sector’s future. They continuously pursue more efficient solutions to industry problems, through the application of suitable technologies and resources.
**Enterprise Conferences**

**DIgSILENT GmbH** is a consulting and software company providing highly specialized services in the field of electrical power systems for transmission, distribution, generation and industrial plants. DIgSILENT develops the leading integrated power system analysis software covering the full range of standard and highly sophisticated applications including a performance monitoring system.

**ENDESA** is the leading utility in the Spanish electricity system and the number one private electricity company in Latin America. It is a significant player in the energy sector of the European Mediterranean region. It also has a growing presence in the Spanish natural gas market and is advancing rapidly in the area of renewable energy.

ENDESA carries out electricity production, distribution and supply activities. It also has stakes in renewable and cogeneration energy facilities representing a combined capacity in service or under construction of 2,035 MW.
Red Eléctrica de España is the TSO (Transmission System Operator) of the Spanish power system.
Being the owner of 99% of Spain's high voltage power transmission grid, it is the only company that specialises in the transmission of electricity in Spain. Red Eléctrica, as the system operator, guarantees the continuity and security of the power supply and the proper coordination of the production and transmission system.

**FORES**: Technological company focussed on renewable energy systems optimization, providing efficiency and safety. Created in 2010 as a spin-off of CIRCE.

**Hydrogen Technology Development Foundation**: This Foundation was promoted by the Government of Aragon with the aim of carrying out the organization, management and execution of a wide range of actions with the purpose of generating, storing and transporting hydrogen for its use in fuel cells, in transport applications or for the generation of distributed energy.
A couple of months with lots of memories
Thank you for your attention

We will wait for you in Zaragoza